

Household-centered WASH: Household water treatment and safe storage

Product development insights gained from a field evaluation of a beta prototype with 14 households in Andhra Pradesh, India

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October 31, 2012



Photo credit: Robyn Wilmouth (PATH)

Purpose of study

Goal:

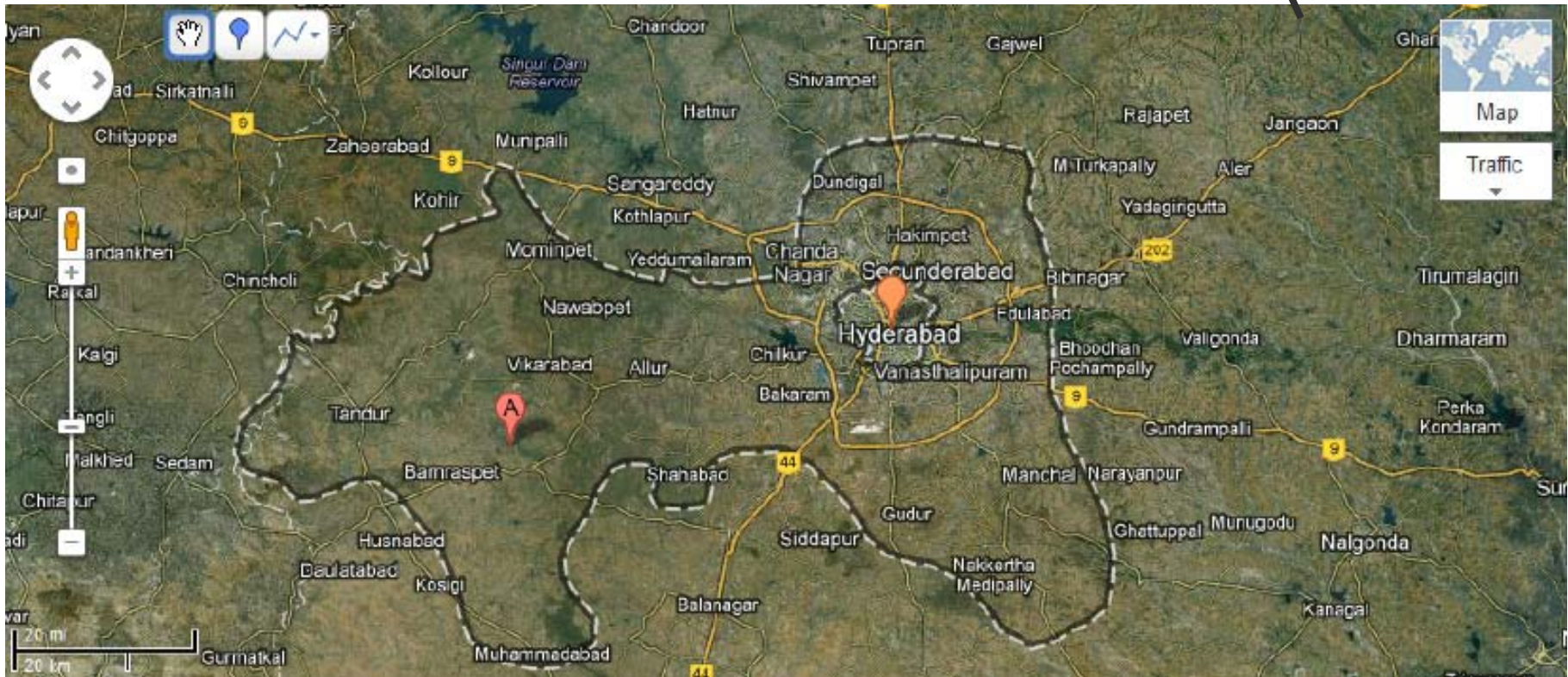
To design and validate a household water treatment and safe storage (HWTS) device that meets performance and price targets while also addressing the user needs within low-resource settings in India.

Three study objectives:

- 1) Document and understand **inexperienced end-user interaction** with the new prototype filter.
- 2) Validate **performance** of the new prototype filter in the intended context of use of the targeted consumers within India.
- 3) Probe about **willingness to purchase** the prototype HWTS unit.

