

Arsenic Removal Filters in Bangladesh

A Technical and Social Assessment

Suzanne Hanchett, **Richard Johnston**, Mohidul Hoque Khan

UNC Water and Health Conference

October 5, 2011

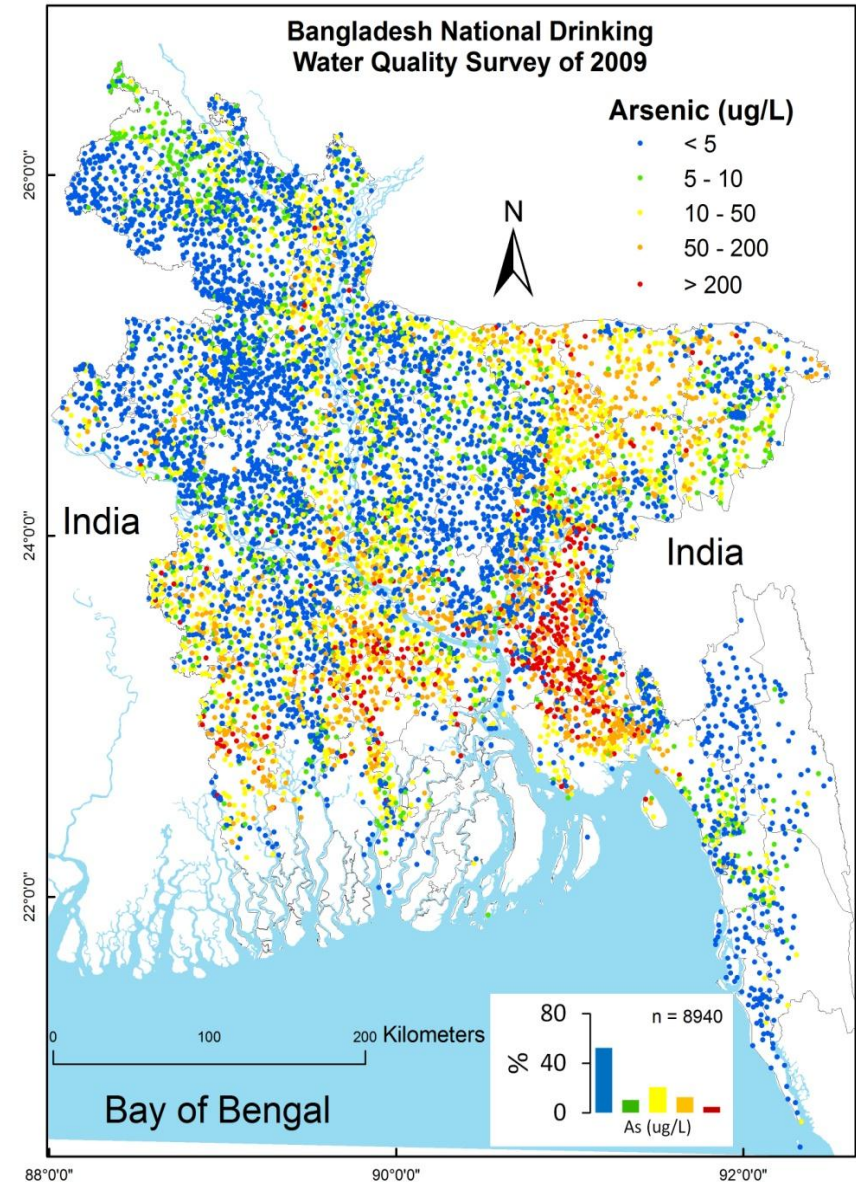
Background

Arsenic affects 20 M

Arsenic-free alternatives

Arsenic removal filters

- BETV-SAM
 - 6 household, 1 community
- verification-unit.org



BBS/UNICEF (2011). "Bangladesh National Drinking Water Quality Survey of 2009."

