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Major article

Identifying the psychological determinants of handwashing: Results from two cross-sectional questionnaire studies in Haiti and Ethiopia

Nadja Contzen PhD *, Mosler Hans-Joachim PhD

Environmental and Health Psychology Cluster, Department of Environmental Social Sciences, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, Switzerland

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Background: Diarrheal disease kills around 760,000 infants every year. Many of these deaths could have been prevented by handwashing with soap. However, the whole range of psychological factors encouraging handwashing is not yet identified and handwashing campaigns are often limited to awareness-raising and education. The purpose of this article was to identify the psychological determinants of handwashing in Haiti (study 1) and Ethiopia (study 2).

Methods: Data were collected cross-sectionally by administering face-to-face interviews with the primary caregiver in a participating household ($N_{Haiti} = 811$; $N_{Ethiopia} = 463$). Hierarchical multiple regression analyses were performed on self-reported handwashing.

Results: In both countries, risk factors—meaning awareness and health knowledge—accounted for only 11%-19% of variance in handwashing and were not consistently associated with handwashing. The inclusion of additional factor-groups, namely attitude, norm, ability, and self-regulation factors, led to significant increases in explained variance ($P \leq .01$), accounting for 25%-44% of additionally explained variance. The attitude factor disgust, the norm factor, the ability factors motivational self-efficacy and perceived impediments, and the self-regulation factors coping planning and commitment emerged as especially relevant.

Conclusions: Handwashing campaigns should focus especially on attitudes and norms and not only on risk.

Diarrheal disease is the second leading cause of death in infants[1] and one of the most common causes of death during humanitarian disasters.[2] The single most effective prevention against diarrheal disease is the seemingly simple and relatively cheap act of handwashing with soap[3] (for simplicity, in this article, *handwashing* stands for handwashing with soap). Furthermore, regular handwashing effectively lowers rates of additional infectious diseases, such as respiratory illnesses[4] and nosocomial infections.[5]

Accordingly, the promotion of domestic handwashing is high on the agenda of development and relief organizations. However, these campaigns are rarely grounded in theory, often following a logic model and focusing on awareness-raising and knowledge-building (for an example, see the Global WASH Cluster[6]).[7] This is of particular concern in the light of the finding that even when the majority of a population is aware of the importance of handwashing (71%-84%), only a minority (14%-31%) regularly washed hands.[8] Moreover, other studies[9] showed that education-based campaigns may fail in boosting handwashing. Although education-based approaches might be a good starting point to promote handwashing, additional interventions are needed to spur regular handwashing.[7] However, the factors to be intervened on are underspecified; up to now, only a few scholars have addressed the determinants of domestic handwashing in developing countries.[7] Based on qualitative and quantitative research, habit, motivational (eg, disgust or attraction), and planned factors (eg, keeping good family health) have been suggested as handwashing determinants.[10] Others advocate the importance of opportunity (eg, access and norms), ability (eg, self-efficacy and social support), and motivational factors (eg, attitudes and threats).[11] Although these factors are a good starting point to investigate the drivers of handwashing, their

* Address correspondence to Nadja Contzen, PhD, Department of Environmental Social Sciences, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Überlandstrasse 133, PO Box 611, 8600 Dübendorf, Switzerland.

E-mail address: nadja.contzen@eawag.ch (N. Contzen).

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classification lacks a comprehensive theoretical underpinning and the evidence base remains limited. Better explored are factors determining handwashing among health care workers in developing countries.[5,12,13]

The aim of our article was to identify the psychological determinants of domestic handwashing based on theory. Potential determinants were derived from a recent model of behavior change developed for the water, sanitation, and hygiene sector in developing countries; namely, the Risk, Attitudes, Norms, Abilities, and Self-Regulation of Behavioural Change (RANAS) model.[14] It integrates the psychological factors proposed by major theories of behavior change into a comprehensive model with five factor groups. In short, when exploring the determinants of handwashing, the RANAS model,[14] based on psychological theories of behavior change, suggests to examine not only risk factors (ie, awareness and health knowledge) but also attitude, norms, ability, and self-regulation factors. Table 1 provides an overview of the considered factors, their definitions, and the underlying theories.[15-18]

In line with the RANAS model, we addressed the following research question: Do additional factor groups; that is, attitude, norm, ability, and self-regulation factors, explain self-reported handwashing above and beyond risk factors? By answering this question, we hoped to enable a reflection on new and innovative handwashing campaigns in addition to awareness-raising and education.

