Evidence-based Behavior Change for Safe Water Consumption

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Behavior change – what for?

Rainwater harvesting
Behavior change – how?

Supply with household filters

Person

Acceptance

Use
Behavior change – how?

Supply with household filters

Factor A
Factor B
Factor C
Factor D

Person

Behavioral Determinants

Drinking safe water

Hardware

Software

Behavior Change

Technique

Hardware

Supply with household filters

Factor A
Factor B
Factor C
Factor D

Person

Behavioral Determinants

Drinking safe water

Hardware

Supply with household filters

Factor A
Factor B
Factor C
Factor D

Person

Behavioral Determinants

Drinking safe water
Evidence based behavior change protocol

1) Identify behavioral determinants

2) Measure and calculate differences between Doers and Non-Doers

3) Select behavior change techniques (Software)

4) Design & implement software

5) Monitor change in behavioral determinants and behavior

Supply with hardware

Drinking safe water

Factor A
Factor B
Factor C

NOT Drinking safe water

Factor -A
Factor -B
Factor -C

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Supply with hardware
Evidence-based Behavior Change Protocol

1) Identify behavioral determinants
   ➔ RANAS-Model

2) Measure and calculate differences between Doers and Non-Doers
   ➔ Standardized survey

3) Select behavior change techniques
   ➔ RANAS Table of determinants vs. techniques

4) Design and implement software
   ➔ Examples form guideline

5) Monitor change in behavioral determinants and behavior
   ➔ Pre-Post survey
Am I at risk?
Why?
Do I like it?
What will others say?
Can I do it?
How to manage it?
What does it cost/bring?
How to manage it?
Psychological factors for behavior change

- Risk Factors: Am I at risk? Why?
- Attitude Factors: Do I like it?
- Norm Factors: What will others say?
- Ability Factors: Can I do it?
- Self-Regulation Factors: How to manage it?
- Behavior Factors: How to do it?

Behavior
Intention
Use/Behavior
Habit
The RANAS-Model: Risk, Attitudes, Norms, Ability and Self-regulation

**Risk Factors:**
- Perceived Vulnerability
- Perceived Severity
- Factual Knowledge

**Attitude Factors:**
- Instrumental Beliefs
- Affective Beliefs

**Norm Factors:**
- Descriptive Norm
- Injunctive Norm
- Personal Norm

**Ability Factors:**
- Action Knowledge
- Self-Efficacy
- Maintenance S.-Efficacy
- Recovery S.-Efficacy

**Self-Regulation Factors:**
- Action Control/Planning
- Coping Planning
- Remembering
- Commitment

**Behavior**
- Behavior A
- Intention
- Use/Behavior
- Habit

**Behavior**
- Behavior B
- Intention
- Use/Behavior
- Habit
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Example Bangladesh: Geogenic arsenic in drinking water

- 20 Mio. at risk in Bangladesh
- Health effects: arsenicosis → Preventable!
- Well-testing → awareness
- Arsenic-safe water options
- Many options not used or maintained
Data collection

- **Face-to-face interviews:**
  - Team of local interviewers, supervisors
  - Duration: 1-1.5 hours

- **Structured questionnaire:**
  - Water consumption
  - Behavioral factors

- **Participants:**
  - Randomly selected households
  - Person responsible for drinking water
## Standardized survey: questionnaire

<table>
<thead>
<tr>
<th>Beh. Factor</th>
<th>Item example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Open-ended: Can you tell me how you can contract arsenicosis? → 1 point per correct answer → sum score.</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>How high or low do you feel are the chances that you get arsenicosis when drinking unsafe water? [-4 = very low ..... 4 = very high]</td>
</tr>
<tr>
<td>Severity</td>
<td>Imagine that you contracted arsenicosis, how severe would be the impact on your life in general? [0 = not sever ..... 4 = very severely]</td>
</tr>
<tr>
<td>Attitude</td>
<td>How much do you like or dislike arsenic-safe disinfected water? [-4 = I dislike it very much ..... 4 = I rather like it]</td>
</tr>
<tr>
<td>Injunctive norm</td>
<td>Do you think that, overall, people who are important to you rather approve or disapprove that you drink arsenic-safe water? [-4 = nearly all disapprove .... 4 = nearly all approve]</td>
</tr>
<tr>
<td>Descriptive norm</td>
<td>How many of your relatives drink arsenic-safe water? [0 = (Almost) nobody (0%) ..... 4 = (Almost) all (100%)]</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>Are you sure that you can use as much arsenic-safe water as you need within the next month? (very unsure – very sure)</td>
</tr>
<tr>
<td>Coping planning</td>
<td>Have you made a detailed plan regarding what to do when you are hindered to collect your arsenic-safe water? [0 = No detailed plan at all ..... 4 = Very detailed plan]</td>
</tr>
</tbody>
</table>
Doer Non-Doer analysis

