

This is part of a series of project briefs discussing the activities, research findings, and field experiences of PATH's Safe Water Project.

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Findings From Investigation of User Experience With Household Water Treatment and Storage Products in Andhra Pradesh, India

Introduction

In 2006 PATH launched a five-year project to examine how commercial market forces can help deliver practical and affordable household water treatment and storage (HWTS) systems to poor families. An initial goal is to identify a family of effective and commercially viable HWTS products for sale to low- and middle-income consumers in India.

To help achieve this goal, the PATH Safe Water Project conducted informal user testing (IUT) in the



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state of Andhra Pradesh in 2007. This qualitative study explored the behaviors and preferences of potential consumers of HWTS products. It also collected customer input on a series of HWTS products that already are—or will soon be—on the market in India. Team members will use the findings to identify promising product categories, inform product design, develop distribution and marketing strategies, and direct further research efforts.

Women in Andhra Pradesh, India, learned about different water treatment products through demonstrations (shown here) before participating in in-depth interviews about their perceptions and opinions on the products.



People believe that the source determines the quality and safety of water. Women travel further to collect water from sources like this pond because its water tastes “sweeter.”

Study Design

The IUT study was conducted in two urban and two rural communities located in a single district of Andhra Pradesh, India. Participants were drawn from low- and middle-income households that rely on different sources of drinking water. Because women are primarily responsible for handling water in the home, the study enrolled more women than men. Participants came from diverse ethnic backgrounds but all spoke Telugu, the primary language of Andhra Pradesh. Many of the participants were agricultural workers.

A team of six local researchers was trained to conduct:

- A series of eight roundtable sessions with 76 women, during which the women tried seven

different HWTS products and participated in focus group discussions (FGDs).

- In-depth interviews with 32 women and 8 men at their homes, which included demonstrations of two or three HWTS products.
- Case studies (including observations and interviews) of 5 women who, contrary to prevailing custom, regularly use HWTS products and thus can be considered positive deviants.

The project team selected seven HWTS products for study based on their current or anticipated availability in India, product type and category, effectiveness at removing bacterial pathogens, marketability, affordability for low- and middle-income families, and the manufacturers' ability to support a

model market. Three of the products were chemical treatments that fall into the category of consumables; that is, they cost little, are quickly used up, and need to be replenished regularly. The other four products were water filters and purifiers that fall into the category of consumer durables; that is, they are relatively costly, do not wear out quickly, and are expected to remain in use for several years. Participants were not familiar with most of these HWTS products before seeing them demonstrated during the roundtables and interviews.

Findings

Perceptions of Water Quality and the Need for Treatment

Most women and men believe that safe water is important because it prevents diseases, such as joint pains, diarrhea, fever, cholera, cough, and allergies. Some even suggested that one reason to invest in a water filter is to reduce future medical costs. One rural woman explained, “If we hesitate spending one rupee for filtered water, we will end up spending two rupees in paying for the hospital and losing our health too.” In two communities, Pamur and Kandukur, participants were deeply concerned about the health impact of high fluoride levels in the local water supply.¹ Doctors and government officials have advised people in these communities to treat their water, and the local government has distributed

¹ The accumulation of fluoride in the bone causes skeletal fluorosis. Early symptoms include stiffness and joint pain. As the disease progresses, there is calcification of ligaments, osteoporosis, and other changes in the bone structure.

Case Study: Dealing with Fluoride

Mrs. V. and her husband, an agricultural officer, bought their first water filter when they realized that fluoride in the ground water was causing them health problems. However, they had to abandon that filter, which they purchased from the government at a subsidized price of Rs 350, because they could not find replacement supplies for the fluoride filtering granules. Next they bought a commercial de-fluoridation filter manufactured by ICS for Rs 2,500. The sales agent offered the ICS filter on an installment plan and also promised to service it at their home.

Mrs. V. has not had any problems using either de-fluoridation filter. While cleaning the three-chambered systems is a little difficult, it does not pose

a serious burden. She periodically boils and washes the candles to improve the filter's efficiency and checks the water level in the filter daily.

But after using the ICS filter for two years, the family was not entirely satisfied. The filter's capacity—20 to 24 liters a day—was not sufficient for a household of five people, and family members also disliked the chemical smell and taste of the treated water. Mrs. V. began buying packaged drinking water, which is delivered to their home every other day at a cost of Rs 16 for a 20-liter bottle. She still uses the ICS filter to treat the water she cooks with, however, and notes that untreated water turns rice a yellowish color.

subsidized de-fluoridation filters in one community (see above case study on “Dealing with Fluoride”).