Several scholars have previously emphasized the problem of inflated self-reports in terms of socially desirable behavior, including handwashing.[19] Whereas self-reports are prone to reporting bias, they have been found to be associated with child diarrhea[20] and child diarrhea mortality,[21] and are thus worthy of study.

METHODS

To answer the above research question, cross-sectional studies were conducted in Haiti and Ethiopia. For study 1, field research was conducted during 2011 in displacement camps and poor neighborhoods in Port-au-Prince and in rural areas in the West Department of Haiti during the recovery phase of the earthquake and cholera outbreak in 2010. For study 2, data were collected during 2012 in rural villages in the Borana zone of southern Ethiopia during the recovery phase of a major drought in the Horn of Africa during 2011-2012.

Procedure

Data were obtained by means of structured face-to-face interviews with the primary caregiver in a voluntary study household. Households were selected using a modified random route sampling.[22] That is, each site was subdivided into 10 areas to which the interviewers were randomly assigned. 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. Primary caregivers were interviewed because they are responsible for childcare and preparing food and thus have the highest chance of spreading diarrheal disease. In Ethiopia, in addition, only households with at least one child younger than five years of age were targeted because these children are most vulnerable to diarrhea.

Interviews took around 45 minutes to 1 hour and were carried out in the local language (ie, Haitian Creole in Haiti and Afaan Oromo in Ethiopia) by a team of 10 local students, scientists, and social workers. Before data collection, workshops were given to train the respective team in interviewing and team members were supervised by researchers and a local field research coordinator during data collection.

Sample

For the purposes of our studies, sample size estimation with G*Power 3.1[23] suggested to survey 400 households to detect small to medium changes in explained variance with a Type I error probability of 0.05 and a statistical power of 0.95. For study 1, however, we aimed for a larger sample size to allow the testing of additional research questions, presented elsewhere, requiring a larger sample size.[24] With 39 households in Haiti (4%) and 27 households in Ethiopia (5%) that refused to participate, the response rates were high. In study 1, the achieved sample size was $N = 811$, with the majority of study households located in Port-au-Prince ($n = 528$) and a smaller subsample stemming from the rural areas ($n = 283$). The respondents' ages ranged between 15 and 90 years (mean, 34.68 ± 12.90 years). In terms of gender, 713 interviewees were women (88%) and 98 were men. Whereas nearly half of the sample did not finish primary school ($n = 395$; 49%), almost one-quarter did not go to school at all ($n = 193$; 24%). The mean income per person, per day of $1.07 was slightly below the poverty line of $1.25.[25]

In study 2, a total of 463 respondents took part. The mean age of the sample was 34.27 ± 13.89 years, with a range of 15-90 years. The vast majority of respondents were women ($n = 450$; 97%) and only 13 were men. In terms of education, 98% ($n = 440$) did not attend school at all and 97% ($n = 449$) could neither read nor write. The mean income per person, per day of $0.17 was far below the poverty line of $1.25.[25]

Questionnaire and measures

The interviews were based on structured questionnaires developed for these studies. A large part of the items were built on recent work by Inauen et al[26] and Huber et al.[27] These were complemented with items from a questionnaire study on domestic handwashing determinants in a developing country.[10] The questionnaires covered sociodemographic characteristics, self-reported handwashing, and psychological factors. They were prepared in English, translated into the respective local language, and retranslated into English to ensure the quality of the translation. In both studies the questionnaire's applicability was verified in a pretest of $N = 20$.

Handwashing at key times was measured by means of self-reported answers to questions such as, "In general, how often do you wash your hands with soap before eating?" using 5-point Likert scales ranging from 0-4. Surveyed key times were: handwashing after defecation, wiping a child's bottom, and other kinds of contact with feces; before eating, preparing food, feeding a child, and handling water. In study 2, an additional key time was included; handwashing before breastfeeding. Exploratory factor analysis (study 1) and confirmatory factor analysis (study 2) proved that two different handwashing situations are distinguishable, stool-related handwashing and food-related handwashing. Whereas the former subsumes handwashing after defecation, wiping a child's bottom, and other kinds of contact with feces, the latter incorporates handwashing before eating, preparing food, feeding or breastfeeding a child, and handling drinking water. In both studies two mean scores were computed to represent the two factors and the scores were then used to test the handwashing drivers separately for stool- and food-related handwashing (Cronbach's alphas study 1, $\alpha_{stool} = 0.76$ and $\alpha_{food} = 0.81$; Cronbach's alphas study 2, $\alpha_{stool} = 0.88$ and $\alpha_{food} = 0.86$).

