

Persuasion factors influencing the decision to use sustainable household water treatment

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(Received 4 February 2009; final version received 2 September 2009)

Solar water disinfection (SODIS) is a sustainable water treatment method. With the help of the sun and plastic bottles, water is treated and illnesses prevented. This paper aims to identify the factors influencing SODIS uptake, that is, why someone may become a SODIS user. This uptake decision can be influenced by persuasion. From behaviour theory, variables are recognised which have been proven to influence intention and behaviour and simultaneously can be influenced by persuasion. A total of ($n = 878$) structured interviews were conducted in a field study in Zimbabwe. Linear and binary logistic regressions showed that several of the initially proposed persuasion variables have significant influence. Persuasion factors have a stronger influence on the uptake of SODIS use and on intention to use SODIS in the future than on the amount of SODIS water consumed. Ideas are presented for using the effective variables in future SODIS campaigns and campaigns in other fields.

Keywords: intervention; solar water disinfection (SODIS); behaviour change; campaign; persuasion; convictions

Introduction

Although clean water is a human right, 1.1 billion people still do not have access to safe drinking water (World Health Organization [WHO] 2006b). About 1.8 million people die from diarrhoeal illnesses every year (WHO 2007). These illnesses are mainly due to a lack of safe drinking water, sanitation and hygiene. This means many deaths can be avoided and living conditions improved by enabling access to safe drinking water. Boiling water is one common method of treating unsafe water to avoid diseases. However, it uses a lot of natural and human resources, requiring fuel (wood or gas) as well as time. Solar water disinfection (SODIS) is a way of treating water with the help of the sun and (used) plastic bottles that is more socially and environmentally sustainable. It uses a waste product (used plastic bottles) and the sun to treat drinking water instead of using wood or gas for boiling or chemicals for disinfecting.

SODIS is a pro-poor household-based water treatment method that uses transparent plastic bottles to disinfect the water with the help of the sun. PET bottles filled with water are exposed to sunlight for six hours (or two consecutive days if it is more than 50% cloudy). This procedure inactivates pathogens that are responsible for waterborne diseases like diarrhoea, dysentery or cholera (Joyce et al. 1996;

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Berney et al. 2006). The sunlight destroys these pathogenic microorganisms through two mechanisms: (i) UV-A radiation (wavelength 320–400 nm), and (ii) increased water temperature (Meierhofer and Wegelin 2002). Disease incidence and mortality rates can thus be reduced, especially for vulnerable groups like the elderly, children or HIV-infected persons (Conroy et al. 2001; Graf et al. 2008). This is particularly important for those who cannot afford to treat their water by other means, because wood, gas or chemicals are too expensive. By contributing to overall health, SODIS also creates economic benefits by making more working days available and saving money for medication.

SODIS is not only socially sustainable, giving people the chance to improve their living conditions independently of external help, but also environmentally sustainable, as the winning of the Energy Globe Award shows (Energy Globe 2004). PET bottles, which are otherwise only a source of pollution, are re-used, and firewood or gas, which would otherwise be used for boiling water, is saved. Deforestation is slowed down and air pollution avoided; instead, a sustainable energy source, namely the sun, is used.

In spite of all these obvious advantages, SODIS usually encounters a slower and more limited uptake than one would expect (Moser et al. 2005; Heri and Mosler 2008; Moser and Mosler 2008). The reasons for this are still not fully understood. In order to run more successful dissemination campaigns in the future, it is important to know which factors contribute to a fast uptake of SODIS. There is consequently a need to analyse how people can be convinced of this sustainable innovation. Since doubts about the effectiveness of such a simple method as SODIS may exist (Meierhofer and Wegelin 2002) persuasion of its advantages would be necessary. It is possible to convince a person of adopting an innovation, e.g. a water treatment method, by persuading that person about its advantages. Persuasive communication is deliberately used to influence the attitudes and therefore the behaviours of the recipients of arguments. Thus, it should be possible to influence the uptake of SODIS with the help of persuasion. To study this process, we will identify the factors that may be changed by persuasion and simultaneously influence intention and use of SODIS. This approach will allow us to identify the factors on which a campaign should concentrate.

Persuasion factors

Persuasion has been studied extensively and in great detail (Petty and Cacioppo 1986a; Chaiken et al. 1996; Petty and Wegener 1999; Murphy 2001; Weisbuch et al. 2005). Some of the factors that are being researched in persuasion research also proved to explain behaviour in well-known behavioural models like the health belief model (e.g. Janz and Becker 1984; Schwarzer 2004) or the theory of planned behaviour (Ajzen 1991). The following variables are those variables from these models that have been used in persuasion research so far.

Involvement

The first factor to have an influence on behaviour is the involvement of the recipient. Involvement, which is a common construct in persuasion research (Johnson and Eagly 1989), means that a topic is viewed as belonging to the self. It has been shown that involvement has an influence in persuasion. For example, a TV show that

influenced the feeling of involvement showed the direct impact of involvement on the behavioural intention to donate corneas (Bae 2008). Thus, it is hypothesised that the higher a person's involvement, the more likely he or she is to be a SODIS user and the more SODIS water he or she will drink and intend to drink.