Generally people think the quality of water is determined by the source. The participants in the IUT study collected water from open wells, borewells, ponds, tanks, municipal taps, tanker trucks, and bottled water. They choose among available sources of drinking water based on taste and perceived safety. Indeed, many collect their drinking water from a different source than the water they use for cleaning and other domestic purposes. Members of the lower castes have fewer options since they are often prohibited from using the same source of water as other villagers. As a result, they may spend more time and effort to collect water of inferior quality.

Regardless of residence, education, and class, people agree that good quality water has four attributes: it is clear, white (i.e., not discolored),

odorless, and sweet tasting. Most participants believe they can judge the cleanliness and safety of drinking water based on these characteristics. Hence, if their customary water source meets these criteria, they do not perceive a need to treat their water. Many people only treat water seasonally when the clarity, color, or taste deteriorates, for example, in the rainy season when run-off increases turbidity or in the dry season when falling water levels foul the water.

Taste is a key criterion for assessing water. People universally dislike water that tastes bland, and women will make an extra effort to collect water from more distant sources that provide “sweeter” water. Some participants mentioned that people become accustomed to the flavor of their local water, which makes it hard to change water sources. As a woman in an urban FGD explained: “It’s hard to have liking for other water sources...it is not

palatable.” The focus on flavor poses a challenge for HWTS products, which frequently change how water tastes. For example, participants complained that some treated water—including boiled water—was too bland, while most objected to the chlorine taste left by chemical treatments and some multistage purifiers.

The IUT study uncovered one other important attribute: many people value the cool temperature of water during the summer and change their water handling practices accordingly. For example, they may shift to clay pots for storage or stop using water filters and purifiers.

Water Handling and Storage

Households collect, transport, and store water in steel, brass, and aluminum vessels. Most transport and store water in the same



Water is stored in open metal vessels. When women draw water, they often dip their fingers into the container along with a tumbler—which may contaminate the water.

container. Plastic containers are occasionally used to collect water, but never to store it. Some women prefer to store water in clay pots during the summer to keep it cooler.

If possible, households collect fresh water daily, sometimes even twice a day. However, households that get water from tanker trucks only receive deliveries every three to five days. Similarly, municipal taps only flow every three to seven days, depending on the season. Men may help collect water for the household, carrying it home on their bicycles.

Women are aware that they need to protect the quality of the water stored in their homes. They take several actions to keep their drinking water safe. Cleaning the containers used to collect and store water is an integral part of women's daily chores. Women wash the containers each time they refill them. Some women also place lids on storage vessels and keep them off the ground. Most

women feel strongly that discarding stale water is critical to maintaining the safety of the family's water supply. They discard leftover water each time they collect fresh water, daily if possible. When water has been boiled or treated, however, they are willing to keep it longer.

Family members draw water by dipping metal tumblers or glasses into the top of storage vessels, often immersing their fingertips in the process. A few participants used the same tumbler for drawing water and drinking. Some households let children draw their own water, while others place storage vessels out of children's reach. Few people understand that the process of drawing water can contaminate it. One woman said that even though people touched the water in the storage vessel, the water remained clean because she never stored it for longer than a day or two.

These water handling practices raise

a basic issue for HWTS. Chemically treated water can be recontaminated when users dip their hands into standard storage containers along with the serving vessel. In contrast, water filters and purifiers prevent recontamination by storing treated water in an enclosed chamber that is accessible only with a tap.

Knowledge and Use of HWTS

If people perceive water at the source to be clean, many do not treat the water at all. For those who do, the most common practice is to pass the water through a plastic sieve—either at the source or at home—in order to remove visible debris, such as insects and plant material. During the rainy season when the water becomes muddy, some women add alum or filter the water to remove suspended particles. Women who use alum say that it makes the water taste bland but consider this better than drinking muddy water.

People in both rural and urban communities agree that boiling water helps prevent illness—a message passed along by both doctors and other women. None of the study participants boil water regularly, however. As one rural woman explained, “Boiling ... is good, but it changes the taste of water, involves extra work and time. It costs in terms of more fuel wood and cooking gas.” Instead women boil water in specific situations (for example, when a water source becomes contaminated during the rainy season) or for vulnerable people (such as babies, sick family members, and pregnant and breastfeeding women). There is some confusion about the correct way to boil water, with some women only heating the water until it is

warm or lukewarm.

Many study participants were familiar with chemical treatments for water, such as bleach and chlorine tablets. Several had tried the tablets, but most stopped using them because they objected to the smell and taste of the treated water. Some also complained that the tablets were inconvenient to repurchase.