Psychological factors were measured according to suggestions in the RANAS approach.[14] For each behavior factor, one or more items were included in the questionnaire. If several items were used, where possible, these were combined into summary variables (supplementary material containing item wordings, Cronbach's alphas, and

Table 1
Overview of potential handwashing determinants specified in psychological theories and summarized in the Risk, Attitudes, Norms, Abilities, and Self-Regulation of Behavioral change (RANAS) model[14]

		Psychological theories and models				
Factor groups	Factors	HBM	TRA	SCT	HAPA	RANAS
Risk factors	Vulnerability (subjective perception of the individual risk of contracting a disease)	**√**			√	√
	Severity (subjective perception of the seriousness of a disease's individual consequences)	**√**			√	√
	Health knowledge (knowledge about a disease's causes and consequences and its prevention)					√
Attitude factors	Instrumental beliefs (perceived advantages [eg, health or status improvements], and disadvantages [eg, time and monetary costs])	√	**√**	√	√	√
	Affective beliefs (feelings arising when thinking about or performing a behavior)	√	√			√
Norm factors	Descriptive norms (behaviors typically practiced by others)		**√**	√	√	√
	Injunctive norms (behaviors typically approved or disapproved by others)					
Ability factors	Motivational self-efficacy (confidence in one's ability to initiate and execute a behavior)			**√**	**√**	√
	Volitional self-efficacy (confidence in one's ability to maintain a behavior in light of barriers and to recover from relapse)			√	**√**	√
	Impediments (anticipated barriers and distractions to a behavior)			**√**	√	
Self-regulation factors	Coping planning (establishing plans to overcome anticipated barriers and distractions to a behavior)				**√**	√
	Forgetting (frequency of forgetting to perform a behavior at a specific time/in a specific situation)					**√**
	Commitment (strength of commitment toward practicing a behavior)					**√**

NOTE. Boldface type indicates factors that are especially emphasized within the respective theory or model or that were introduced by the respective theory or model.
HAPA, Health Action Process Approach;[18] *HBM*, Health Belief Model[15]; *SCT*, Social Cognitive Theory[17]; *TRA*, Theory of Reasoned Action.[16]

descriptive statistics is available from the authors upon request). Furthermore, 9-point Likert scales ranging from −4 to +4 were used to measure bipolar variables and 5-point Likert scales ranging from 0-4 were used to measure unipolar variables. In study 2, four factors, namely effort, time costs, and expensiveness were omitted from scale construction and analyses due to minimal variance insofar as respondents did not find handwashing effortful, time consuming, or expensive at all. Further, as handwashing facilities were nonexistent in the study region of study 2 the item asking about the perceived distance of the handwashing facility was not applicable.

Data analyses

To select factors potentially relevant in explaining handwashing, correlations with handwashing were inspected (supplementary material containing correlation data is available from the authors upon request). Due to the nonnormal distribution of the behavior measures, Spearman correlations were calculated.[28] Only those factors with significant correlations were included into the main analyses presented here. To identify factors explaining handwashing above and beyond risk factors, hierarchical multiple regression analyses with five steps were conducted. In model 1, only the risk factors were included; in models 2-5, the additional factor groups (ie, attitude, norm, ability, and self-regulation factors) were added successively. To increase the estimation accuracy, the regression models were tested using bootstrap estimation with 10,000 replications. All analyses were undertaken in SPSS version 22 (IBM-SPSS Inc, Armonk, NY).

Informed consent and ethics statement

In both studies informed consent was obtained from all participants. The studies were conducted in strict compliance with the ethical principles of the American Psychological Association, the Declaration of Helsinki, and the ethics board at the Faculty of Arts of the University of Zurich. According to the Swiss Federal law that was in force when data were collected no ethical approval was required for the two studies. Whereas for study 1 no formal ethical approval was applied for, study two was approved by the Ethiopian National Research Ethics Review committee and the ethics board at the Faculty of Arts of the University of Zurich.