Attitude

Attitude is a variable that is widely used, in behaviour models (e.g. Ajzen 1991) as well as in persuasion research (Petty and Cacioppo 1986b). Attitude can be described as a tendency to react to something with like or dislike (Eagly and Chaiken 1995). Petty and Cacioppo (1986b) found that an induced attitude change about using different kinds of razors also changed the behavioural intention to buy the corresponding product. The extent to which attitude and intention changed due to argument quality varied with cognition intensity, but the correlation between them remained significant (Petty and Cacioppo 1986b). Two other persuasion studies, about bus use and organ donation, also found this relation between attitude change and the corresponding behaviour (Beale and Bonsall 2007; Bae 2008). Therefore, the more positive the attitude towards SODIS, the more likely and the higher the intention to use SODIS and the corresponding behaviour.

Habit

Habits are routines of behaviour that are repeated frequently and occur without thinking consciously (Bargh and Chartrand 1999). Habits have proven to influence behaviour amongst others through persuasion. Beale and Bonsall (2007) found that the previous behaviour and habitual disposition of potential bus users played a significant role in differentiating between those whose behaviour could be changed through persuasion and those whose behaviour did not change. That means that SODIS users with a higher habit to use SODIS should have a higher consumption of SODIS-treated water.

Affect

This variable refers to the experience of feeling or emotion (Blechman 1990) and emotions were found not only to facilitate persuasion but also to influence (in this case political) behaviour (Brader 2005). In another study, possible cornea donors were influenced affectively, with an indirect effect on behavioural intention (Bae 2008); other findings show that behavioural intention can even be directly influenced by the kind of feeling induced (Rucker and Petty 2004). Rucker and Petty (2004) induced sad and angry states to determine whether subjects preferred active (angry participants) versus passive (sad participants) holidays. This indicates that a more positive affect towards SODIS should result in a higher likelihood of being a SODIS user, a higher intention to use SODIS and higher SODIS consumption by SODIS users.

Knowledge

Knowledge is known as an influential factor in persuasion research (e.g. Tormala and Petty 2007). A meta-analysis of condom use (Albarracin et al. 2003) showed that

next to (attitudinal) information, knowledge about behavioural skills led to an increase in behaviour. It is therefore hypothesised that better knowledge about why SODIS should be used increases the likelihood of using it as well as the intention to use it and its consumption.

Beliefs

Most persuasion research is designed to change beliefs; therefore, these are one of the most important factors to examine. In a study of patient behaviour in relation to medication (Jalnawala and Wilkin 2007), beliefs were found to be influenced by persuasion (and different argument types) as well as to influence the intention to ask for a certain medication. In the present study, positive beliefs about how much SODIS costs and how much time it takes should lead to more SODIS consumption and the belief about how healthy SODIS is to more SODIS consumption, a higher intention and more SODIS users.

Perceived benefit

Perceived benefit plays an important role in persuasion. People are more easily persuaded when they see a good cost:benefit ratio for themselves; perceived negative consequences are viewed rather critically (Martin et al. 2003). Therefore, messages focusing on the benefit of a behaviour (gain-framed messages) are more persuasive (Rivers et al. 2005). These findings agree with the results of an experiment with beach-goers whose intentions and behaviour concerning sunscreen-use were changed more effectively by a gain-framed message than a loss-framed one (Detweiler et al. 1999). Thus, when people think that SODIS is worth more than it costs – that is, when they see a positive cost:benefit ratio – they will be more likely to become SODIS users, SODIS users will drink more SODIS, and the intention to use SODIS will be higher.

Ability

The better a person can process and understand incoming information, the more persuasive is that information (Pierro et al. 2005). Ability is an important factor in persuasion research and determines which route to persuasion is taken (Chaiken 1980). Distracting subjects limits their ability to process information while giving them more time to think about a message enhances it (Albarracin and Wyer 2001). Manipulating distraction and processing times was found to have various impacts on the intention to vote for comprehensive exams at the subject's university as well as on the actual voting in an artificial situation (Albarracin and Wyer 2001). SODIS use will be more frequent and more likely and intention stronger for subjects with a better ability to process information.

Social influence

Social influence (or subjective norm) is used as a proven factor in the Theory of Planned Behaviour (Ajzen 1991), but also in persuasion research (e.g. Cialdini and Trost 1998). Persuasion through social influence is more effective when more people share the same opinion (Erb 1998) and when other people are models for certain

behaviours (Cialdini and Trost 1998). As regards social influence, persuasion takes place indirectly, via social pressure, as in the case of young people from Ireland who were influenced to start smoking by peer pressure (Stewart-Knox et al. 2005). Therefore, it is hypothesised that the more people someone knows who use SODIS, the more likely is that person to use SODIS and the higher its consumption and the intention to use it.