Water consumption: 40.3% users of arsenic-safe tubewells (N = 775)

Behavioral factors (means) for non-users and users:

- Commitment
- Coping planning
- Recovery self-efficacy
- Maintenance self-efficacy
- Perceived behavioral contr.
- Descriptive norm
- Injunctive norm
- Response efficacy
- Social constraints
- Instrumental attitude
- Affective attitude
- Severity
- Vulnerability

Users of arsenic-safe wells
Non-users of arsenic-safe wells

Mean value
Max

-0.50
0.00
0.50

-0.50
0.00
0.50
Max
Evidence-based Behavior Change Protocol

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   ➔ Examples form guideline

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   ➔ Pre-Post survey
<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Informational BCTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual knowledge</td>
<td>Presentation of facts/knowledge transfer</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>Personal risk information</td>
</tr>
<tr>
<td>Severity</td>
<td>Showing scenarios</td>
</tr>
<tr>
<td></td>
<td>Fear arousal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attitudinal Factors</th>
<th>Persuasion BCTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental beliefs</td>
<td>Persuasive arguments</td>
</tr>
<tr>
<td></td>
<td>Persuasive means</td>
</tr>
<tr>
<td></td>
<td>Talking to others</td>
</tr>
<tr>
<td>Affective beliefs</td>
<td>Affective persuasion</td>
</tr>
<tr>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Normative Factors</th>
<th>Normative BCTs</th>
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<tbody>
<tr>
<td>Descriptive norm</td>
<td>Highlighting norms</td>
</tr>
<tr>
<td>Injunctive norm</td>
<td>Informing about others’ approval/disapproval</td>
</tr>
<tr>
<td>Personal Norm</td>
<td>Public commitment</td>
</tr>
<tr>
<td></td>
<td>Anticipated regret</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability Factors</th>
<th>Infrastructural, Skill &amp; Ability BCTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action knowledge (skills)</td>
<td>Provide instruction</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>Guided practice</td>
</tr>
<tr>
<td></td>
<td>Facilitating resources (financing)</td>
</tr>
<tr>
<td></td>
<td>Social help</td>
</tr>
<tr>
<td></td>
<td>Modelling</td>
</tr>
<tr>
<td></td>
<td>Reattribution of past successes and failures</td>
</tr>
<tr>
<td>Maintenance (Coping) self-efficacy</td>
<td>Coping with barriers</td>
</tr>
<tr>
<td>Recovery self-efficacy</td>
<td>Coping with relapse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Self-Regulation Factors</th>
<th>Planning &amp; Relapse Prevention BCTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action control</td>
<td>Daily routine planning</td>
</tr>
<tr>
<td>Coping planning</td>
<td>Outcome feedback</td>
</tr>
<tr>
<td>Remembering</td>
<td>Stimulus control</td>
</tr>
<tr>
<td>Commitment</td>
<td>Forming implementation intentions</td>
</tr>
<tr>
<td></td>
<td>Prompts</td>
</tr>
</tbody>
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Reminders

→ Induce commitment (Mosler, 2012)

Before your Kalosh is empty, go to collect water for drinking or cooking from _______’s (name of neighbor) green shallow tubewell!

Do NOT use this water for:

× Drinking
× Cooking
× Boiling and then drinking

You CAN use this water for:

✓ Washing hands, face, and body
✓ Toilet
✓ Bathing animals
✓ Washing dishes and clothes
Implementation intentions

→ Induce commitment (Mosler, 2012)

When, where, and how plans (Gollwitzer, 1999)

Every day after / before (getting up / breakfast /...)

and after / before and after / before

I am going to walk to Mubarok’s tubewell (name of green tubewell owner)

and I am going to collect (number of kolshi)

for (drinking / cooking / drinking and cooking).

Signature
Public self-commitment

→ Induce commitment, increase norms (Mosler, 2012)
Educational session ➔ Control
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Users of arsenic-safe drinking water at follow up (number of households in %)

- Information only: 10%
- Reminders + Information: 30%
- Impl. intention + Reminders + Information: 50%
- Public commitment + Impl. Intention + Reminders + Information: 70%

Note: at T1 all households were drinking arsenic-contaminated water.

