

# Use and Acceptance of Available Arsenic-Safe Drinking Water Options in Rural Bangladesh

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# Arsenic in Bangladesh

## Arsenic as a serious public health threat for Bangladesh



- 62 out of 64 districts are affected with arsenic (Johnston & Sarker, 2007)
- 20 million people are at risk in Bangladesh (Johnston & Sarker, 2007)
- 42,700 to 56,400 deaths per year have been attributed to arsenic intake via drinking water (Flanagan et al., 2012)
- Since 1990s, GoB, local NGOs and international agencies are trying to combat this health threat (UNICEF, 2007)
- A variety of alternative arsenic-safe drinking water options have been developed and promoted as mitigation initiatives (GoB, 2004)

# Arsenic-safe drinking water options in rural Bangladesh

Household  
arsenic  
removal  
filters



SONO



Alcan



Read-F



Community filter (Sidko)

Pond  
sand  
filter



Rainwater  
harvesting

Piped  
water  
supply



Dug  
well



Deep  
tubewell

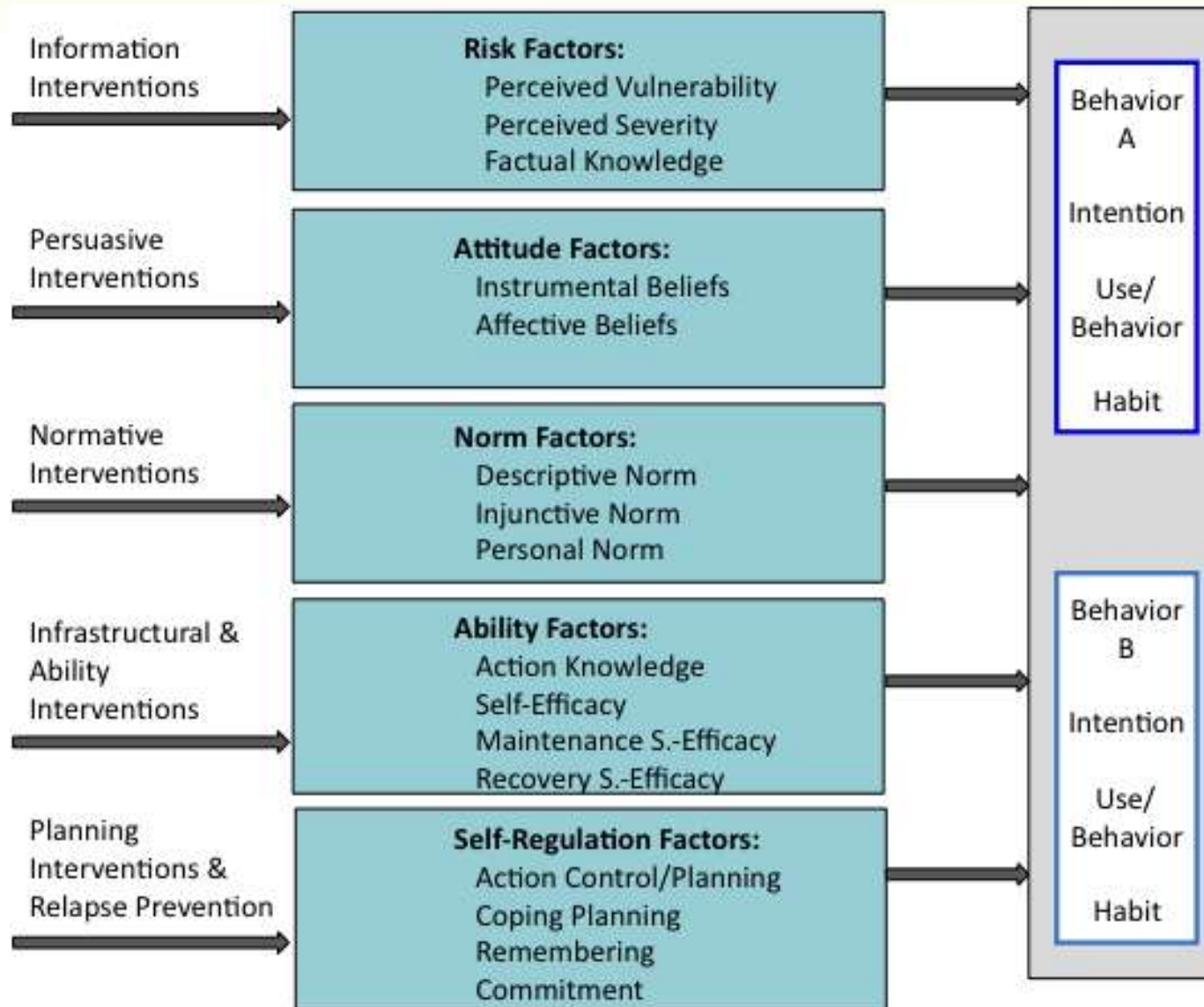


Arsenic-  
safe  
shallow  
tubewell

- By 2006, more than 100'000 alternative sources had been installed (Kabir and Howard, 2007)
- Many arsenic-safe drinking water options not used or maintained regularly (Hoque et al., 2004)
- A survey of 1,000 arsenic-safe water sources reported –
  - 10% of deep tubewells
  - nearly 25% of dug wells and pond sand filters
  - 33% of rainwater harvesting systems
  - 83% of arsenic removal technologies
 were non-functional (Kabir and Howard, 2007)
- Psychological theories and research suggest that people have many reasons for using and accepting of an mitigation option (e.g. Mosler et al., 2010)

# Behavioral determinants

## The RANAS-Model (Mosler, 2012)



## Objectives of the Study

- Based on the RANAS model, the study aimed to answer the following two research questions:
  - I) To what extent are available arsenic-safe drinking water options actually used by people in contaminated areas?
  - II. Which safe water options are more accepted than others regarding psychological factors?

# Data collection

- **Two cross-sectional surveys:**
  - Study -1: November 2009
  - Study -2: December 2010
- **Total sample size 1268 households:**
  - Study -1: N=872
  - Study -2: N=396
- **Participants:**
  - Randomly selected households
  - Risk of drinking arsenic-contaminated water
  - Access to arsenic-safe water option(s)
  - Person responsible for drinking water
- **Face-to-face interviews:**
  - Team of local interviewers, supervisors
  - Duration: 1-1.5 hours



- **Structured questionnaire:**
  - Water consumption
  - Acceptance factors from the RANAS model