Self-persuasion

Anyone can be influenced by self-persuasion. It is thus an interesting topic in persuasion research (Aronson 1999). Self-persuasion occurs when someone talks about a topic; the point of view which they communicate has a persuasive influence on them (Frey and Gaska 1993). Thus, by talking about a topic, self-persuasion has a powerful and long-lasting effect on attitudes and behaviour (Aronson 1999). So the more someone talks about SODIS, the higher his/her intention to use SODIS, the likelihood to be a SODIS user and for users to drink more SODIS.

There are additional widely-used factors like self-efficacy or perceived behavioural control, which are being used in other well-known behavioural models, like the protection motivation theory or the health belief model (for an overview, please see Prentice-Dunn and Rogers 1986). However, these factors have not yet been linked to persuasion research. That is why they will not be included in the analysis at hand.

For the persuasion variables that have been identified from behaviour models and persuasion research (involvement, affect, attitude, habit, knowledge, perceived benefit, beliefs, social influence, self-persuasion), it is hypothesised that the higher (or more positive) they are, the more likely someone is to be a SODIS user and the more SODIS water he/she consumes. Many studies of persuasion and behaviour change examine the intention to do something along with or instead of the behaviour (e.g. Bassili 1996; Lewis et al. 2007). Also, in the present study, the intention to use SODIS should be proportional to the magnitude of the identified persuasion variables:

- (1) The intention to use SODIS (for non-users and users separately) is predicted by the identified persuasion variables;
- (2) The higher (or more positive) the identified persuasion variables, the more SODIS-treated water does a SODIS user drink;
- (3) The higher (or more positive) the identified persuasion variables, the more likely someone is to be a SODIS user.

The denoted variables have been chosen because they have proven to be important in persuasion research. Some of the chosen variables are also widely used in behaviour models. These variables have been shown to influence behaviour as well as intention. Therefore, it shall be shown that the persuasion variables influence behaviour and intention. However, SODIS behaviour can be divided into two parts: the uptake and the amount of SODIS water consumed. Uptake means that someone decides to be a SODIS user, but it does not specify how much SODIS water (as part of the overall drinking water) someone consumes. Thus, both options are being analysed.

Besides examining the named questions, this paper aims to use these findings to develop a campaign with persuasion strategies that suits the situation and needs of

the people it is meant for. Designing one such campaign can create a model for and an example of how to design other interventions with persuasion strategies.

Methods

Research area

The field research was carried out in informal settlements in high-density areas around Harare. Harare is the capital of Zimbabwe, which currently has the highest inflation rate in the world and is thus economically very unstable. The municipal infrastructure, including the water supply and sanitation is good, but the high-density areas and so-called informal settlements that grew after a governmental relocation of city residents in 2005, such as Epworth and Hopley Farm, widely lack access to sanitation and safe drinking water (Amnesty International 2006). Only 47% of the 13 million inhabitants of Zimbabwe in rural areas have access to improved sanitation, 72% have access to improved drinking water sources and the mortality rate of children below five is 10%. Of these, 12% die from diarrhoeal diseases (WHO 2006a). These numbers are believed to be higher in the high-density areas and to increase rapidly with the deteriorating situation in Zimbabwe. As most people get their water from unsafe water sources such as (unprotected) wells, secondary contamination is high and most people do not treat their water; there is great potential for a water treatment technique like SODIS (Murinda and Kraemer, 2008).

Procedure

Data was obtained by conducting structured interviews in the households of the interviewees. People took part voluntarily in this study and without receiving anything for it. They were chosen randomly, by means of Random-Route-Sampling (Hoffmeyer-Zlotnik 2003). That means the interviewers (who were local citizens from around Harare and chosen on behalf of their qualifications and work experience) only went to every third household on their way through their assigned area. That way, 10 interviewers completed 5–8 interviews a day, each one taking about 45 min. Interviews were held in Shona, the main native language of Zimbabwe. Rejection rate of the households that were asked to participate was 5%; 926 people were asked to participate, 48 people refused, which leaves a final figure of $n = 878$ subjects. The person in the household responsible for the drinking water of the members of the household was interviewed.

The interviews based on our questionnaire took place in May 2007, 2–3 weeks after an information event about SODIS in the respective areas. People were informed about these information events by local leaders and through posters. Since some people had heard about SODIS like this, the questionnaire started with questions about SODIS use which led to a section with questions about details of its use for those who used SODIS or to general questions about drinking water, water sources, knowledge and convictions related to water treatment for those who did not use SODIS. If people had a preferred method of water treatment, they answered the next section about this method, and were then asked general questions about health and washing hands. The next step was for the interviewers to provide standardized information about SODIS to the interviewees. That made sure that everyone could answer the next part, namely general questions about SODIS. Sections about

communication, motivations, habits and network formed the last part of the questionnaire.

Sample

The participants in this field research were $n = 878$ inhabitants of high-density areas, $n = 364$ from Hopley Camp Farm, southwest of Harare, and $n = 514$ from Epworth, southeast of Harare. The interviewees were $n = 802$ (91%) women and $n = 76$ men. The mean age was $M = 34$, the mean number of years of education were $M = 8$ years, the mean income was $M = 400.000$ Zim\$ (about 15 US\$ at that time) per month per household ($M = 4.5$ persons per household). This means that on average, people in the research areas lived far below the poverty line of 1 US\$ per day. Most people in the project areas were unemployed (24%), vendors (20%), informal traders (11%) or housewives (17%). On average, there was one child ($M = 0.9$) below five years of age in each household.

