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Alexandra Claudia Huber [a] & Hans-Joachim Mosler [a]
[a] Siam, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Ueberlandstrasse 133, P.O. Box 611, Duebendorf, 8600, Switzerland

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Alexandra Claudia Huber* and Hans-Joachim Mosler

Siam, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Ueberlandstrasse 133, P.O. Box 611, Duebendorf 8600, Switzerland

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In developing countries, the lack of safe water options leads to many health risks. In the Ethiopian Rift Valley, most water sources are contaminated with an excess of fluoride. The consumption of fluoride-contaminated water leads to dental and skeletal fluorosis. The article presents an approach to designing community interventions based on evidence from quantitative data. After installing a community filter, a baseline study was conducted in 211 households to survey the acceptance and usage of the filter. To identify important psychological factors that lead to health behavior change, the Risk, Attitude, Norm, Ability, Self-regulation (RANAS) model was taken into account. Descriptive statistics were calculated for behavioral determinants, and their influence on consumption was analyzed with a linear regression. For every behavioral factor, an intervention potential (IP) was calculated. It was found that perceived distance, factual knowledge, commitment, and taste strongly influenced participants' consumption behavior and therefore should be tackled for interventions.

Keywords: interventions; behavior change; drinking water; RANAS; Ethiopia

Introduction

Health issues resulting from contaminated drinking water affect the everyday lives of the citizens of developing countries. For this reason, many safe water options for households and communities are being implemented worldwide. However, research has mainly been conducted on the technical performance of mitigation options. Little research has focused on factors determining the continuous use of safe drinking water options. As a result, different social, situational, and psychological determinants of using mitigation options remain unclear. Therefore, health psychological approaches can be useful to understand citizens' health behaviors in developing countries and successfully implement intervention strategies to change their health-related behaviors (Mosler et al. 2010; Huber et al. 2011; Tamas and Mosler 2011). It is important to investigate the determinants of the use of newly implemented safe drinking water options in order to identify hindering and enhancing factors for using a new technology. A clearer understanding of the determinants will enable interventions aimed at promoting habitual use to be designed more successfully (Michie et al. 2008; Mosler 2012). As several

*Corresponding author. Email: alexandra.huber@eawag.ch

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behavior-change researchers point out, the first step in designing interventions is identifying the target behavior and examining the determinants of sustainable behavior patterns so that interventions not only address but also change possible barriers to behavior change (Abrahamse et al. 2005; Michie et al. 2005).

In the Ethiopian Rift Valley, with a population of approximately 10 million people, the ground and surface water contains high levels of fluoride because of seismic activity and volcanic rocks (Tekle-Haimanot et al. 2006). The consumption of this water leads to a high risk of dental and skeletal fluorosis. Endemic fluorosis causes not only physical impacts (decay of teeth, joint pain, crippling of bones), but also social and psychological (social exclusion and rejection) ones (World Health Organization 2004; Tekle-Haimanot et al. 2006). Unfortunately, it has been found that the medical treatment of dental and skeletal fluorosis is difficult and mostly ineffective, especially when the condition has reached an advanced stage (Tekle-Haimanot et al. 2006). For this reason, it is crucial to prevent high fluoride consumption. To decrease fluoride intake, different methods of defluoridating drinking water have been developed. One possible method is filtering the water on a community or household basis before consumption (Kloos and Tekle-Haimanot 1999).

The goal of this study is to determine the psychological factors that influence people's fluoride-free water consumption and hence can be targeted for behavior-change interventions. For this purpose, the Risk, Attitude, Norm, Ability, Self-regulation (RANAS) model of behavior change (Mosler 2012) was employed. The behavior determinants in the model are derived from various health behavior change theories, such as the theory of planned behavior (Ajzen 1991), the health action process approach (Schwarzer 2008), and research on habit development (Tobias 2009). The model focuses on five different factor blocks that determine behavior change: risk factors, attitude factors, norm factors, ability factors, and self-regulation factors. In several publications, the factors of the RANAS model have been verified to influence behavior: for solar water disinfection (SODIS) see Heri and Mosler (2008) in Bolivia and Kraemer and Mosler (2010) in Zimbabwe; for hygiene behavior see Graf et al. (2008) in Kenya; for using arsenic-free deep tube wells see Mosler et al. (2010) in Bangladesh; and for the consumption of fluoride-free water in rural Ethiopia see Huber et al. (2011).