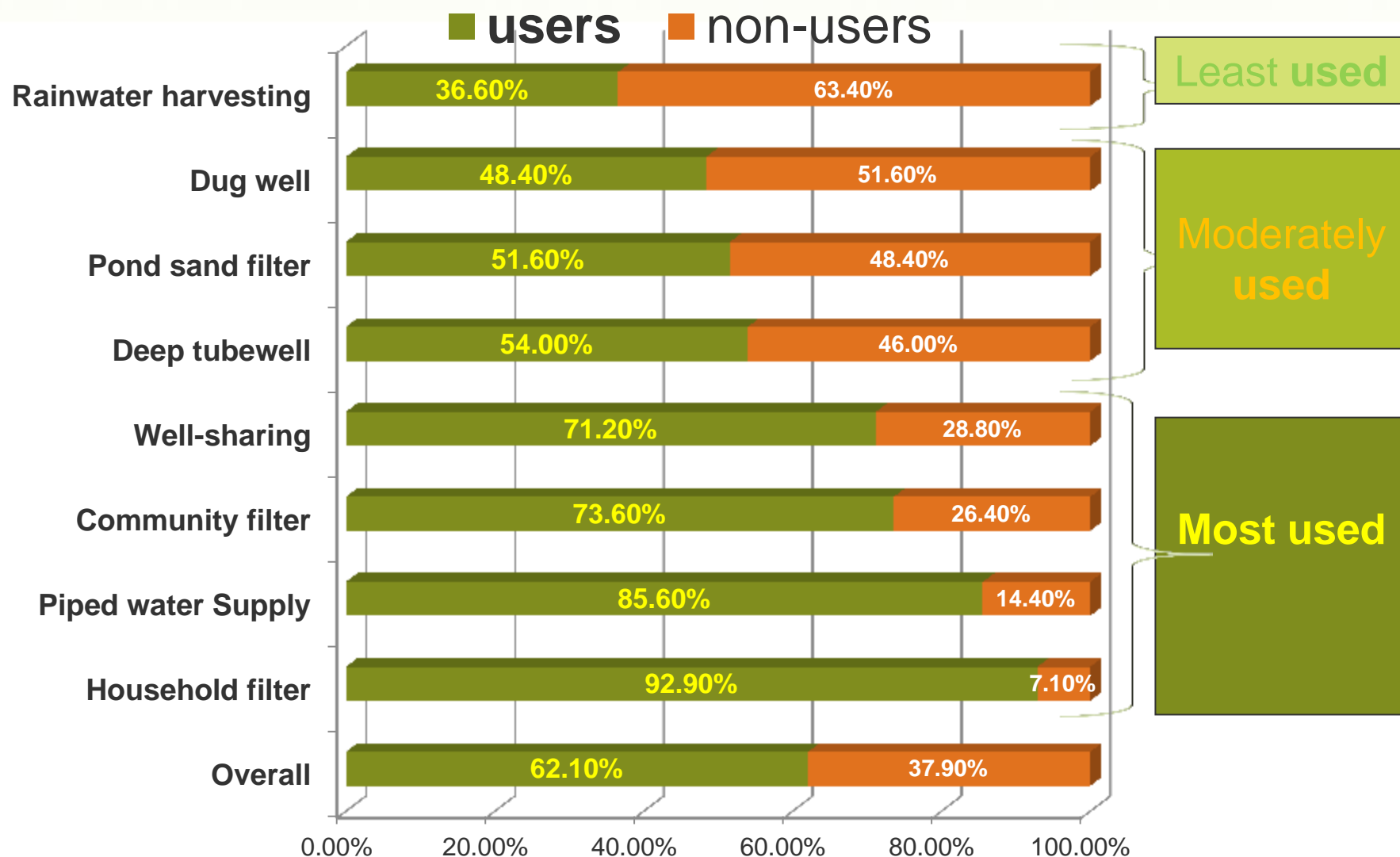
*Some examples of assessment question:*

Water consumption:	How many vessels of which water option and in total they collected for drinking on a typical day?
Risk factors: perceived vulnerability	How high or low do you feel are the chances that you get arsenicosis? (on a scale of -4 = very low to 4 = very high)
Attitude factors: affective beliefs	How much do you like or dislike the taste (temperature) of the water from the arsenic-safe water option? (on a scale of - 4 = dislike it very much to 4 = like it very much)
Normative factors: descriptive norm	How many people outside your family collect water from arsenic-safe option? (on a scale of 0 = almost nobody to 4 = almost everybody)
Ability factors: self-efficacy	How sure are you that you can collect as much water from the arsenic-safe option as you need? (0 = not at all sure to 4 = very sure)
Self-regulation factors: coping planning	Have you made a detailed plan regarding what to do when the arsenic-safe water option gets broken? (on a scale of 0 = no detailed plan at all to 4 = very detailed plan)

## Data processing and analyzing

- SPSS 18.0

# Using of arsenic-safe water options



4= Highest acceptance  
0= Lowest acceptance

## Acceptance of arsenic-safe water options

### Piped water supply:

- was high rated on all acceptance factors, e.g.
- stronger commitment (users  $M=3.60^*$ , non-users  $M=2.06^*$ )
- collecting water as not being very time-consuming (users  $M=1.14^*$ )

### Deep Tubewells:

- well supported by most acceptance factors, such as
- higher satisfaction with water temperature (users  $M=3.15^*$ , non-users  $M=2.66^*$ )
- more favourable descriptive norms (users  $M=2.72^*$ )

### Household arsenic removal filters:

- Highest taste ratings, factual knowledge, and commitment, but
- lower descriptive norms (users  $M=1.82^*$ )
- low levels of remembering (users  $M=0.18^*$ )