Questionnaire

Behaviour

Two questions were asked to assess SODIS behaviour – one for determining the number of SODIS users (uptake) and one for the amount of SODIS water used. (1) Uptake: “Are you doing SODIS?” identifies SODIS users. This question had four possible answers: Am doing SODIS regularly/have tried SODIS and am doing it sometimes/have tried SODIS but stopped/am not doing SODIS. Thus, SODIS users were those who were doing SODIS regularly or sometimes and SODIS non-users those who did not do SODIS. The decision whether someone was a SODIS user will also be referred to as “uptake” in the following. (2) Amount of SODIS water consumed: The amount of SODIS water one household drinks per day was assessed with “How many litres of SODIS does your family drink per day?” with an open answer. Together with questions about the amount of litres of other kinds of water consumed, a percentage of SODIS water of the overall drinking water could be calculated.

Intention

The intention to do SODIS was surveyed using the question “Will you be doing SODIS regularly in the next two weeks?” Four answers were possible: Very probable/probable/slightly probable/not probable.

Involvement

The survey question was “Do you see a need for water treatment?” Answer categories were: Very much/much/slightly/not at all.

Attitude

Attitude was examined with “Do you think it is good or bad to do SODIS?” with the answers in seven steps: Very good/good/a little bit good/neither good nor bad/a little bit bad/bad/very bad.

Habit

Since habits are routines of behaviour, that are executed automatically, without thinking, strong habits should not be forgotten easily (Tobias 2009). Thus, habit strength was measured here with “How often does it happen that you intend to do SODIS and then forget to do so?” Answers were given in four steps: (Almost) always/often/rarely/never.

Affect

The question for affect was “How do you feel about SODIS?” with an answer category in seven steps: Very positive/positive/slightly positive/neither positive nor negative/slightly negative/negative/very negative.

Knowledge

Knowledge about bacteria was surveyed with two questions: “Are there any problems with the quality of your drinking water?” Answer categories: knows about contamination and the solutions (water treatment, hygiene)/does not know about bacterial contamination, but knows solutions/knows how bacterial contamination happens and the health problems/knows problems about bacterial contamination, details/knows of the problems about bacterial contamination, but no details/knows some problems, but not related to bacterial contamination/does not know any problems.

Beliefs

Several beliefs were analysed about time consumption, expenses and the healthiness of SODIS. Conviction as regards time consisted of the question: “How time-consuming is it to treat your water with SODIS?” (Answers: very time-consuming/time-consuming/slightly time-consuming/not time-consuming). Conviction as regards money was asked with: “How expensive is it to treat your water with SODIS?” (Answers: Very expensive/expensive/slightly expensive/not expensive). Conviction as regards health was measured by: “Do you think that drinking raw water makes you healthier or less healthy?” (Answers: much healthier/healthier/slightly healthier/neither healthier nor unhealthier/slightly unhealthier/unhealthier/much unhealthier).

Perceived benefit

The question for perceived benefit was: “Do you think it is worth it to do SODIS?”. The range of answers were: It is worth a lot more than it costs/it is worth more than it costs/it is worth slightly more than it costs/it is worth the same as it costs/it costs slightly more than it is worth/it costs more than it is worth/it costs a lot more than it is worth.

Ability

Ability in the persuasion process can either be measured with the amount of distraction present at the time of information or with the amount of time the receiver

of the information has to process the information. In the field, it is extremely difficult to know how much distraction was present when the information was disseminated. Therefore, ability was assessed with the time a person had to process it and the question: "Had you heard about SODIS before this interview?" (Answers: Yes/no). People who had heard about SODIS before the interview had more time to think about it than those who were told about SODIS at the interview.

Social influence

Social influence was surveyed with: "How do other people think about you when you do SODIS?" Answers were: Very positively/positively/slightly positively/neither positively nor negatively/slightly negatively/negatively/very negatively.

Self-persuasion

Since talking about a topic is a means of self-persuasion, the question used here was: "How often do you talk about water treatment, health and hygiene with others?" Possible answers were: Every 1–3 days/every week/every 2 weeks/every 3 weeks/every month/less often than every month/never.

Results

Data from a total of $n = 878$ subjects were utilised for analysis. These subjects can be split up into users ($n = 95$), and non-users ($n = 783$). Overall, the subjects gave very positive replies to SODIS (see Table 1): Of all the subjects (Table 1, upper three parts), 93% said they would probably or very probably do SODIS in the next two weeks. 96% would probably or very probably talk about SODIS in the next two weeks. Some 95% had a positive or very positive attitude, and 91% a positive or very positive affect towards SODIS; 76% thought that SODIS costs nothing. Some 62% thought that drinking raw water could make them much healthier and that drinking SODIS water could make them much healthier. 33% thought that other people would think neither positively nor negatively about them if they did SODIS. 57% had little knowledge about bacterial contamination. 51% saw a (high) need for water treatment. Of all the users (see Table 1, lower part "SODIS users"), 83% thought it was not time-consuming to do SODIS, 72% did SODIS on a strongly habitual basis, and 76% thought SODIS was worth a lot more than it costs. See Table 1 for the complete frequencies.