Most participants were familiar with stainless steel water filters containing ceramic candles and could describe their assembly, operation, and maintenance. These were the HWTS durables that participants were most likely to own. Fewer people knew about multistage water purifiers which employ some combination of filters and chemical or mineral treatments to purify water. Participants reported that they had seen stainless steel filters and multistage purifiers on television ads, in shops, in hotels, and at the homes of neighbors and relatives.

Most participants who owned a water filter or purifier were not currently using them, both according to their own reports and to researchers' observations. The most common reason was that the filter was broken or the candles needed replacement. Some did not use the filter because there was too little difference in the quality of treated and untreated water or because the filter did not provide enough water to meet their family's needs. During home interviews, researchers also noted that some people misused the filters, for example, by installing candles incorrectly, not closing taps properly, and failing to replace components that were exhausted.



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A girl demonstrates the use of a plastic strainer to remove visible debris. This is the most common way to treat water.

Impressions of HWTS Consumables

During the roundtables and interviews, researchers demonstrated three chemical treatments, including a liquid, tablets, and powder sachets. The first two products only required stirring a disinfectant into the water and waiting for it to work. The third involved more steps, including waiting for impurities to settle and filtering the water through a cloth.

Convenience. There was general agreement that the liquid and tablets were convenient and easy to use, especially for working women. Although some people objected to the 30-minute wait for the disinfectant to work, many participants pointed out that women could quickly add disinfectant to water in the morning, work in the fields all day, and then return home to a pot of treated water. In contrast, the more complicated

treatment process required for the powder sachets was rejected as too time-consuming, laborious, and cumbersome for everyday use by working women.

Women liked the fact that chemical treatments let them treat a large quantity of water at one time, unlike water filters and purifiers. Most participants easily and accurately measured out the chemicals and water for treatment. Some preferred the liquid product because it does not require users to treat a set amount of water.

While the consumables were easy to use, buying additional supplies could be difficult. Some study participants who had tried chlorine tablets found that they were not readily available in the local community.

Effectiveness and safety. Some people questioned the effectiveness and safety of chemical treatments, in part because they did not fully

Case Study: Treating Water Seasonally

Mrs. S. decided to buy a stainless steel water filter about eight months ago, after seeing one at her sister-in-law's house and observing how clean the treated water was. Her husband agreed to the purchase. The couple, both of whom work as agricultural laborers, was able to pay the entire purchase price, Rs 2000, at one time.

According to Mrs. S., she and her family have been pleased with their steel Titan filter. She finds it easy to use and does not consider cleaning it to be much of a burden, since she has to clean her other pots and vessels daily. All of the family enjoys the treated water.

After using the water filter for a month, Mrs. S.

said it accidentally fell during cleaning and two of its three ceramic candles were broken. She stopped using the filter and feels no urgency to replace the candles before summer, when water levels drop and the water source becomes muddy. At other times of the year, Mrs. S. says their water is clear and does not really need to be treated. While she acknowledges and appreciates the filter's ability to remove particles from the water, she sees little difference in the taste, color, and odor of treated and untreated water. In addition, replacement candles are not available in her village. For all these reasons, she is willing to defer fixing and using the filter.

understand the mechanism of action. One woman even refused to taste chemically treated water until a researcher drank some first. Participants looked for visual evidence that a treatment was working, such as effervescent bubbles, a change in the color of the water, or clumps settling to the bottom. Even with this evidence, they expressed doubt that such a small amount of chemicals could treat a large volume of water. People also expressed concern that chemically treating water without filtering it would leave dead germs and physical impurities in the water. They asked what would happen if they added too much disinfectant to the water by mistake or if children drank the water without waiting the prescribed time.

Impact on water aesthetics.

Opinions about the impact of the chemical treatments on the clarity, taste, and odor of water varied widely. While most felt that all three

products did affect taste and odor, there was no consensus on the extent of the change or whether it was good or bad. For example, some urban participants (who may be used to chlorinated water from municipal taps) preferred a bleach odor and taste, because they thought it meant the water was safe to drink. However, most people disliked the chemical taste and odor. Participants praised one of the products for its ability to clarify turbid water.

Affordability. People from all income levels agreed that consumables were most appropriate for the poor because they are inexpensive. Participants stated that they were willing to pay at least the actual retail price, and sometimes considerably more, for each of the chemical treatments. In fact, they overestimated the actual retail price of all three products tested.

After trying the full range of consumable and durable products,

many roundtable participants concluded that chemical treatments were more affordable and hence more appropriate for their own circumstances. They said these would be the products they would buy if they felt the need to treat their drinking water.

Impressions of HWTS Durables

Researchers demonstrated a stainless steel water filter and three multistage water purifiers, each of which employed some combination of mechanical filters and chemical or mineral treatments. The stainless steel filter and one of the purifiers use ceramic candles, which limits their flow rate to about 1 liter per hour. Flow rates are much faster for the other two purifiers, which can process a 13-liter batch of water in about an hour.