The focus of this study is to describe a psychological approach to designing an evidence-based community intervention to change health behaviors. This leads to our main research questions: (RQ1) Which psychological factors influence the consumption of fluoride-free water and (RQ2) which of the influencing factors still have the potential to be changed? The study analyzes data gathered from a survey, describing the sample's mean values of all psychological factors and use of the community filter. Further, the psychological factors are tested in terms of their influence on the targeted behavior, and the intervention potentials (IP) of the factors that enhance the consumption of safe water are calculated. Finally, possible intervention strategies are discussed to further increase the use of a newly implemented community filter and the consumption of fluoride-free water.

Methods

Study area and design

The data gathered for this study is part of a cross-sectional research study in Tuchi Gragona, a village in the Northern Rift Valley region of Ethiopia. The study took place in July 2011 three to four weeks after the fluoride-removal community filter was installed. In the project area, people rely on water sources (one windmill and 40 hand-dug wells) that are highly contaminated with fluoride. Very few households have the resources to fetch water from the nearby town of Meki, whose water sources – while still over the WHO guidelines for fluoride (1.5 mg/l) – are not as contaminated as the sources in their village. Tuchi Gragona is a typical rural village in the Rift Valley region inhabiting approximately 2000 people. The village lies 90 miles southeast of the capital, Addis Ababa, and around four miles south of the closest town, Meki. People live in simple mud houses with no electricity or proper sanitation. Most of the villagers work as self-sustaining farmers or daily laborers. There are two public schools (for grades 1–8) in the project area. In June 2011, Addis Ababa University and the research team implemented a fluoride-removal community filter based on aluminum oxy-hydroxide filter material, a mixture of aluminum sulfate and sodium hydroxide (Shimelis et al. 2006). The filter was installed at the central water source, the Tuchi Gragona windmill. As there is no other village within a distance of four miles, the community filter is mainly for the usage of the inhabitants. The opening ceremony for the filter project was attended by many beneficiaries of the project area as well as by roughly a dozen representatives from the region, the Ministry of Water and Energy, research institutions, and different non-governmental organizations (NGOs). The inauguration included speeches and a performance by a local theater group raising awareness of the fluoride problem. The inauguration festivity was the first and only informational activity in the project village. Unlike the raw water sources, which are free of charge, the community and the regional water committee decided to sell the fluoride-treated water for the price of 25 Ethiopian cents[1] per 20 l. The water price was set to cover repairs and the salary of a caretaker to ensure the sustainable maintenance of the filter.

Measurement

Because of high illiteracy in the project area, the measurements were made with standardized questionnaires in the form of face-to-face interviews. Through a random route procedure (Hoffmeyer-Zlotnik 1997), every second household was selected for interviewing. The households were visited without preannouncement. Every participant was informed in detail about the study and asked for verbal consent before starting the interview. The interviews were held with the person responsible for water fetching and water treatment in the respective household. A total of 211 households (approximately 50% of the inhabitants in the area) were interviewed. Two experts from the NGO translated the questionnaire from English into two local languages (Oromic and Amharic) and back to English for verification. During a two-day training period, the interviewers (local college students) revised every item of the questionnaire in order to ensure consistency of meaning and correct translation. Further, during the training, the interviewers were provided with knowledge about the project area, fluoride, fluorosis, and the community filter. Moreover, social skills and interviewing techniques (e.g. how to approach a household) were covered. The interviewers were supervised by the research team throughout the survey. The questionnaire was designed to cover various factors of interest: demographics, community filter use, consumption of filtered water, and psychological variables of the RANAS model. The application of the RANAS factors was discussed during expert interviews and focus group discussions. As a result, the research team decided to evaluate the attitude factors of the RANAS model more in detail, not only differentiating between affective and instrumental beliefs but also perceived taste, distance, costs, and attitude regarding the caretaker were added to the model. Example items for each factor can be found in Table 1.