Hypothesis (I), which states that the intention to use SODIS is predicted by the persuasion variables, can partly be confirmed (see Tables 2 and 3). Since users could answer some questions that non-users could not (e.g. as regards habits), two calculations were performed. A linear regression on the intention to use SODIS was calculated separately for users (see Table 2) and non-users (see Table 3) with the identified persuasion variables. For users, the intention to use SODIS was predicted (adjusted $R^2 = 0.40$) by the habit strength ($\beta = 0.30$, $p = 0.002$), by conviction as regards health ($\beta = 0.35$, $p = 0.006$), by social influence ($\beta = 0.30$, $p = 0.008$), and marginally by affect ($\beta = -0.19$, $p = 0.085$), the attitude towards SODIS ($\beta = 0.23$, $p = 0.055$), and self-persuasion ($\beta = 0.21$, $p = 0.062$).

The second part of Hypothesis (I) was also partly confirmed (see Table 3): a regression analysis was used to test whether the intention to use SODIS is predicted

Table 1. Percentages of persuasion variables.

Variable	SODIS non-users and users ($n = 783$)						
	Steps of answers						
	Very high/very important/very probable/no costs/not time-consuming	High/important/probable/cheap/slightly time-consuming	Low/slightly important/slightly probable/expensive /time-consuming	Very low/not important/not probable/very expensive/very time-consuming			Missing
SODIS use	9.3 (regular use)	1.5 (sporadic use)	0 (stopped use)	89.2 (no use)			0
Intention to use SODIS	59.6	33.1	6.0	0.8			0.5
Intention to talk about SODIS	64.7	31.1	3.3	0.5			0.5
Conviction health	61.7	35.2	2.6	0.2			0.2
Conviction money	75.5	15.3	5.4	1.0			2.8
Involvement (need for water treatment)	28.4	22.6	17.2	31.2			0.7
Social influence	6.4	18.5	27.2	19.2			28.7
	Very good/positively	Slightly good/positively	Neither good nor bad	Slightly bad/negatively	Bad/negative	Very bad/negative	Missing
Attitude	54.8	40.1	0.5	0.1	0.1	0	0.5
Affect	45.7	45.7	0.9	0.3	0.1	0	0.9
	High	High	Middle		Low		Missing
Knowledge about bacteria	2.6	2.6	40.7	56.7	0		0
	SODIS users ($n = 95$)						
	Very high/very important/very probable/no costs/not time-consuming	High/important/probable/cheap/slightly time-consuming	Low/slightly important/slightly probable/expensive /time-consuming	Very low/not important/not probable/very expensive/very time-consuming			Missing
Conviction time	83.2	8.4	0	0			8.4
Habit strength	71.6	14.7	4.2	1.1			8.4
Perceived benefit	75.8	10.5	1.1	0			12.6

for non-users by the identified persuasion variables. For non-users, the intention to use SODIS was predicted by their attitude towards SODIS ($\beta = 0.39, p = 0.000$), by their involvement ($\beta = 0.10, p = 0.013$), their conviction health ($\beta = 0.12, p = 0.002$), their process ability ($\beta = -0.10, p = 0.006$), and marginally by their knowledge about bacteria ($\beta = 0.06, p = 0.093$), (adjusted $R^2 = 0.28$).

Overall, this meant the intention to use SODIS was higher for users when people were convinced that drinking untreated water was unhealthy, when they thought that others thought positively about them when they used SODIS (social influence), when the habit to use SODIS was stronger. Tendentially, the intention of users was

Table 2. Linear regression on intention for SODIS users.

Variable	Coefficients (a)				
	Non-standardised coefficients		Standardised coefficients		Sig.
	B	Std. Error	Beta	t	
(Constant)	0.561	0.107		5.23	0.000
Knowledge about bacteria	-0.021	0.029	-0.073	-0.721	0.474
Affect	-0.122	0.070	-0.192	-1.75	0.085
Attitude	0.171	0.087	0.232	1.96	0.055
Perceived benefit	0.036	0.105	0.041	0.341	0.734
Involvement	-0.062	0.047	-0.137	-1.32	0.192
Habit	0.148	0.047	0.297	3.16	0.002
Conviction money	0.037	0.078	0.047	0.479	0.633
Conviction time	0.087	0.104	0.083	0.842	0.403
Conviction health	0.260	0.092	0.352	2.83	0.006
Ability	-0.074	0.052	-0.136	-1.43	0.158
Self-persuasion	0.065	0.034	0.208	1.90	0.062
Social influence	0.069	0.025	0.297	2.73	0.008

Dependent variable: intention to use SODIS; adjusted $R^2 = 0.40$.

Table 3. Linear regression on intention for non-users.