Provisionally Approved Filters

SIDKO

121,000 L
6 months

300,000 Tk
\$4,300

ALCAN

8,100 L
6 months

3,500 Tk
\$50

READ-F

40,000 L
30 months

5,500 Tk
\$80

SONO

8,100 L
6 months

2,700 Tk
\$40



DART Project: Deployment of Arsenic Removal Technologies

CIDA Support

Linked with BETV-SAM

Filters distributed in UNICEF programme areas (12 sub-districts)

- NGO partners
 - Monitored by Community Hygiene Promoters
- Trial period, selection amongst choices
 - Phase 1: 2006-07
 - Phase 2: 2008
- User contribution of 10-20%
- 12,685 household filters
- 53 community filters



Filters for arsenicosis patients

Filters distributed to arsenicosis patients

- Columbia University project: BEST
 - Bangladesh Vitamin E and Selenium Trial
- Free filters for study participants
- 4,312 household filters (2007-08)
- Monitored by BEST health workers



BEST Village Health Workers

DART Social and economic assessment

Eight months, Jan-Oct 2009

Goal 1: Conduct social & economic assessment of four provisionally approved arsenic removal technologies, after operation under real field conditions for considerable time.

Goal 2: To analyze people's current thinking about arsenic, and about water quality generally, in project implementation areas.

Planning Alternatives for Change (Suzanne Hanchett)

Pathways Consulting Services Ltd (Mohidul Hoque Khan)

Approach to Social Assessment

Distinguish between *responses to the technology itself*, and *cultural ideas about water*

Quantitative and qualitative research methods

- Transect walks
- Social mapping
- Focus group discussions
- Key informant interviews
- In-depth interviews
- Structured observation
- Random sample of HH filters
- Complete census of comm. filters



Focus Group Participants

Household surveys

Description	Sono	Alcan	Read-F	SIDKO	All
Project Target of filters distribution	10,900	7,800	1,440	53	20,193
Filters distribution up to 31-10-08	8,378	5,381	1,084	53	14,896
Targeted sample households	400	400	200	53	1053
Questionnaire interviews (16-uz) (completed, filter acceptors)	417	376	177	53	1023
Control households (non-acceptors of filters)	-	-	-	-	500
Qualitative investigations (10 uz.) Household interviews: re: filters Focus Groups, Other discussions	29	34	24	30	117 90+

In addition, 2,458 water samples were collected from the sample households in 120 ml acidified bottles and sent to PMID for lab testing.