Data analysis

To determine the psychological factors with the strongest IP three different analyses were applied. First, descriptive statistics on the dependent variable (consumption of fluoride-free water) and all psychological variables were computed. Second, a linear regression analysis was carried out to identify significant behavior determinants. The unstandardized regression coefficients (Bs) indicate the slope or strength of association between the determinant and the behavior, or in other words, how much the predicted change is in the dependent variable if the corresponding independent variable changes one unit (Field 2009). In the last step, IP for the significant determinants were calculated. The sample's mean was subtracted from the factor's targeted value and then multiplied by the regression weight B of the determinant.

Results

Descriptive statistics

The vast majority (95.4%) of the respondents were female and 72.2% illiterate. The rejection rate of interviews was very low (2.8%). Out of the total sample, 45.5% of the households stated to use only filtered water for drinking and cooking. From those who consumed filtered water variably, 20.9% indicated that less than 50% of the water they consumed was fluoride-free water, 25.5% indicated that between 50 and 75% of the water they consumed was fluoride-free, and 8.1% indicated that at least 75% of the water they consumed was fluoride-free water. Only three respondents (1.3%) had not yet consumed filtered water at all. On average, the respondents stated that 89.9% (ranging from 0 to 100%, Mdn = 100) of their drinking water came from the filter, but only 62.8% (also ranging from 0 to 100%, Mdn = 75) used filtered water for cooking. On average, participants reported buying 4.9 jerrycans per week from the community filter (ranging from 0 to 14 jerrycans, Mdn = 5). For every person in the household, there was an average of 2.9 l (0–10.7 l, Mdn = 2.6) filtered water available per day. However, one person consumed (including both drinking and cooking) an average of 4.4 l of water per day, thus indicating that almost 50% of water intake still came from fluoride-contaminated water.

The descriptive statistics on the main psychological factors are shown in Table 2. The means of most factors are quite high. Table 2 shows that participants perceive fluorosis as severe (M = 3.70), have a very positive overall attitude about fetching water at the community filter (M = 3.35), feel that consuming filtered water is a personal obligation (personal norm, M = 3.15), feel highly committed to using the filter (M = 3.32), and very seldom forget to fetch water from the filter (M = 0.18). Further, it is seen in Table 2 that participants' factual knowledge about fluoride, fluorosis, and the prevention of fluorosis is moderate (M = 2.94). Moreover, the perceived distance is on average to some extent far from their home (M = 2.35), and the cost of the filtered water is perceived as cheap (M = 1.38). In addition, the taste of filtered water (especially food or coffee made with it) is considered good (M = 2.66),

Table 1. Example items for each factor used for the analyses, response options, and values.

Factors	Example Items	Response options	Values
Behavior	How many jerrycans/barrels of water do you fetch from the community filter per week?	Open	
Risk factors			
Vulnerability	How high or low do you feel are the chances that someone in your family will develop skeletal fluorosis? The chances are...	Five-point scale from much higher than average to much lower than average	0 to 4
Severity	Imagine that you contracted skeletal fluorosis; how severe would the impact be on your life in general?	Five-point scale from not severe at all to very severe	0 to 4
Knowledge	How can you prevent getting fluorosis? With boiling the water before consuming it With filtering the water before consuming it With taking medicine With brushing your teeth more often	For each: 0 = answer was wrong 1 = answer was right	0 or 1
Attitude factors			
Overall attitude	Do you think that drinking filtered water is good or bad for your health?	Nine-point scale from very unhealthy to very healthy	−4 to 4
Perceived distance	Is the community filter far from your home?	Five-point scale from very far to not far at all	0 to 4
Perceived cost	Do you think that 0.25 Birr for one 20-liter jerrycan of fluoride-free water is too cheap, too expensive, or reasonable?	Nine-point scale from much too expensive to much too cheap	−4 to 4
Taste	How much do you like or dislike the taste of food cooked with filtered water?	Nine-point scale from I dislike it very much to I like it very much	−4 to 4
Normative factors			
Descriptive norm	How many people from your kebele (community) fetch water from the community filter?	Five-point scale from almost nobody to almost everybody	0 to 4
Injunctive norm	Most of my neighbors think I should fetch water from the community filter.	Nine-point scale from I strongly disagree to I strongly agree	−4 to 4
Personal norm	I feel a strong personal obligation to fetch water from the community filter.	Nine-point scale from I strongly disagree to I strongly agree	−4 to 4
Ability factors			
Self-efficacy	I believe I have the ability to fetch water from the community filter regularly in the next month.	Nine-point scale from I strongly disagree to I strongly agree	−4 to 4