Variable	Coefficients (a)				
	Non-standardised coefficients		Standardised coefficients		Sig.
	B	Std. Error	Beta	t	
(Constant)	0.337	0.035		9.57	0.000
Knowledge about bacteria	0.035	0.021	0.063	1.68	0.093
Affect	0.045	0.042	0.049	1.08	0.281
Attitude	0.390	0.047	0.387	8.24	0.000
Involvement	0.055	0.022	0.097	2.48	0.013
Conviction money	0.000	0.003	0.002	0.060	0.952
Conviction health	0.097	0.032	0.124	3.04	0.002
Ability	-0.077	0.028	-0.101	-2.73	0.006
Self-persuasion	0.030	0.025	0.048	1.20	0.232
Social influence	0.009	0.011	0.033	0.878	0.380

Dependent variable: intention to use SODIS; adjusted $R^2 = 0.28$.

higher, when they had an overall positive affect and attitude towards SODIS, and when they talked more about SODIS (self-persuasion). The intention of non-users was higher, when they had more time to think about information about SODIS (ability), when they saw a need for water treatment (involvement), when they had an overall positive attitude towards SODIS, and when they were convinced that drinking untreated water was unhealthy. Additionally, there was a tendency that the intention of non-users was higher when they had good knowledge about bacterial contamination of water.

Hypotheses (II) was not supported (see Table 4). It was hypothesized that the higher (or more positive) the identified persuasion variables, the more SODIS-treated water a SODIS user consumed as part of his or her overall drinking water. Not all persuasion variables proved to have an influence on the amount of SODIS water consumed, but ability, habit and (marginally) involvement did. A linear regression on the amount of SODIS water consumed showed that the higher the involvement ($\beta = 0.23$, $p = 0.068$) and the habit to use SODIS ($\beta = 0.24$, $p = 0.042$), and the lower the ability ($\beta = -0.24$, $p = 0.039$), the more SODIS-treated water a SODIS user drank. The overall explained variance by these variables was low (adjusted $R^2 = 0.11$).

Hypotheses (III) was partly supported. The higher (or more positive) the identified persuasion variables, the more likely it was for someone to be a SODIS user. Some of the identified persuasion variables did indeed increase the likelihood of a person being a SODIS user (see Table 5). A binary logistic regression (ENTER method) for the dependent variable of using SODIS showed that whether a person used SODIS was significantly influenced by involvement ($B = 2.21$, $p = 0.000$), ability ($B = 5.08$, $p = 0.000$) and marginally by social influence ($B = 0.76$, $p = 0.076$), (Nagelkerke's $R^2 = 0.70$). This meant the more someone was involved, the more ability to process someone had and the more social influences someone experienced, the more likely that person was to use SODIS.

Table 4. Linear regression on amount of SODIS for users.

Variable	Coefficients (a)				
	Non-standardised coefficients		Standardised coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	17.19	29.55		0.582	0.563
Knowledge about bacteria	6.58	6.99	0.115	0.942	0.350
Affect	28.59	17.37	0.219	1.65	0.105
Attitude	-36.59	22.99	-0.233	-1.59	0.117
Perceived benefit	7.89	26.96	0.043	0.292	0.771
Involvement	21.23	11.43	0.232	1.86	0.068
Habit	24.06	11.58	0.241	2.08	0.042
Conviction money	-20.27	19.22	-0.128	-1.05	0.296
Conviction time	39.93	26.99	0.177	1.48	0.144
Conviction health	2.43	22.72	0.016	0.107	0.915
Ability	-32.96	15.63	-0.238	-2.11	0.039
Self-persuasion	-3.30	8.49	-0.052	-0.388	0.699
Social influence	-0.174	6.18	-0.004	-0.028	0.978

Dependent variable: amount of SODIS consumed; adjusted $R^2 = 0.11$.

Table 5. Logistic regression: users vs. non-users.

Variable	Variables in the equation					
	B	SE	Wald	df	Sig.	Exp(B)
Knowledge	0.106	0.512	0.043	1	0.835	1.11
Affect	0.145	1.41	0.010	1	0.919	1.15
Attitude	16.98	8171	0.000	1	0.998	23597602
Involvement	2.21	0.508	18.93	1	0.000	9.10
Conviction money	-1.47	0.931	2.49	1	0.114	0.230
Conviction health	18.78	8841	0.000	1	0.998	143547087
Ability	5.08	0.619	67.46	1	0.000	161
Self-persuasion	-0.599	0.441	1.84	1	0.175	0.549
Social influence	0.763	0.430	3.15	1	0.076	2.14
Constant	-42.46	12039	0.000	1	0.997	0.000

Dependent variable: group membership: users vs. non-users; Nagelkerke's $R^2 = 0.70$.

Overall, different variables were found to influence intention (of non-user and users), uptake and amount of SODIS consumed. The variables that influenced the uptake of SODIS were involvement, ability to process and social influence. The amount of SODIS water consumed was influenced by involvement, habit and ability. For users, the intention to use SODIS was influenced by conviction health, habit, social influence, self-persuasion, affect, and attitude. For non-users, the intention was influenced by attitude, ability, involvement, conviction health and knowledge. These variables will consequently be used to design interventions for a SODIS dissemination strategy.