In the following, the results of study 1 and study 2 are presented separately.

RESULTS

Study 1: Handwashing determinants in Haiti

The median level of self-reported handwashing was rather high (median, 3.67 in stool-related handwashing and 3.25 in food-related handwashing). Spearman correlations revealed that only severity was not significantly associated with stool-and food-related handwashing (supplementary material containing correlations is available from the authors upon request). This factor was omitted from regression analyses. Surprisingly and counterintuitively, correlation analyses also revealed that health knowledge and vulnerability were negatively associated with both types of handwashing.

Table 2 presents the hierarchical regression results for stool-related handwashing. Risk factors, tested separately in model 1, accounted for 11% of the variance in stool-related handwashing. By including the additional factor groups, in each step, the amount of explained variance increased significantly (see models 2-5 in Table 2). The final model explained 36% of the variance; that is, 25% more than risk factors only (see model 5 in Table 2). An explained variance of 36% corresponds to an effect size of $f^2 = 0.56$, which is a large effect.[29]

To assess the factors' relative explanatory power, for model 5 the standardized regression coefficients (ie, the factors' effect sizes) were consulted. The best explanatory variables were coping planning ($\beta = 0.18$), commitment ($\beta = 0.14$), and disgust ($\beta = 0.12$). In addition, significant explanatory power in the expected direction was found for norms ($\beta = 0.09$), motivational self-efficacy ($\beta = 0.11$), impediments ($\beta = -0.11$), and forgetting ($\beta = -0.07$). However, counterintuitively, albeit corresponding with correlation results (see above), higher levels in knowledge were related significantly with lower levels of stool-related handwashing ($\beta = -0.13$).

Regarding food-related handwashing, risk factors accounted for 12% of the variance (see model 1 in Table 3). Again, the explained variance increased significantly with each additional step (see models 2-5 in Table 3). In the final model, 56% of the variance was explained; thus, 44% more than for risk factors alone (see model 5 in Table 3). An explained variance of 56% corresponds to an effect size of $f^2 = 1.27$, which is a large effect.[29]

Regarding the factors' effect sizes for model 5, coping planning ($\beta = 0.22$) was the most important explanatory variable, followed

Table 2
Hierarchical multiple regression analysis explaining self-reported stool-related handwashing in Haiti (N = 807) and Ethiopia (N = 463)

	Haiti					Ethiopia				
	B				Model 5	*B*				Model 5
Predictors	Model 1	Model 2	Model 3	Model 4	*B* (90% CI)	Model 1	Model 2	Model 3	Model 4	*B* (90% CI)
Constant	3.99***	3.03***	2.96***	2.80***	2.53 (2.20 to 2.86)	0.19	−0.87*	−1.35***	−1.24**	−1.32 (−2.00 to −0.65)
Vulnerability	−0.03**	−0.02*	−0.01	0.00	0.00 (−0.01 to 0.01)	−0.08**	−0.11***	−0.06*	−0.03	−0.03 (−0.08 to 0.01)
Severity†	–	–	–	–	–	0.85***	0.41***	0.40***	0.36***	0.38 (0.23 to 0.51)
Health knowledge†	−0.42***	−0.21***	−0.19***	−0.18**	−0.17 (−0.26 to −0.09)	–	–	–	–	–
Instrumental beliefs		0.10**	0.06*	0.03	0.01 (−0.03 to 0.06)		0.10	0.05	0.01	−0.01 (−0.14 to 0.12)
Nurture		0.05**	0.05**	0.04*	0.03 (0.00 to 0.06)		0.55***	0.52***	0.49***	0.48 (0.37 to 0.59)
Affective beliefs		0.07*	0.04	0.02	−0.01 (−0.04 to 0.03)		0.07	−0.07	−0.05	−0.06 (−0.14 to 0.03)
Disgust		0.08***	0.06***	0.05**	0.03 (0.01 to 0.06)		0.10*	0.13**	0.10*	0.07 (0.00 to 0.14)
Norms			0.10***	0.07**	0.05 (0.01 to 0.09)			0.41***	0.39***	0.36 (0.27 to 0.44)
Motivation self-efficacy				0.16***	0.10 (0.04 to 0.15)				0.15***	0.12 (0.05 to 0.18)
Volitional self-efficacy				0.02	−0.01 (−0.06 to 0.05)				−0.01	−0.05 (−0.11 to 0.00)
Impediments				−0.11***	−0.08 (−0.12 to −0.04)				−0.12***	−0.10 (−0.17 to −0.04)
Coping planning					0.11 (0.07 to 0.15)					0.13 (0.07 to 0.20)
Forgetting					−0.04 (−0.07 to 0.00)					−0.02 (−0.07 to 0.05)
Commitment					0.15 (0.08 to 0.22)					0.15 (0.06 to 0.23)
R^2	.11	.26	.28	.31	.36	.19	.35	.46	.51	.52
F	52.08***	47.91***	45.43***	38.12***	35.36***	54.59***	41.25***	57.55***	48.17***	39.67***
Δ R^2		.15	.02	.04	.04		.16	.12	.05	.02
Δ *F*		40.62***	22.71***	15.33***	17.91***		28.08***	100.68***	14.33***	5.97**