(*continued*)

Table 1. (*Continued*).

Factors	Example Items	Response options	Values
Self-regulation factors			
Action planning	Do you have a detailed plan regarding when during the day to start collecting from the community filter?	Five-point scale from no detailed plan at all to a very detailed plan	0 to 4
Coping planning	Have you made a detailed plan regarding what to do if the community filter breaks?	Five-point scale from no detailed plan at all to a very detailed plan	0 to 4
Commitment	Do you feel committed to fetching water from the community filter?	Five-point scale from not committed at all to very committed	0 to 4
Perceived habit	How much do you feel that you fetch water from the community filter as a matter of habit?	Five-point scale from not at all a habit to a very strong habit	0 to 4
Automaticity	I fetch water from the community filter automatically without thinking much about it.	Nine-point scale from I strongly disagree to I strongly agree	−4 to 4
Forgetting	How often does it happen that you forget to fetch water from the community filter?	Five-point scale from almost always to almost never	0 to 4

and opinions about the caretaker are positive (M = 2.96). Moreover, people think that at least half of the people they know also fetch water from the community filter (descriptive norm, M = 2.51), and important others approve of their using the community filter (injunctive norm, M = 2.80). Further, on average, people feel able to use the community filter (self-efficacy, M = 2.96), plan how and when to initiate the behavior (action planning, M = 2.55), and report detailed plans on overcoming upcoming barriers (coping planning, M = 2.33). On average, people perceive fetching water from the filter as a medium strong habit (M = 2.85) and do it automatically (M = 2.36). However, the mean of the perceived vulnerability factor (M = 0.69) indicates that on average, people do not feel very vulnerable to fluorosis.

Determinants of fluoride-free water consumption

The percentage of fluoride-free water consumption was taken as a dependent variable in a linear regression analysis. The calculated regression displayed in Table 2 shows the factors that significantly predict or influence the consumption of filtered water. An outlier analysis revealed the necessity of excluding eight cases (residuals exceeded more than three standard deviations) from the regression sample resulting in a total sample size of 203. The final model displayed a high explanation of variance (adjusted $R^2 = 0.568$). The regression analysis revealed seven psychological factors influencing fluoride-free water consumption, four of which influenced the behavior positively and three of which influenced the behavior negatively. From the risk factors, it was determined that it is knowledge that influences the behavior ($B = 3.98$, $p < 0.01$), meaning that the more knowledge someone has about fluoride, fluorosis, and the prevention of fluorosis, the more filtered water is consumed.

Table 2. Descriptive statistics, linear regression analysis on the consumption of fluoride-free water, and calculated intervention potentials for significant factors.