Evidence-based Behavior Change Techniques (BCTs) are more effective than interventions based on common sense.
## Cost effectiveness for the BCTs in Bangladesh

<table>
<thead>
<tr>
<th></th>
<th>BDT</th>
<th>USD</th>
<th>Behavior change effects</th>
<th>Effectiveness ratio</th>
<th>Cost ratio of standard intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information only</td>
<td>60.0</td>
<td>0.8</td>
<td>0.14</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reminders + info</td>
<td>135.0</td>
<td>1.7</td>
<td>0.36</td>
<td>2.4</td>
<td>2</td>
</tr>
<tr>
<td>Implementation intentions + reminders + info</td>
<td>145.0</td>
<td>1.8</td>
<td>0.53</td>
<td>3.6</td>
<td>2</td>
</tr>
<tr>
<td>Public commitment + impl. Intentions + reminders + info</td>
<td>195.0</td>
<td>2.4</td>
<td>0.65</td>
<td><strong>4.4</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

**Evidence-based BCTs are 4-5 times more effective but only 3 times more expensive**
Mechanisms of behavior change

Multiple mediation analysis

Changes in...
- Risk perc.
- Aff. attitude
- Instr. attitude
- Inj. norm
- Descr. norm

Commitment
Planning
Self-efficacy
Maint. self-eff.
Deep tubewell use at T2 (y/n)

Public Com. + impl. Int + reminders + info versus Information only (n = 76)

Risk perc. -1.94 (.88)
Aff. attitude
Instr. attitude
Inj. norm 2.12 (1.19)
Descr. norm 6.24 (2.57)
Self-efficacy 6.98 (2.87)
Maint. self-eff. 2.77 (1.24)
Planning .82

Mechanisms of behavior change

Multiple mediation analysis

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- Risk perc.
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Maint. self-eff. 2.77 (1.24)
Planning .82
Conclusions of Bangladesh example

Evidence-based behavior change protocol

• Enables to identify the significant behavioral determinants to be changed

• Makes behavior change interventions more effective

• Enables to inquire the way of functioning of behavior change interventions
Example 2: Fluoride in the African Rift Valley
Dental & skeletal fluorosis

- WHO guideline: 1.5 mg/l
- Rift Valley surface- & groundwater contaminated with 2-30 mg/l
- Medical treatment difficult & ineffective → prevention
- physical, social and psychological impacts
Fluoride-removal options based on the *Nakuru technique*

- Bone char (charred animal bones)
- Contact precipitation (Ca PO$_4$ pellets)

1) Community filter

2) Household filter
Method

- Study areas: 5 villages, 180 HF & 160 CF beneficiaries
- Face-to-face interviews → high illiteracy rate
- Standardized questionnaires
- Translation into Amharic and Oromic
- Training of interviewers (prior to every survey)
- Pretest of questionnaire
## Study on household filters

<table>
<thead>
<tr>
<th>Group</th>
<th>Survey</th>
<th>Intervention</th>
<th>Survey</th>
<th>Intervention</th>
<th>Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>Baseline T1 Sept. 2010</td>
<td>New Filter</td>
<td>Survey T2 Febr. 2011</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td>Filter before</td>
<td>Social prompt</td>
<td></td>
<td>Workshop &amp; commitment</td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>Filter before</td>
<td></td>
<td></td>
<td></td>
<td>Survey T3 May 2011</td>
</tr>
</tbody>
</table>

- **T1**: Baseline T1 Sept. 2010
- **T2**: Survey T2 Febr. 2011
- **T3**: Survey T3 May 2011
Intervention effects

- New device - nothing
- Social prompt - workshop
- Nothing - workshop

F-free water in liters per person and day
Conclusions of household filter study

1. Technical intervention alone is not enough to sustain behavior
   → after implementation of the new technology a psychological intervention is crucial

2. Psychological interventions increased behavior (50% to over 80%)

3. Double psychological intervention not necessary (workshop after prompt insignificant increase)
Fluoride removing community filter

Bishaan Dhugaatii fi nyaata bilcheesuuf Bishaan Calaltuu fiiloraayidii Uummattaan Yero Hundaa haa fayadamnuu!
Results of baseline

Differences in mean of 100% users and less than 100% users
### Interventions to increase community filter usage

#### General recommendations

- Promotion manuals (NGO approach) → mostly recommended
- Awareness creation
- Risk perception

#### Evidence-based

- Baseline survey (research)
- Highest intervention potential
- Influence + potential to increase

---

Perceived vulnerability

Perceived costs
Persuasion on perceived costs

Higher price = better quality

- Examples with common things (red teff vs. white teff, oil vs. butter)