NOTE. B, unstandardized regression coefficient. Model 1 = risk factors tested. Model 2 = attitude factors added. Model 3 = norm factors added. Model 4 = ability factors added. Model 5 = self-regulation factors added.
CI, confidence interval.
Constant, predicted value of stool-related handwashing when all other predictors are 0.*$P \leq .05$.
**$P \leq .01$.
***$P \leq .001$.
†Variables excluded due to insignificant correlations with handwashing in Haiti and Ethiopia, respectively.

Table 3
Hierarchical multiple regression analysis explaining self-reported food-related handwashing in Haiti (N = 807) and Ethiopia (N = 463)

	Haiti					Ethiopia				
	B				Model 5	*B*				Model 5
Predictors	Model 1	Model 2	Model 3	Model 4	*B* (90% CI)	Model 1	Model 2	Model 3	Model 4	*B* (90% CI)
Constant	3.47***	1.00***	0.81***	0.82***	0.92 (0.56 to 1.29)	0.06	−0.81**	−1.31***	−1.07**	−0.99 (−1.66 to −0.38)
Vulnerability	−0.10***	−0.05**	−0.04**	−0.02	−0.01 (−0.03 to 0.01)	−0.05	−0.07**	−0.02	0.00	0.00 (−0.04 to 0.04)
Severity†	–	–	–	–	–	0.81***	0.51***	0.46***	0.42***	0.42 (0.30 to 0.55)
Health knowledge†	−0.55***	−0.21**	−0.13*	−0.10	−0.06 (−0.15 to 0.03)	–	–	–	–	–
Instrumental beliefs		0.37***	0.22***	0.13**	0.08 (0.01 to 0.15)		0.02	−0.06	−0.10	−0.11 (−0.23 to 0.01)
Nurture		0.10***	0.08**	0.05**	0.03 (0.00 to 0.07)		0.40***	0.37***	0.35***	0.35 (0.26 to 0.45)
Affective beliefs		0.32***	0.21***	0.16***	0.10 (0.04 to 0.16)		0.10*	−0.05	−0.04	−0.05 (−0.14 to 0.04)
Disgust		0.04*	0.03*	0.02*	0.03 (0.01 to 0.05)		0.08	0.13**	0.10*	0.09 (0.01 to 0.17)
Norms			0.33***	0.23***	0.16 (0.10 to 0.22)			0.50***	0.47***	0.46 (0.39 to 0.55)
Motivation self-efficacy				0.24***	0.13 (0.06 to 0.20)				0.11**	0.08 (0.01 to 0.15)
Volitional self-efficacy				0.05	0.01 (−0.06 to 0.08)				0.00	−0.03 (−0.08 to 0.02)
Impediments				−0.24***	−0.18 (−0.24 to −0.13)				−0.11***	−0.06 (−0.13 to −0.01)
Coping planning					0.21 (0.15 to 0.27)					0.09 (0.03 to 0.15)
Forgetting					−0.11 (−0.15 to −0.06)					−0.08 (−0.13 to 0.00)
Commitment					0.13 (0.06 to 0.21)					0.04 (−0.05 to 0.13)
R^2	.12	.36	.45	.50	.56	.19	.28	.45	.48	.50
F	54.37***	77.00***	92.74***	81.06***	77.50***	54.40***	30.04***	54.01***	43.73***	35.50***
Δ R^2		.25	.08	.06	.05		.09	.17	.04	.02
Δ *F*		77.81***	118.55***	29.97***	32.84***		14.60***	141.56***	11.18***	4.56**