Factors		Descriptive statistics						Regression analysis			Intervention potentials (IP)
		n	Range	M	SD	α	Items	*B*	*SE B*	*p*	
Risk factors	Vulnerability	211	[0, 4]	0.69	0.79	0.785	2	−1.13	1.78	0.527	–
	Severity	211	[0, 4]	3.70	0.471	–		2.18	3.04	0.473	–
	Knowledge	209	[0, 5]	2.94	1.07	–		3.98**	1.22	0.001	8.20
Attitudinal factors	Overall attitude	211	[−4, 4]	3.35	0.531	0.814	5	−2.08	3.52	0.555	–
	Perceived distance	211	[0, 4]	1.65	1.06	–		−6.14***	1.35	<0.001	10.13
	Perceived cost	211	[−4, 4]	1.38	1.60	–		−1.59	0.889	0.076	–
	Taste	211	[−4, 4]	2.66	0.929	0.870	3	5.59***	1.50	<0.001	7.50
	Caretaker	211	[0, 4]	2.96	0.746	0.892	3	−3.35	2.51	0.183	–
Normative factors	Descriptive norm	211	[0, 4]	2.51	0.856	0.831	3	−5.99**	2.16	0.006	–
	Injunctive norm	211	[−4, 4]	2.80	0.757	0.857	4	4.81	2.75	0.082	–
	Personal norm	211	[0, 4]	3.15	0.592	0.703	4	−0.135	3.66	0.971	–
Ability factor	Self-efficacy	211	[−4, 4]	2.96	0.647	0.805	4	2.29	3.37	0.496	–
Self-regulation factors	Action planning	211	[0, 4]	2.55	1.01	0.923	2	2.73	1.92	0.158	–
	Coping planning	211	[0, 4]	2.33	0.961	0.686	2	0.161	2.43	0.947	–
	Commitment	211	[0, 4]	3.32	0.533	0.743	4	11.05**	3.13	0.001	7.49
	Perceived habit	211	[0, 4]	2.85	0.964	–		4.75*	2.20	0.032	5.47
	Automaticity	211	[−4, 4]	2.36	1.84	0.948	2	−0.716	0.825	0.387	–
	Forgetting	211	[0, 4]	0.180	0.627	–		−10.03***	2.28	<0.001	1.80

Notes: Means (M), standard deviations (SD), and value ranges (Range) for all factors are provided. For factors with multiple items, Cronbach's alpha (α) for scale reliability and the number of items used is indicated. B = unstandardized regression coefficient; $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; $SE\ B$ = standard error of B; p = significance level. Adjusted $R^2 = 0.568$, $N = 203$. A forced entry method was used for the calculation. Intervention potential (IP)=[Maximum value (Max) – Mean (M)] × unstandardized regression coefficient (B).

Further, two attitudinal factors influence the behavior: perceived distance ($B = -6.14$, $p < 0.001$) and taste ($B = 5.59$, $p < 0.001$). This indicates that the more people feel the filter is far away from their home, the less water they fetch from the community filter, and the more they like the taste of filtered water, the more they consume it. Further, the examination of the parameter estimates revealed that the descriptive norm has a negative influence on behavior ($B = -5.99$, $p < 0.01$). That is, the more water people think neighbors are fetching at the community filter, the less they fetch themselves. This negative relationship between the descriptive norm and filtered water consumption was found to be due to a suppressor effect, meaning that one or more factors in the regression suppressed the influence of the descriptive norm. Further analyses revealed that both commitment and overall attitude suppressed the influence of the descriptive norm. Only if people feel committed (value > 3) to using the filter does the descriptive norm positively relate to the behavior ($r = 0.195$, $p < 0.05$), and only if they have a positive overall attitude (value > 3) toward the filter is the behavior positively influenced by the descriptive norm ($r = 0.212$, $p < 0.05$).

Finally, commitment showed a strong, positive influence on behavior ($B = 11.05$, $p < 0.01$). Hence, the more people feel committed to using the community filter, the more they consume filtered water. However, perceived habit ($B = 4.75$, $p < 0.05$) and forgetting ($B = -10.03$, $p < 0.001$) are also important influential factors of behavior. The less people forget to fetch water from the filter and the more they feel that they fetch water as a matter of habit, the more they consume filtered water.

Intervention potentials

In Table 2, the calculated IP are displayed. For each factor, the sample's mean was subtracted from the factor's targeted value and then multiplied by the regression weight of the determinant B (the slope or strength of association between the determinant and the behavior). The higher the resulting value for the determinant, the greater the potential impact of the intervention targeted at changing this factor. The potentials were calculated only for the psychological factors that had a significant influence on the target behavior (see regression analysis). As seen in Table 2, for most factors (except for perceived habit and forgetting), the IP are high. The calculated potential for perceived habit is moderate (IP = 5.47), mainly because habit is already quite strong, and the influence on behavior is less strong than the influence of other factors. It also seems that participants rarely forgot to fetch water from the community filter, which explains why its potential is low (IP = 1.80). The highest IP was reached by perceived distance (IP = 10.13). Further, knowledge (IP = 8.20), perceived taste (IP = 7.50), and commitment (IP = 7.49) also reached high IP.