Note: **Bolded values** are significantly **greater** and *italicized values* are significantly *lower* than overall means and \*  $P < .05$

4= Highest acceptance  
0= Lowest acceptance

# Acceptance of arsenic-safe water options

## Community arsenic removal filters:

- lower satisfaction with water temperature (users  $M=2.04^*$ , non-users  $M=1.06^*$ )
- low levels of action knowledge (users  $M=1.41^*$ , non-users  $M=1.29^*$ )
- above-average norm factors (descriptive: users  $M= \mathbf{2.59^*}$  and injunctive: non-users  $M= \mathbf{3.00^*}$ )

## Pond sand filters:

- less satisfaction with water temperature (non-users  $M=1.07^*$ )
- lower self-efficacy (non-users  $M=0.93^*$ )
- more time-consuming (non-users  $M=\mathbf{2.77^*}$ )

## Household rainwater harvesting:

- least time-consuming (users  $M=1.09^*$ , non-users  $M=1.13^*$ )
- Lower normative factors (descriptive: users  $M=1.22^*$ , non-users  $M=0.64^*$  and Injunctive: non-users  $M=1.79^*$ )

Note: **Bolded values** are significantly **greater** and *italicized values* are significantly *lower* than overall means and \*  $P < .05$

# Acceptance of arsenic-safe water options

4= Highest acceptance  
0= Lowest acceptance

## Dug wells:

- low rated on almost all acceptance factors
- lowest ratings of water taste (users  $M=2.40^*$ , non-users  $M=1.05^*$ )
- lowest ratings of water temperature (users  $M=2.22^*$ , non-users  $M=1.20^*$ )

## Sharing of arsenic-safe shallow tubewells:

- was poorly rated on almost all factors
- found collecting water as more time-consuming (users  $M=1.96^*$ )
- below-average normative ratings (descriptive: users  $M=1.78^*$  and Injunctive: users  $M=2.31^*$ , non-users  $M=1.56^*$ )

Note: **Bolded values** are significantly **greater** and *Italicized values* are **significantly lower** than overall means and \*  $P < .05$

# Use of arsenic-safe water options

Only **near about two-thirds (62.1%)** of the population **are using** arsenic-safe drinking water options

- **The most used arsenic-safe water options:**
  - Household arsenic removal filters **!! Refusals! → Bias!**
  - Piped water supply
  - Community arsenic removal filters
  - Sharing of arsenic-safe shallow tubewells **→ !!!**
- **Moderately used arsenic-safe water options:**
  - Deep tubewells **→ !!!**
  - Pond sand filters
  - Dug wells
- **The least used arsenic-safe water options:**
  - Household rainwater harvesting

# Acceptance of arsenic-safe water options

*According to different psychological factors-*

- **The most accepted arsenic-safe water options:**
  - Piped water supply
  - Deep tubewells → !!!
- **Moderately accepted arsenic-safe water options:**
  - Household arsenic removal filters → !!!
  - Community arsenic removal filters
  - Pond sand filters
  - Household rainwater harvesting
- **The least accepted arsenic-safe water options:**
  - Dug wells
  - Sharing of arsenic-safe shallow tubewells → !!!

## Conclusion and Recommendations

- Still nearly two-fifths (37.9%) of the population with access to a safe water option are not using these
- To maximize the impact of arsenic mitigation efforts:
  - Greater emphasis should be given to the installation of accepted rather than poorly supported options
  - These can be promoted with interventions derived from the results of this study
  - Interventions can also be derived from these results to promote any of the already installed option

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- Tribedi Women Social Development Association (TWSDA)
- Voluntary Association for Welfare and Social Development (VAFWSD)
- Village Education Resource Center (VERC)

## More information:

Inauen, J, Hossain, MM, Johnston, RB, Mosler, H-J (2013) Acceptance and Use of Eight Arsenic-Safe Drinking Water Options in Bangladesh. *PLoS ONE* 8(1): e53640.

To Download: <http://dx.plos.org/10.1371/journal.pone.0053640>

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**THANKS FOR YOUR ATTENTION**