NOTE. B, unstandardized regression coefficient. Model 1 = risk factors tested. Model 2 = attitude factors added. Model 3 = norm factors added. Model 4 = ability factors added. Model 5 = self-regulation factors added.
CI, confidence interval.
Constant, predicted value of food-related handwashing when all other predictors are 0.*$P \leq .05$.
**$P \leq .01$.
***$P \leq .001$.
†Variables excluded due to insignificant correlations with handwashing in Haiti and Ethiopia, respectively.

by norms (β = 0.17) and impediments (β = −0.16). Furthermore, there was significant explanatory power in the expected direction for the instrumental beliefs (β = 0.06), the affective beliefs (β = 0.09), disgust (β = 0.05), motivational self-efficacy (β = 0.10), forgetting (β = −0.13), and commitment (β = 0.09). Neither vulnerability nor health knowledge had significant explanatory power in either direction.

To obtain further empirical evidence on the determinants of handwashing and to test the factors in a different cultural, social, and situational context, study 2 was conducted.

Study 2: Handwashing determinants in Ethiopia

On average, respondents reported washing their hands rather frequently (median levels, 3.20 for stool-related handwashing and 3.33 for food-related handwashing). Only one factor, health knowledge, was uncorrelated with handwashing (supplementary material containing correlation data is available from the authors upon request). Thus, the factor was omitted from subsequent analyses.

As can be seen in model 1 of Table 2, risk factors explained 19% of the variance in stool-related handwashing. The amount of explained variance increased significantly by entering the additional factor groups (see models 2-5 in Table 2). The final model accounted for 52% of the variance; that is, 32% more than risk factors alone (see model 5 in Table 2). An explained variance of 52% corresponds to an effect size of $f^2 = 1.08$, which is a large effect.[29]

With regard to the psychological factors, the effect sizes in model 5 revealed that nurture ($\beta = 0.33$) was the best explanatory variable, followed by norms ($\beta = 0.32$) and severity ($\beta = 0.19$). In addition, disgust ($\beta = 0.07$), motivational self-efficacy [$\beta = 0.10$], impediments [$\beta = -0.14$], coping planning [$\beta = 0.11$] and commitment [$\beta = 0.12$] had significant explanatory power in the expected direction.

Risk factors accounted for 19% of the variance in food-related handwashing (see model 1 in Table 3). Again, the explained variance increased significantly with each additional step (see models 2-5 in Table 3). In the final model, 50% of the variance was accounted for, which was 31% more than with risk factors only (see model 5 in Table 3). An explained variance of 50% corresponds to an effect size of $f^2 = 1.00$, which is a large effect.[29]

With regard to the factors' relative importance, the most important explanatory variable in model 5 was the norm factor ($\beta = 0.42$), followed by nurture ($\beta = 0.26$) and severity ($\beta = 0.23$). In addition, significant explanatory power in the expected direction was found for disgust ($\beta = 0.07$), motivational self-efficacy ($\beta = 0.07$), impediments ($\beta = -0.09$), coping planning ($\beta = 0.08$) and forgetting ($\beta = -0.12$).