Use of household filters

Household filters: ~75% used in last 7 days



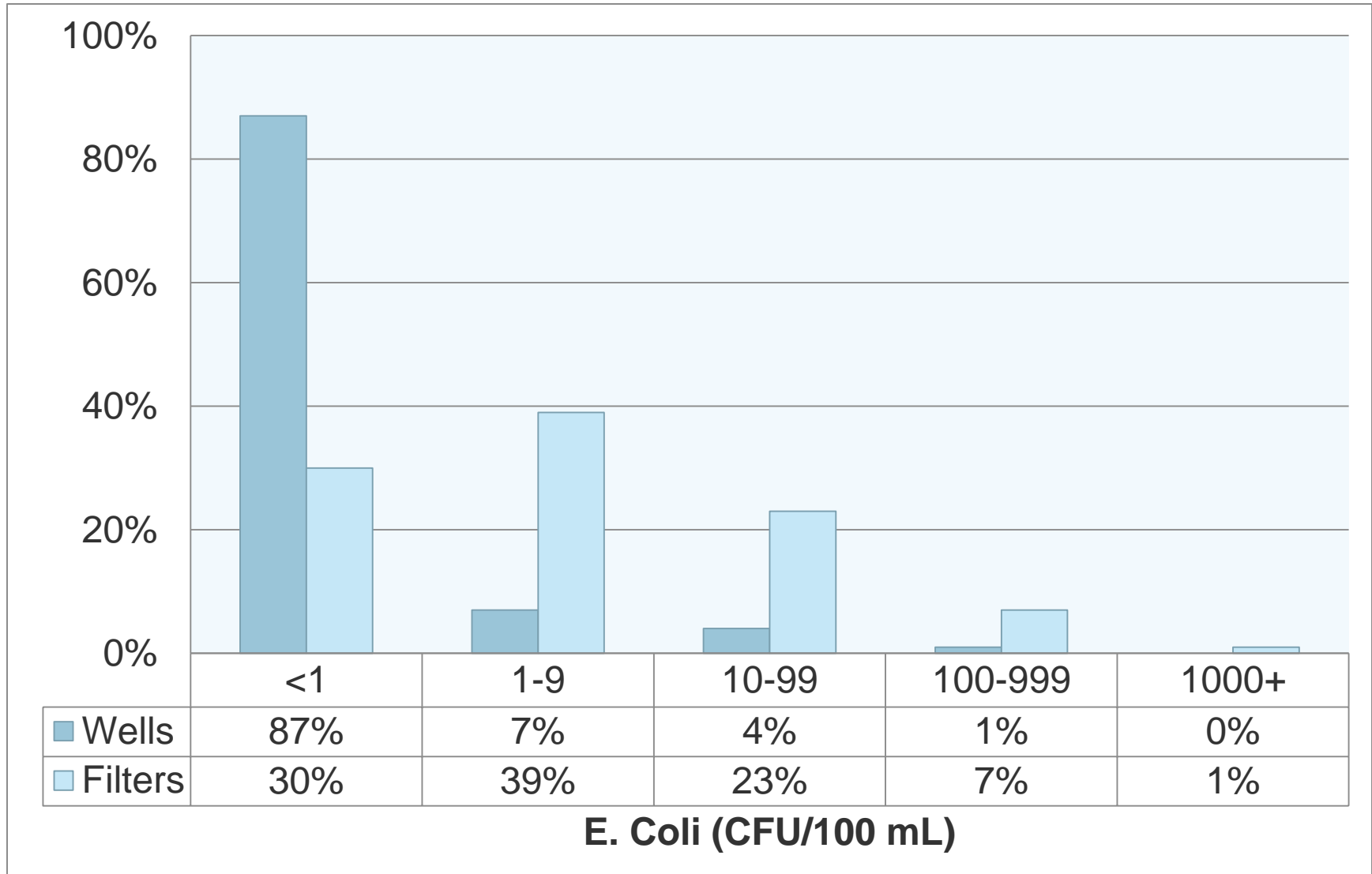
Arsenic in filtered water

- 794 paired samples
- 546 (69%) with raw water > 50 ppb

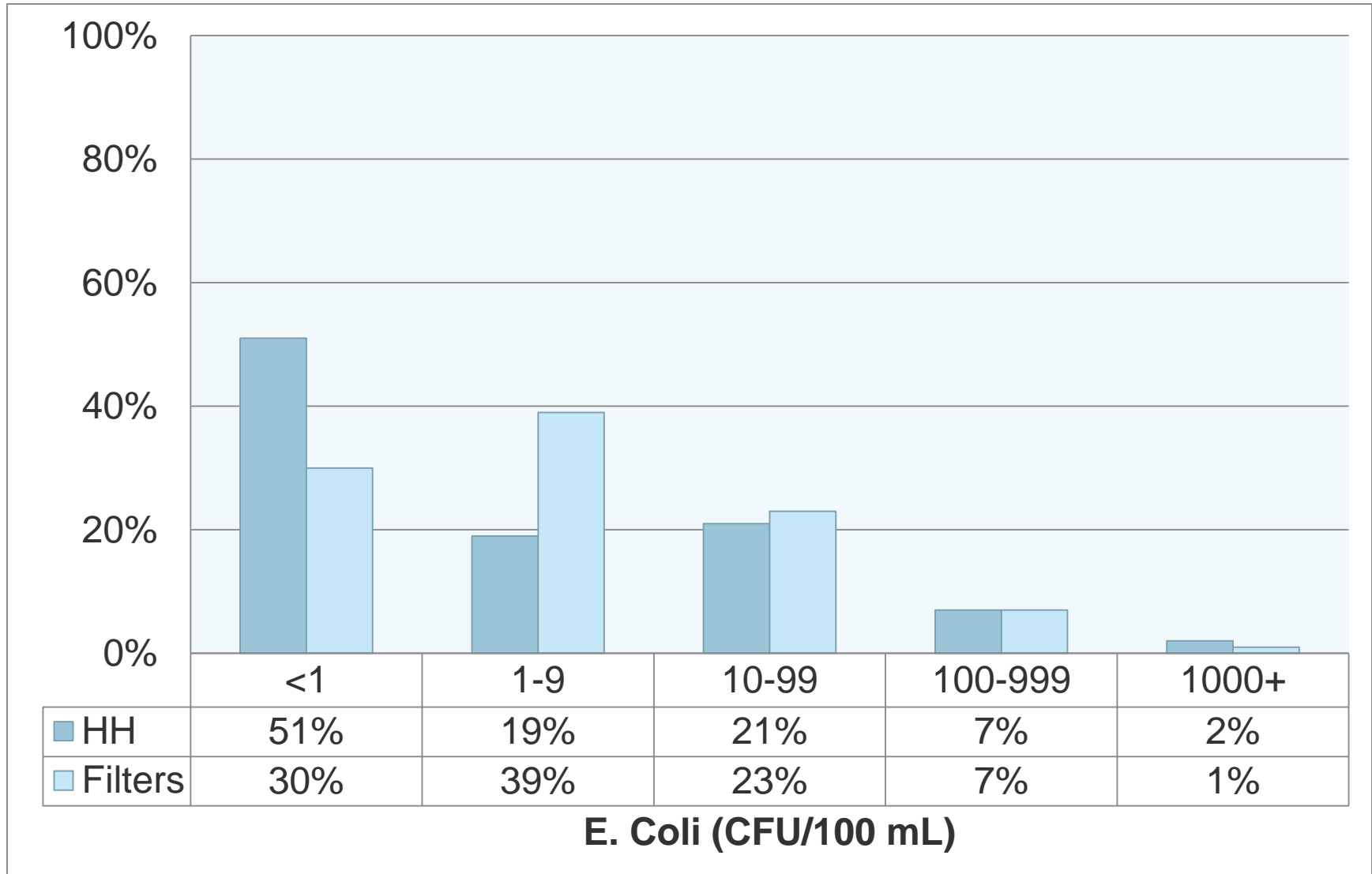
ART	N	Raw water, ppb		Filtrate, ppb		Difference, ppb		% removal		% failing standard	
		Median	90 th %	Median	90 th %	Median	10 th %	Median	10 th %	10 ppb	50 ppb
Alcan	194	150	385	0	29	135	55	100%	79%	25%	6%
Read-F	87	160	455	3	49	144	53	99%	59%	34%	9%
SONO	228	222	490	15	93	195	55	93%	64%	58%	19%
SIDKO	37	155	315	10	61	120	55	93%	50%	49%	14%
Total	546	170	455	8	63	160	55	97%	69%	42%	12%

Even filters failing the 50 ppb standard are removing 70% of arsenic (210 ppb)

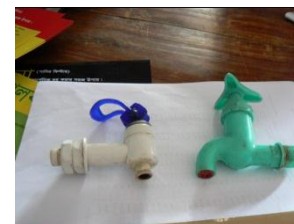
Microbiological quality (1)



Microbiological quality (2)



Problems faced by filter users



	SONO	ALCAN	READ-F
Ever faced problems	30%	22%	28%
Low/stopped flow	19%	5%	16%
Tap broken	8%	13%	3%
Filter body broken	2%	0%	0%
Other	1%	4%	9%

User feedback

	Advantages	Disadvantages
SONO	Lowest price Local technology 5 year warranty	Heavy weight Damage during transport Slow flow rate Ineffective warranty clause
ALCAN	Well-designed bucket Foreign technology Good flow rate Moderate price	Replacement parts not available Burden to clean
READ-F	Small and handy	Highest price Bad smell during initial use No reservoir
ALL	Perceived water quality Iron removal	Lack of commercial network Burden to clean “Coldness” in winter High replacement cost

Economics of household filters

- Actual capital cost: 2700 – 5500 Tk
- User capital cost: 10-20% = 270 – 1100 Tk
- Average daily wage: 137 Tk (men), 91 Tk (women)
- Monthly income: 2500-5000 Tk
- Food expenditure: 3023 Tk average
- Payment in instalments for capital costs
- No subsidy for replacement