Personal water budget

- Promoter calculates water consumption of family
- How much water do they need from community filter?
- How much money does it cost?

```
Intervention sheet on perceived costs

Persuasion: costly = better quality
Imagine you grow to different types of teff, the red and the white teff. You take the teff to the market.
• For how much would you sell 1 sack of red teff?
• And for how much would you sell 1 sack of white teff?
• So white teff is much more expensive than red teff?
• Why is it more expensive?
• So you think white teff is better quality teff than red teff? Even though it is both teff?
→ So, it is logical, that white teff is more expensive than red teff, because it's quality is a lot better.

Imagine you cook wat. So you can use butter or oil for cooking wat.
• Which one is better for your health? Butter or oil?
• Which one is better for your health? Butter or oil?
• Which one is more expensive? Butter or oil?
• So at the end, which one is better quality? Butter or oil?
→ So, it is logical that butter is much more expensive than oil, because it is healthier and it's quality is a lot better.

The same it is with water in Waye Gabriel. There are different water sources. All of the sources contain a lot of fluoride, which is very dangerous for your health. Still, you have to pay money for water at any water source. The community filter offers fluoride-treated water, which is very good for your health because it prevents you from getting fluoride.
If you compare now for example the Community filter with water from Shibe or Melekan water point:
• Which is better for your health?
• Which has better quality?
• Which is more expensive?
→ Even if both are water their price is different (like red and white teff or butter and oil).
But it is logical that community filter water is more expensive than untreated water, because it is much healthier and it's quality is a lot better.

Personal water budget for the household
→ Take the budget sheet and fill it out with the family!

<table>
<thead>
<tr>
<th>cups/jugs</th>
<th>How many cups does one child drink per day?</th>
<th>How many cups does one adult drink per day?</th>
<th>How many jerrycans do you use for cooking per day (including food, coffee, shalli)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>liters</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total liters</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total per day</td>
<td>Sum of total drinking and cooking</td>
<td>Total per week</td>
<td>Above multiplied by 7 days:</td>
</tr>
<tr>
<td></td>
<td>liters</td>
<td>liters</td>
<td>liters</td>
</tr>
<tr>
<td>Total per week</td>
<td></td>
<td>Total jerrycans per week</td>
<td>Above divided by 20 liters:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total expense per week</td>
<td>Above multiplied by 0.50 Birr:</td>
</tr>
</tbody>
</table>

So if you want that your family only consumes filtered water you have to buy: jerrycans of 20 liters per week at the Community Filter.
This will cost you: Birr per week.
That is only: Birr more than if you consume fluoride contaminated water.

All other water you need, for your cattle, animals, for washing and cleaning you don’t have to buy at the Community Filter, you can buy untreated water, which is cheaper.
```
Persuasion on children’s vulnerability

1) Current water source contaminated

2) Personal risk information for all children
   → Individualized undeniable messages!

3) What can you do?
Results: Evaluation of evidence-based cost persuasion

### Consumption behavior

<table>
<thead>
<tr>
<th>COST</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

0 = not at all expensive, 4 = very expensive

### Perceived costs

<table>
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<tr>
<th>COST</th>
<th>Control</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
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<tr>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>1</td>
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<td>3.5</td>
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<tr>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

0 = not at all expensive, 4 = very expensive

### Table

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Compared groups</th>
<th>M (SD) Group A</th>
<th>M (SD) Group B</th>
<th>U</th>
<th>p^a</th>
<th>r^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆BEH</td>
<td>Cost Persuasion, Control group</td>
<td>.18 (.43)</td>
<td>-.14 (.46)</td>
<td>1782.5</td>
<td>.001</td>
<td>.32</td>
</tr>
<tr>
<td>∆COST</td>
<td>Cost Persuasion, Control group</td>
<td>-.267 (.31)</td>
<td>-.101 (.43)</td>
<td>953</td>
<td>.047</td>
<td>.19</td>
</tr>
</tbody>
</table>
Results: Evaluation vulnerability persuasion

Consumption behavior

Perceived Vulnerability

<table>
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<th>U</th>
<th>p^a</th>
<th>r^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔBEH</td>
<td>Vuln Persuasion</td>
<td>Control group</td>
<td>-.033 (.48)</td>
<td>-.14 (.46)</td>
<td>1174.5</td>
<td>.56</td>
<td>.055</td>
</tr>
<tr>
<td>ΔVUL</td>
<td>Vuln Persuasion</td>
<td>Control group</td>
<td>-.177 (.55)</td>
<td>-.101 (.43)</td>
<td>864</td>
<td>.108</td>
<td>.153</td>
</tr>
</tbody>
</table>
Conclusions of community filter study

- With persuasion campaigns, behavior can be changed without changing objective barriers (e.g. actual price)
- Evidence-based interventions are more effective than interventions based on common knowledge
Evidence-based behavior change protocol enables

1. the systematic determination of the psychological factors to be changed
2. the focused selection of the corresponding behavior change strategies
3. and their proven record of success

Evidence-based psychological behavior change protocols should be used in development projects