DISCUSSION

Summary and interpretation of results

Consistent with our expectations, in both studies attitude, norm, ability, and self-regulation factors explained stool- and food-related handwashing above and beyond risk factors. In fact, risk factors were sometimes unrelated, sometimes positively related, and sometimes even negatively related with handwashing. Correspondingly, previous formative research showed that a perceived threat is a cause for handwashing during cholera epidemics only.[10] Moreover, there is evidence that mothers with higher threat levels are less likely to have a designated place for handwashing, which is a proxy for handwashing behavior.[11] Vulnerability, consistently negatively associated with both types of handwashing in both studies , was shown to be negatively correlated with various health behaviors such as exercising or cancer screening.[30] In terms of knowledge, although no negative correlations are known, previous studies have revealed a mixed pattern, with some studies indicating a positive association with handwashing and others finding no association.[9,11] There are two explanations for the found negative association. First, it might reflect that for respondents with higher levels of knowledge, self-reports are more accurate because they are more aware of the indications and opportunities for handwashing. Alternatively, high knowledge might implicate higher awareness of the multiple causes and multiple preventive measures related to diarrhea; respondents might not believe they are capable of actually engaging in all these preventive actions and abandon the efforts. This is in line with the finding that fear (potentially aroused by high knowledge) results only in protective behavior when capability (ie, self-efficacy) beliefs are high.[31] The association between health knowledge and handwashing should be further investigated; thereby, it should be controlled for self-efficacy beliefs with regard to all preventive measures.

As to the second factor group, attitudes, our results indicate that the surveyed instrumental beliefs were of varying importance. The instrumental beliefs scale did not have any explanatory power in either of the two studies. However, nurture had ample relevance in terms of explaining handwashing in study 2. That means that respondents who reported washing their hands to keep their children healthy and to educate them in correct behavior tended to wash their hands more often than respondents to whom handwashing was not such a matter of nurture. This result supports findings from formative studies in which nurture was often mentioned as a reason for handwashing.[10]

Similarly, the affective beliefs scale was of minor importance, whereas disgust had consistent explanatory power in both studies, meaning that respondents who believed that it is disgusting not to wash hands after defecation or before handling food tended to wash their hands more often than others. In line with this are findings from formative, survey, and experimental studies, all of which emphasized the importance of disgust in triggering handwashing.[10,32]

Norm factors, the third factor group, were of major relevance in both studies. That is, respondents who believed that people in their surroundings often wash their hands and believe that significant others expect them to wash their hands, tended to wash their hands more often than others. Similar conclusions about the importance of these norms have been drawn in formative, survey, and experimental handwashing studies.[10,11,33]

Turning to ability factors, motivational self-efficacy was relevant in terms of both behaviors in both studies. In other words, respondents who felt able to wash their hands at all required times tended to wash their hands more often than those who felt unable to do so. Volitional self-efficacy, in contrast, was irrelevant. Impediments were crucial for both types of handwashing in both studies, meaning that people who felt hindered in handwashing tended to wash their hands less often than those who did not feel hindered. This is in line with previous research on handwashing showing that the antipole to impediments, which is access, determines handwashing.[11]

Regarding self-regulation, coping planning was essential in both studies for both behaviors. That is, respondents who had specific plans for how to deal with impediments tended to wash their hands more often than those without such plans. Commitment also had explanatory power in both studies, although not for food-related handwashing in study 2, meaning that respondents who were committed to washing their hands tended to wash their hands more often at the specific times. Similarly, forgetting was relevant in both studies except for stool-related handwashing in study 2. That is, respondents who stated they did not forget handwashing tended to wash their hands more often. To our knowledge, there are no previous handwashing studies looking at self-regulation factors, so these results could not be compared.

Our studies further revealed that one can distinguish between stool- and food-related handwashing. The variance in both types of handwashing was substantially explained by the tested factors. However, although some factors explained stool- and food-related handwashing equally well, there are factors explaining only one behavior or with differing power. This is in line with findings from previous research on stool- and food-related handwashing in Kenya.[10]

In sum, risk factors were revealed to be rather inconsistently related with handwashing. This finding questions the current status quo of handwashing campaigns, which focus on awareness and knowledge. Instead, handwashing was consistently explained in both studies by disgust, norms, motivational self-efficacy, perceived impediments, coping planning, and commitment. These factors should be tackled in promotional activities.

Practical implications

Our findings highlight the necessity of applying additional promotions to awareness-raising and education to tackle those factors most important in explaining handwashing. To determine appropriate interventions, the RANAS model can be consulted.[14] It provides a framework ascribing intervention techniques to each factor group. To spur the emotion of disgust, for instance, affective persuasion is indicated. That is, aversion has to be attached to the unhealthy behavior of not washing hands by demonstrating, for example, that not washing hands after defecation and before eating eventually means eating feces.

To strengthen norms, norms can be highlighted by referencing important others; for example, other communities, other regions, or even other countries that (apparently) wash their hands frequently.