Discussion

The goal of this study was to reveal the psychological factors that positively influence safe water consumption and have the potential to be changed. The newly implemented community filter seemed to be widely accepted within the community. Of course, the study had a few limitations. One limitation, as with all self-reported data, was the risk of a social desirability tendency in the respondents' answers. However, we attempted to reduce this risk by selecting interviewers who were local and not higher than the participants in terms of status. Moreover, the interviewers passed an intensive training course in which they were sensitized to that bias. During the course, they practiced how to explain to the respondents the importance of answering as honestly as possible. Moreover, interviewers were visited randomly during their work and the first author checked each questionnaire regarding missing data, mistakes, and ambiguities in order to ensure data quality. Unfortunately, there was no alternative method of gathering the data because of the high illiteracy rate in the project village.

As the time of the survey is very early after the installation of the community filter, all users have to be considered as early adopters (Rogers 2003). Middle and late adopters might have different reasons for using the community filter as it was shown for the adoption of solar water disinfection in Bolivia (Moser and Mosler 2008).

Further, the present study is only cross-cutting, as it is meant to evaluate the current influencing factors of fluoride-free water consumption in order to determine which behavior change interventions would be most effective. However, it would be valuable to investigate longitudinal data to understand how and why people's consumption behavior changed over time and if the suggested interventions were able to increase filter use and tackle the targeted psychological factors. Future studies should replicate the results using a different setting and sample, because the IP may not be the same in other Ethiopian villages. Moreover, in a different setting there might be other underlying psychological factors that are missing in the RANAS model and if added could further increase the model's validity.

Implications for practice

With the knowledge of the decisive determinants of filtered water consumption and their IP, specific intervention strategies can be designed to enhance the usage through influencing these psychological factors.

The highest IP was reached by perceived distance, which was as expected. The majority of people in this village have access to a private or shared hand-dug well. Therefore, the walking distance to such a well is very short and requires a minimal amount of effort. A similar result was found in a study about the usage of arsenic-free deep tubewells in Bangladesh, where the time needed to collect water at a tubewell significantly influenced the use of that well (Mosler et al. 2010). Perceived distance is, on the one hand, a situational factor, but changing the situation would require installing more community filters, which, due to financial constraints, is not feasible. On the other hand, perceived distance is an attitudinal factor. Therefore, changing people's beliefs or attitudes about the distance might be more useful and cost effective. This could be done with persuasive communication. Strong arguments must be found and delivered by, for example, health promoters to decrease people's perceived distance and increase their willingness to walk longer distances for fluoride-free water. Possible arguments could include the value of walking longer for safe water and a healthy family. Further, people's perceived effort could be reduced by developing a weekly plan regarding when and how much water has to be fetched each week instead of walking there every day.

Furthermore, perceived taste also showed the potential for change. However, the taste is, in general, perceived as good. This result implies that either people do not associate the salty taste with bad taste, in general, or that compared with the taste of raw water, the filtered water is good. Several studies on behavior change regarding water consumption found perceived taste to be influential (e.g. Heri and Mosler 2008; Huber et al. 2011). Changing the actual taste of the water is not that simple. Regarding the aluminum oxy-hydroxide material, it is known that (especially at the beginning) the water might taste a bit salty due to elevated sulfate concentrations. Thus, if people are informed that the taste will get better after a while, it might motivate them to use the filtered water continuously. Nonetheless, the survey took place three to four weeks after the inauguration when the taste might still have been salty. By now, the taste should have improved notably. However, perceived taste is again an instrumental attitude that can be changed by persuasion (Petty et al. 2004). Strong arguments have to be applied to persuade people about the health aspect of the less tasty water. Comparing it to medicine might help in order to help people conclude that what is good for your body does not always taste good (e.g. koso, a traditional plant to treat worms) and vice versa (e.g. sugar).