Discussion

Interpretation of results

The intention to use SODIS is influenced by different persuasion variables for those who use SODIS (users) and those who do not (non-users). The users' intention is predicted by their habit strength, their conviction about health, their social influence, and – as a tendency – by their affect and attitude about SODIS as well as by self-persuasion. This means that if it is easier for people to remember to use SODIS, if they are convinced that untreated water is unhealthy, if people think that others think positively about them when they use SODIS, then their intention to use SODIS will increase. There is also a tendency that if people feel and think positively about SODIS and if they talk more often about it, their intention to use SODIS can grow stronger.

For non-users, the intention to use SODIS is predicted by attitude, involvement, conviction health and ability and – as a statistical tendency – by knowledge. This means if someone who does not use SODIS thinks positively about it, thinks that there is a need for water treatment and that untreated water is unhealthy, if he or she has time to think about the information they receive, then that person has a higher intention of using SODIS. There is also a tendency for this to happen through knowing more about bacterial contamination.

Whereas both users and non-users need to be convinced that raw water is unhealthy and need a positive attitude to generate a high intention of using SODIS,

there are greater differences between these two groups. More important factors for users are what others think about them, developing a habit to use SODIS, their positive feelings about SODIS and how much they talk about it. Users seem partly to convince themselves how good SODIS is by telling others that it is good and by experiencing its benefits through habitual use. For non-users, it is more important to know about bacterial contamination of their water, to have enough time to think about SODIS and to consider it to be necessary to treat their water. These factors seem to be more rational influences on their intention, whereas the users seem to be considering several, also more affective, issues in making up their mind about SODIS. It is clearly a different step, involving different premises, to develop a strong intention to use SODIS for those who have not used it before than for those who are already using it.

For a SODIS user to consume SODIS as a large part of his or her drinking water (amount of water consumed), it is important to have enough time to process the information about SODIS (ability) and to develop the habit of using it. The fact that the user feels a great need to treat his or her drinking water (involvement) also reveals a trend to influence the amount of SODIS consumed. However, considering what a small variance in the amount of SODIS water consumed can be explained (11%) by all the persuasion variables used, it seems that persuasion is not the most important factor in the use of SODIS. Persuasion seems to have a stronger influence on the uptake (whether to use SODIS or not). This becomes visible in the degree of influence that the persuasion variables have on the intention and uptake (being a user or non-user). However, the extent of use of SODIS (amount of SODIS water consumed) does not seem to depend on the quality of the persuasion process.

Persuasion variables play a strong role in whether someone uses SODIS or not. Involvement in water treatment increases the likelihood of someone being a SODIS user by 810%, ability by 1600% and social influence by 114% (these values can be inferred from expected β). This means for people to have enough time to think about the message they received about SODIS is the most important factor for them to decide to use SODIS. The assessment as to whether water treatment is necessary is the second most important premise that raises the likelihood of uptake. When other people seem to think positively about SODIS, the chance of becoming a SODIS user increases considerably for the person who reflects on what the others are thinking.

Thus, the most important persuasion variables for the uptake and for the increase in its use seem to be: Involvement, ability, attitude, conviction of health, habit, social influence, self-persuasion, affect and knowledge. Possible interventions for a dissemination strategy for SODIS should consequently tackle these topics.

Strength and weaknesses of the study

Some of the primarily identified persuasion variables did not show a significant influence on the use or intention to use SODIS. The convictions about money (how expensive they find SODIS) and time (how time-consuming they find it) as well as the perceived benefit of using SODIS had no significant influence on the intention to use SODIS, the uptake, or the amount of SODIS consumed. This could be because people need experience in using SODIS in order to assess these issues. The period of a few minutes between hearing about SODIS and having to give an opinion about how expensive it would be, without having any experience of it, may simply be too

short. And a large part of the interviewees, namely those who heard about SODIS at the interview, had only a few minutes to make this assessment. The three weeks or less that the people who heard about SODIS before the interview had, may also not have been enough to build a realistic opinion about how time-consuming or beneficial SODIS actually is.

Looking at the percentages of people who responded in a particular way to the various topics that we asked them about, it also becomes clear that the variables that showed no impact in the calculations exhibit very little variance. Over 70%, and in the case of the conviction about time-consumption, even over 80% of the people gave a very positive response. They agreed that SODIS is very beneficial, does not cost anything and does not take time. Apart from expressing these opinions because they had little experience with the negative, time-consuming or expensive sides of SODIS, this can also be due to a noted tendency of the people to respond in a socially acceptable way. In Zimbabwe, and especially in the poorer areas, it is frowned upon to give negative answers to a topic. This strong desire to respond positively can impair interviews considerably. Future interviews in Zimbabwe should consider this fact and try to work out ways of asking people that allow them to answer negatively in a socially acceptable way. One example of this would be to make negative statements and ask "How far do you agree to that?"

Although not all the proposed variables showed a significant influence, the overall explained variance of the intention and especially the uptake (user or non-user) was considerable. However, the explained variance of the amount of SODIS consumed was low. This result points to different effects of persuasion on the decisions about the uptake of a chosen behaviour and its execution. Habit strength seems to be a factor that sustains behaviour, whereas the other persuasion variables are more important for developing the intention to use SODIS and for the decision to use SODIS or not (uptake). Further research is needed to make sound statements about the field of impact of persuasion.