To heighten motivational self-efficacy, behavior-based interventions that strengthen ability beliefs and optimize infrastructure are necessary. That is, beneficiaries should be encouraged to tackle hindrance, and where not present yet, handwashing facilities could be constructed at critical junctions; for example, next to latrines and cooking places.

To lower impediments, people should be motivated to identify them and to develop detailed but realistic plans to counter them.[14,18] People could be invited to fill out a form where they specify when exactly during the day they refill the handwashing facility with water and when they check if they are short of soap and where they obtain water and soap.

The studies demonstrated that handwashing drivers partly differ between behavior (stool- and food-related handwashing) and especially between countries. Accordingly, to be effective, handwashing campaigns must be tailored to the specific behavior and the population in which the behavior needs to be changed. Therefore, there is an inevitable need to conduct elicitation research to assess the handwashing determinants in a population before every intervention to select population-tailored interventions. On the other hand, in an emergency situation there is often no time for elicitation research because help has to be administered immediately. Our results, by specifying drivers of handwashing relevant across two cultures, provide evidence to develop a campaign package suitable in various social or cultural contexts.

Strengths, limitations, and perspectives for future research

To our knowledge, these are the first studies that comprehensively explore the psychological determinants of domestic handwashing in developing countries based on theories of behavior change. Previous studies have covered only a set of factors but have never concurrently tested the whole range of factors specified in relevant theories. Only by doing the latter it is possible to assess the relative importance of psychological handwashing determinants.

The findings in these studies are also subject to some shortcomings. Although we focused on psychological determinants of handwashing, a recent behavior model for water, sanitation, and hygiene[34] published after our studies were conducted suggests also considering contextual and technology factors. Some of these factors were covered in our studies by the factors instrumental beliefs (eg, perceived costs) and impediments (eg, lack of water or soap). However, additional contextual factors such as climate or access to water and technology factors such as location, access, and physical characteristics of handwashing facilities might facilitate or hinder handwashing. Future studies should test these factors as determinants of handwashing but also as moderating factors and as antecedents of the psychological determinants.

To survey the whole range of potential psychologic factors in a questionnaire of reasonable length, single factors had to be measured with only a few items, or sometimes with only one item. This is problematic in terms of reliability. Still, the variables that were measured using several items showed acceptable alpha values.

Both studies were cross-sectional, generating correlational data. From that, no causal conclusions can be drawn. To draw causal conclusions in the future, longitudinal or experimental studies are necessary.

Self-reported handwashing is said to be overestimated due to socially desirable answer tendencies.[19] Consequently, it has been suggested to observe the behavior instead. In our studies, due to feasibility issues, behavior data had to be collected by means of self-reports. Nevertheless, self-reports reflect an internal behavior representation that is associated with child diarrhea and child diarrhea mortality,[20,21] and are worthy of examination. Looking at its determinants provides essential information about the formation of this intentional behavior. Still, validation of the results by means of observational data would be preferable.

Not all variables were measured identically in study 1 and study 2. Sometimes, language or cultural specifics impeded identical wording. As a consequence, some caution is advisable when comparing the results. Still, it was insightful to test potential handwashing drivers in two different cultural and social contexts.

In both studies, data were collected during emergency recovery. An emergency situation might affect the relevance of psychological factors; that is, people may feel more vulnerable to communicable diseases or act predominantly out of vulnerability concerns, self-efficacy beliefs could be lowered due to a lack in infrastructure, or perceived costs of goods could be inflated due to financial difficulties. Consequently, the results of our studies should not be generalized to nonemergency situations without caution.

CONCLUSIONS

As one of the first articles examining the psychological determinants of domestic handwashing in developing countries, our studies provide important new evidence on the potential targets of handwashing campaigns. Based on the results, it is possible to say that if a standard framework for handwashing campaigns had to be developed, it should not only focus on risk factors, meaning awareness, and knowledge, but also target attitude factors, such as nurture or disgust; norm factors; ability factors, such as motivational self-efficacy and perceived impediments; and self-regulation factors, such as coping planning, forgetting, and commitment. However, more research in different cultures and contexts is needed to build a better evidence base to develop a much-needed standard framework for emergency handwashing interventions.

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