Study sites: locations

- Urban: Hyderabad (5 households)
- Peri-urban: Ranga Reddy (9 households)



Introduction to the technology

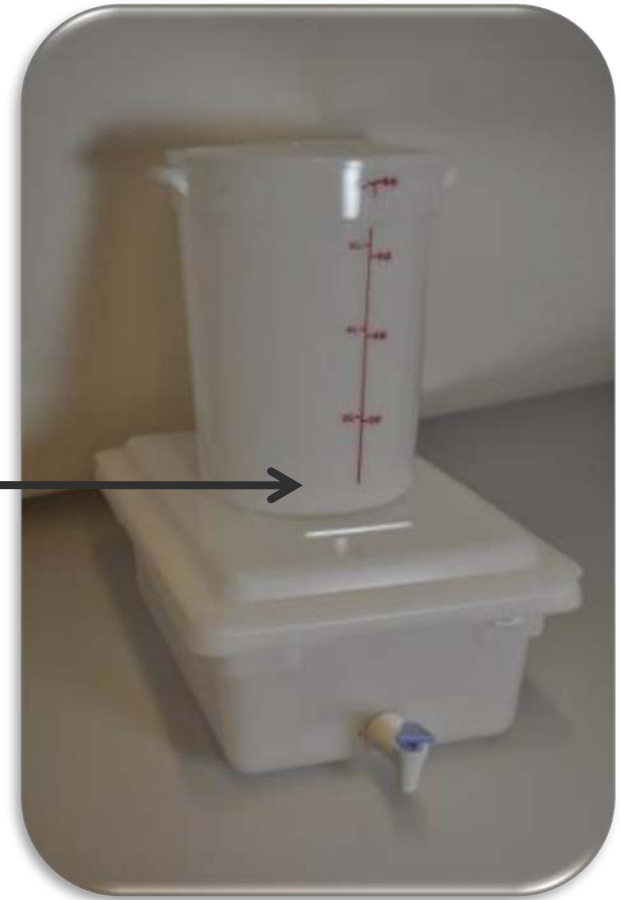
Beta prototype filters and dual-chamber safe storage containers with the C-1 Common Interface were built for feedback from 14 households



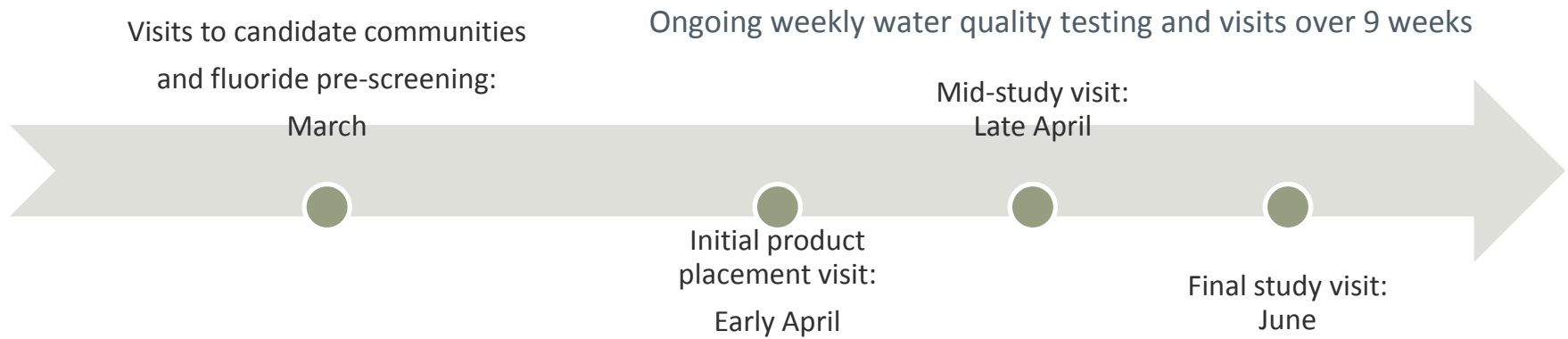
Face Seal
Surface Finish
SPI A-3 Grade #15 Diamond Buff



Common interface
"C-1 Interface"



Study methodology



Study methodology

Methods	Purpose
In-depth interviews	<ul style="list-style-type: none">•Rich feedback in topical areas to identify barriers to uptake, continued use, and correct use
Assembly and cleaning activities	<ul style="list-style-type: none">•Track ease of assembly and ease of maintenance
Photos and rich media	<ul style="list-style-type: none">•Track user interaction and identify barriers and challenges;•Visualize the context of use
Microbial water quality testing	<ul style="list-style-type: none">•Identify level of need for water treatment;•Measure efficacy of treatment
Bromine concentration [Br] testing	<ul style="list-style-type: none">•Monitor [Br] loading and challenges due to local water quality characteristics
Water quality properties testing	<ul style="list-style-type: none">•Monitor the water quality properties potentially challenging the filter
Flow rate monitoring	<ul style="list-style-type: none">•Identify mechanical or fluid-flow challenges;•Identify potential cause of variation in [Br]





Key findings—Validation of common interface

- Validated ease of correct assembly of the C-1 Common Interface with users
- Gained valuable insights about usability for sharing with the product developer



“We also learned how to make devices and filters that households can put together quickly and correctly through this public private partnership.”
– Cascade Designs, Inc.

Key findings—Validation of utility of design guidelines

Initial visit assembly activity:

Type of participant of initial assembly activity	No. of participants	Range M:S*	Median M:S	Average M:S
Inexperienced users in Seattle	10	0:51 to 9:24	1:47	2:59
Inexperienced end-users in India	10**	2:00 to 8:00	3:45	4:32

*M:S= Minutes: seconds

**Video data was not available for four households

Final visit maintenance activity:

2:30 minutes to 8:25 minutes to complete **all three** maintenance steps: disassembly, cleaning, and final reassembly.