In addition, knowledge was found to have a substantial IP. Knowledge being one of the influential behavior factors was also found in a study about the uptake of solar water disinfection (Graf et al. 2008). Increasing people's knowledge about fluoride, fluorosis, and especially the prevention of fluorosis can be transferred by information interventions (e.g. workshops for community members) (Mosler 2012). Heads of household and their wives (who are normally responsible for water treatment) should attend educational training in which they receive factual knowledge. The workshop intervention could even be combined with a commitment intervention, because commitment also showed a respective IP. At the end of the workshop, for example, people could form an intention to always drink and cook with fluoride-free water and express their plan in public, in front of all other community members. Committing oneself in public evokes not only a personal feeling of commitment, but also a social pressure to do what was communicated (Mosler and Tobias 2007).

Further, perceived habit was found to influence people's water consumption. A similar study about the usage of fluoride-removal household filters in Ethiopia found that the more people perceive the usage of the filter as a matter of habit, the more possible they exclusively consume filtered water (Huber et al. 2011). To tackle people's perceived habit, prompts or implementation intentions could be effective intervention strategies (Tobias 2009). Prompts are external memory aids that remind an individual to execute a certain behavior at a specific time (Dahlstrand and Biel 1997). Prompts can be easily designed and distributed by health promoters, who inform the household where to install the prompt so that it is seen every day and reminds people to perform the targeted behavior (e.g. fetching water at the community filter). Personalized prompts can also be very effective and inexpensive. People could have their pictures taken at the community filter, and a slogan could be inserted in order to remind people to always fetch fluoride-free water. Such a personalized prompt would also strengthen people's commitment to fetching water from the community filter. Another effective tool is forming implementation intentions. Implementation intentions help people to perform a specific behavior by making concrete plans of actions that specify *how*, *where*, and *when* actions should be performed to achieve an intended goal (Gollwitzer 1999). In this context, it should be discussed with the household *when* is the best time to fetch water from the community filter in order to fit their daily or weekly routines and *how much* water they have to fetch to cover the household needs. At the same time, it should be discussed *how* to incorporate the consumption of filtered water in their daily activities. As people are in the fields most of the day, it would be appropriate to make plans regarding how they can take filtered water with them.

Conclusions

This study on the usage and acceptance of the newly implemented community filter reveals important insights regarding the determining factors of fluoride-free water consumption. Even though a great number of community members were already adapting well to the new behavior, the consumption of fluoride-free water still needs to be increased. The mentioned intervention strategies (persuasive communication, educational workshops, commitment, prompts, and implementation intentions) could be implemented together or separately to further increase consumption. More precisely, we recommend a collaboration of different stakeholders to implement further fluoride mitigation options. On the regional level, one should discuss which mitigation options are accurate and feasible for a given contaminated area. Further, an implementer is needed, for example a local NGO, who should be in charge of (a) communicating with the community and its leaders about the plan and organization, (b) organizing the construction of the community filter, and (c) designing and implementing effective interventions to change people's water consumption behavior. The results of this study are important for the implementer organization in order to know with which psychological interventions people's behavior can be changed successfully.

Moreover, in Ethiopia, every area has an assigned water bureau, which should be responsible for managing and maintaining the new safe water source. On the national level, it is necessary to further improve access to fluoride-free water for people living in the contaminated Rift Valley Region. Even though considerable achievements have been made since the detection of fluoride in urban areas, effective, sustainable, and well-maintained mitigation options in rural areas are still rare (Tekle-Haimanot et al. 2006). The National Fluorosis Mitigation Project Office is planning to develop a strategy plan that describes future steps to improve the access to fluoride-free water in the Rift Valley region and other fluoride-affected areas in Ethiopia.

To conclude, the newly implemented community filter seemed to be widely accepted within the community. However, people's perceptions (regarding distance, taste, knowledge, habit, and commitment) should be further influenced in order to increase their fluoride-free water consumption and prevent the development of severe fluorosis.

Note

1. 1 Ethiopian Birr = 6 US cents (exchange rate as of 13.6.2011).

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