The influence of the persuasion variables found in this study agrees with past findings. The intention to use SODIS and uptake of it were found to be linked to a positive attitude and affect towards SODIS (Altherr et al. 2008). It had also been found earlier that the use of SODIS by neighbours (social influence) and knowledge about SODIS were correlated with the intention to use SODIS (Altherr et al. 2008). That these and other variables could be confirmed in this field study shows their consistent impact and supports the validity of employing them in strategies for disseminating SODIS.

Implications for practice

Since involvement and ability have been shown to have an impact in more ways than one, they are the most important variables to use for the dissemination of SODIS. Involvement can be increased when people think that there is a great need to treat their water. If someone knows about the contamination of his or her drinking water, that this contamination can cause sicknesses and how this contamination happens and can be avoided, he or she should find it more necessary to treat the water. Thus, knowing more about ways of contamination and its relation to sickness should raise the involvement. Knowledge about water contamination can be easily disseminated and people can be persuaded about the necessity of treating their water by using

flyers and/or promoters to spread the corresponding information. People could be additionally persuaded of the necessity of treating water by pointing out sicknesses that they or their family could suffer and that these sicknesses are avoidable.

The ability to process information about SODIS increases with time. Another way to enhance this ability would be to explain the topic and its background in more detail. This and repetition of the message at regular intervals should increase the ability to understand SODIS and consequently the intention to use it.

Social influence is another important factor for people to opt for SODIS. Apart from improving the overall opinion and attitude of people in an area where SODIS is to be implemented, it would be important to get people to talk about it. Presenting the advantages of SODIS (e.g. with flyers, posters or personally) and asking people to talk about it with others or starting up a snowball system (e.g. "Please tell three other people about SODIS and its benefits and ask each of them to tell three others") can help to spread this social influence.

Getting people to talk about SODIS initiates another important factor, namely self-persuasion. If this is to have a positive impact, however, the overall attitude and convictions about SODIS will need to be equally positive.

Convictions, overall attitude and affects can be shaped by persuasion that bolsters the benefits of SODIS with good arguments. It is important for the arguments to be logical, understandable and presented by someone with whom the recipient of the arguments can identify and who he or she perceives as credible.

Since habit strength persuades users to keep on using SODIS and affects the amount of SODIS water consumed, the habit should also be supported. Memory aids help people not to forget to use SODIS. Prompts are an example of memory aids which are easily set up: A poster, sticker, picture or table card points out: "Have you put your bottles in the sun today?" or something similar. Other psychological strategies to help people develop a habit can include commitment, request or feedback.

However, all these persuasive strategies should not let us ignore any outer circumstances that might prevent people from carrying out the required behavior. For SODIS, this would mean: Are bottles available and affordable to the target group? Do they have sunny places where they can put the bottles and is the water clear enough for SODIS? Helping people to implement something like SODIS requires more than psychological support. The external possibilities must also be in place. For a campaign, this means that these circumstances should be examined and, if necessary, help should be provided to establish a bottle diffusion scheme or showing people how to filter dirty water and to identify other obstacles that could prevent them from using SODIS.

Conclusion and outlook

Involvement, ability, attitude, conviction as regards health, social influence, self-persuasion, affect and knowledge all play an important role in the decision to use SODIS. To work with these elements will influence people's intention to use SODIS and their choice to become SODIS users. These points should consequently be considered for any SODIS campaign run in the future. Examples of how these factors can be involved in future campaigns were given in the previous section.

However, these or similar factors can be of help in campaigns in many other fields, such as those aiming to change behaviour concerning health, hygiene,

sustainability issues or innovative technologies. Any planned activity or public works could include these factors in order to increase their impact and effectiveness.

It became clear that persuasion is especially effective for the first phase of campaigns: the try-out or uptake period. Once people show the intended behaviour, other psychological variables should be employed to support this behaviour over the long term.

The persuasion variables that have proved to be effective will now be used for a campaign targeting the same areas in which the data has been collected. This should help to increase the number of SODIS users considerably. More interviews and their analysis will show whether these variables and the strategies that have been designed with their help actually have the anticipated effects. This will contribute to further improvement in future SODIS campaigns and will keep on generating ideas and outcomes for SODIS and other fields of public work.

Since SODIS is a very beneficial method, not only for preventing illnesses and alleviating life conditions, but also by its contribution to sustainable techniques and procedures in any field of practice, it is worth spending time and effort into finding the most effective ways of spreading it fast and far.

Acknowledgements

This research programme is part of the project entitled “Solar Disinfection of Drinking Water for Use in Developing Countries or in Emergency Situations: SODISWATER”, Contract no: FP6-INCO-CT-2006-031650 from the European Union. We thank everyone involved in that project, especially our partner organisation in Zimbabwe, the Institute for Water and Sanitation Development, and in particular Dr R.A. Sanyanga and Sharon Murinda.

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