Key findings—Validation of utility of design guidelines (cont.)

Descriptor reported by household (HH)	No. HHs reported
Difficult	0
Somewhat difficult	1
Mixed category (Somewhat easy and Somewhat difficult)	1
Somewhat easy	2
Mixed category (Somewhat easy and Very easy)	1
Very easy	9

Somewhat difficult:
“Parts need to be removed and cleaned.”

Somewhat easy:
“It is somewhat easy as the need is to disassemble for cleaning and reassemble for use...the binda is very easy to clean because it is just to be carried and cleaned and is only one part.”

Very easy:
“It is plastic and if you clean with plastic bag and soap it gets clean...not made of brass...not need to clean with tamarind which takes a long time and pressure for cleaning.”

Key findings—Validation of utility of design guidelines (cont.)

Key cleaning behaviors:

- Use of abrasive materials
- Use of various soaps

Challenges for design:

- Need to use scratch-resistant materials
- Need to ensure safety against chemical interactions

Types of cleaning materials used	No. of HHs reported
Dish wash soap	1
Plastic carry bag and laundry soap	2
Brillo green scrubber and dish wash soap	2
Brillo green scrubber and soap	1
Brillo green scrubber and laundry soap	1
Brillo green scrubber, dish wash soap, and metal scrubber	1
Laundry soap	2
Laundry soap and plastic scrubber	1
Dish wash soap and scrubber	1
Detergent/Surf detergent mixed with water	1
No scrubber or soap used	1

Key findings—Validation of utility of design guidelines (cont.)

Quotes capturing comparison of beta prototype device against locally available product (Aquasure) during final household visit:

“Aquasure appears fragile but the color is good. It looks difficult to assemble...difficult to operate.”

After flicking the lower container of the Aquasure, male member of one household stated - *“Doubt this plastic.”*

“Aquasure is risky because too many parts...lot can go wrong.”

“Old device...made of strong plastic and easy to use.”

Key findings—Importance of residual disinfectant

Types of water used for cleaning	No. of HHs reported
Drinking water source	6
Mixture of drinking water source and filtered water	4
Bore well water (not drinking water source)	3
Open well water (not drinking water source)	1

Key findings—Technical insights for bromine disinfection

Field-based insights shared with product developers

- 8 households needed more than one bromine filter
- 5 households needed more than one carbon filter

Challenges reported from the field

- Flow rate differences
- Air bubbles
- Characteristics of local water sources

Identification of properties most challenging to bromine

- High ambient temperatures
- High alkalinity (salt and not pH)



Key findings—Willingness to purchase valued products

Questioned users about the general benefits of the HWTS device:

6 out of 14 families included improved health as a benefit

“Earlier children used to suffer with fever and diarrhea but now no diarrhea...used to forget to cover the binda and the mosquitoes used to get into the water...now mosquitoes may get into the upper container but cannot get into the drinking water in the lower container.”

“Pain in legs reduced.”

“Earlier we used to suffer with cough and used to feel weak...now we are active.”

Key findings—Willingness to purchase valued products (cont.)

Questioned users about expectations of purchase price:

Values from 14 HHs	EXPECTED PURCHASE PRICE: HWTS DEVICE (RPS*)	EXPECTED PURCHASE PRICE: REPLACEMENT FILTER ELEMENTS (RPS)
Highest value	2500	800
Lowest value	500	150

*US \$1= 53.5 Indian Rupees (RPS)

Key findings—Willingness to purchase valued products (cont.)

Questioned users about “desire to purchase” the device:

- 11:14 reported desire to purchase and able to afford.
- 1:14 reported desire to purchase but unable to afford.
- 1:14 reported desire to purchase if volume of device was larger.
- 1:14 (data not available)

“Water is ‘neat’ like filtered water; the filtered water is like Manjeera water (municipal treated water)...this water is covered.”

“It has a lid that protects water from dust; it is useful...do not have the (financial) capacity to buy it.”

“We are now used to drinking filtered water.”

Conclusion

- **User interaction** provides early insights at the prototype stage.
- Contextual and cultural insights are critical to gain early in the process of development.
- Thoughtful and careful design improves user interaction and **experiences**.
- Learning needs to be gained from both laboratory and **field based** evaluations.
- **Stress testing** in challenging environments is a key facet of learning.
- Willingness to purchase includes both **desire** and **ability**.
- There is value in **partnerships**.

Acknowledgements:

India study team:

- Dr. Ghanta Jhansi
- Priyam Varma
- Madhavi Basa
- P. Indira Ranj

Cascade Designs, Inc.:

- Laura McLaughlin

Consultants:

- Jane Verrall
- Michal Lahav

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