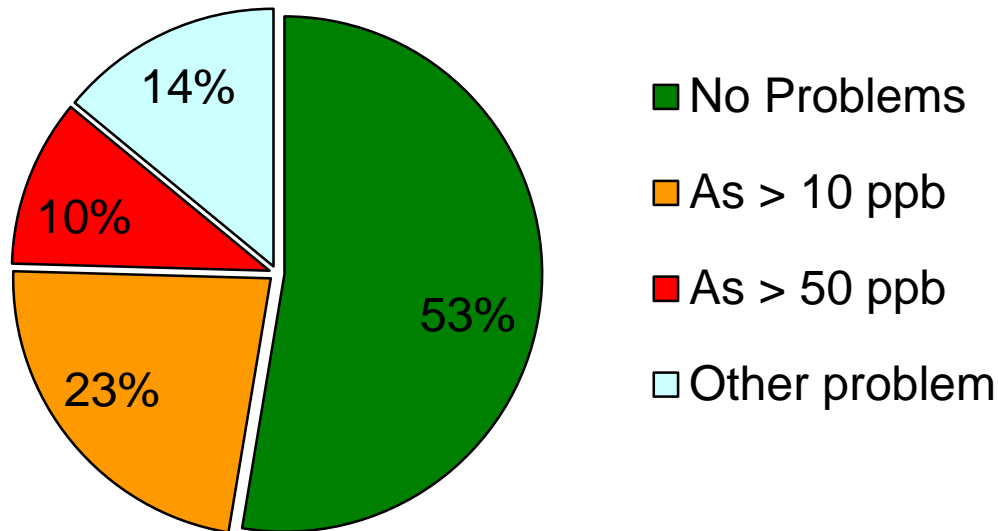
Conclusions: Household Filters

- Market prices of filters & media are all out of reach of poor people
- Programmatic lapses made this an imperfect experiment (“choosing” filters, fielding them, record keeping)
- No unsolvable problems in social acceptance have been found
- Each has features that are perceived differently by different groups of people
- Each has technical challenges that need attention from the proponents

Use of community filters

SIDKO: 48/53 (91%) in use

- Many had treated over 300,000 litres
- 27% had < 50 ppb in raw water
- >50% had had malfunction at some point
- Some savings for media replacement



Under-utilization of SIDKO plants

In principle should serve > 50 households

- 34/41 serving < 50
- Most (16/41) serving 20-35 households
- Only 35% “Very good” or “Satisfactory” socially

1. Land-owner/Caretaker “privatizes” the SIDKO
2. Normal relationships & groups: personal alliances and allegiances among villagers
3. Social barriers
(families, ethnic groups, gender restrictions)
4. Social conflict (less frequent)

Conclusions: Community Filters

- Community-based option has definite advantages in the Bangladesh context
- This is an extremely expensive option, which can be wasted by poor planning and management
- Installation decisions caused problems later: both technical & social problems
- Technical expertise required to maintain/repair
- Social acceptance is either positive or negative, depending on how the SIDKO plant is initially established, and how well it is managed.

Overall Conclusions

- Filters effectively remove arsenic, though filtrate > 10-50 ppb is not uncommon
- Household-level ART's are generally desired and appreciated, but do add to women's workload.
- Lack of post-installation support was a major gap.
- Cost of filters (especially replacement) is beyond reach of consumers without subsidy.
- Community filters hold more promise than household: more financially manageable; easier to monitor and maintain

Thanks!



“Actually, those who are drinking tubewell water now, none of them are doing well. **We are all patients.** Maybe we don’t see any symptoms, but I am sure I am a patient. My family members are also patients, and many community people too, even though they do not understand today, because they have been drinking arsenic contaminated water for a long time.”



Delwar Hossain, UP Chairman,
Dakshin Suchipara Union,
Shahrashti Upazila

“To me arsenic is a very acute problem. We should declare an emergency (*joruari obosta*), but we are giving more importance to sanitation.”



Abul Basher, Union Parishad Chairman,
Gobindapur Union, Laksham Upazila