Convenience. People found all four filters and purifiers to be convenient

and easy to operate, although some participants were initially intimidated by the complexity of the multistage purifiers. During the product demonstrations, most participants proved quite adept in handling the filters and purifiers. They repeated the assembly and treatment process easily and correctly. Women preferred the products that allowed them to see how much treated water was left inside, either because they were made of transparent plastic or because they had a water level indicator.

Most people thought it would be easy to integrate a water filter or purifier into their daily schedules. They pointed out that working women could fill a filter or purifier in the morning, go out to work in the fields, and return home to treated water. Some participants thought the slow flow rates, especially for products with ceramic candles, would be a problem for housewives. However, women who owned these filters said they were satisfied with the flow rate. They pointed out that they could get a glass of water in 15 minutes and that most members of the household were out all day, so they did not have to refill the filter or purifier often. People disagreed about whether the products tested had a large enough capacity to accommodate bigger families.

Maintenance posed a far greater concern. Initially women said that maintaining the filters and purifiers would not add to their workload, because the chore fit naturally into their daily routine of cleaning water vessels. However, former users of water filters reported that scrubbing and boiling ceramic candles was burdensome, and current users



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A woman mixes water with a disinfectant during a product demonstration. Consumables are a good option for poor families, because they are quick and inexpensive.

confirmed that extra effort was required to maintain water filters and purifiers. By the end of the discussions, study participants concluded that women who work as agricultural laborers would probably prefer consumables over durables because of the extra time and effort required to maintain water filters and purifiers.

During home visits for interviews and case studies, researchers observed that most women used their water filters and purifiers inconsistently, incorrectly, or not at all (see page 8 case study on “Stopping Filter Use”). For example, one woman said she did not use her filter during the summertime because it did not keep the water as cool as clay storage pots. Another woman said she did not use her filter

in wintertime when the source water was clear. Many owners did not know how to correctly install or clean various parts of their filters or purifiers.

Effectiveness. People considered the durable HWTS products—especially the multistage purifiers—to be more effective than the consumables for several reasons. They interpreted the longer processing time as indicating more thorough treatment. They liked the fact that the filters and purifiers removed germs and impurities from the water. They believed that the more complex treatment processes used by multistage purifiers made the water purer than simpler treatment methods because they both killed germs and removed impurities. Some participants also praised the built-in storage chamber,

noting that children could not dip their hands into the treated water and dirty it.

Impact on water aesthetics.

People appreciated that filters and multistage purifiers increased the clarity of the water. Opinions were mixed about the impact of HWTS durables on the taste and odor of the water, with some participants complaining that the treated water was bland or tasted like bleach, while others praised the filters and purifiers for not changing the flavor of the water at all. One woman who lived in an area with high fluoride levels reported that she switched to bottled drinking water because her family disliked the chemical odor left by a de-fluoridation filter.

Visual appeal. There was no clear preference for steel or plastic. Stainless steel is widely accepted, durable, and easy to clean, but some people consider it old fashioned and worry about rust. Women who

owned stainless steel filters liked the way they looked and thought they matched the other utensils in their kitchens.

People generally thought the plastic multistage purifiers were attractive and admired them for looking trendy and modern. Many said that if they owned a purifier, they would display it where it could be seen by visitors. However, they were concerned that plastic was fragile and could impart a bad taste and odor to the water.

Affordability. Everyone agreed that water filters and purifiers were too expensive for poor families. The problem was twofold: the high initial cost of the product and recurring costs for replacement parts and repairs. Of the four products tested, two cost much more than people expected and two cost less. However, low-income households were not able or willing to pay for any of them. Most study participants

who owned a filter or multistage purifier reported paying for them in installments, which eased the financial burden of the purchase.

Even when people felt they could afford the up-front cost of a water filter or purifier, they were concerned about how much it would cost to regularly replace component parts with a limited life span, such as ceramic candles. During the product demonstrations, study participants often asked how much replacement parts cost and whether they would be available in the nearby town. Participants also anticipated that they would need to pay for repairs when, for example, ceramic candles cracked, steel corroded, or taps broke. The relative strength and durability of steel and plastic came up frequently in discussions.

Women who owned water filters or purifiers confirmed the relevance of these concerns, as illustrated in the case study above on “Replacement

Case Study: Stopping Filter Use

After moving to Kandukur, Mrs. J. became sick. Her doctor warned her about the fluoride in the local water and advised her to change water sources and to begin treating her drinking water. She began getting her water from a rainwater collection tank. She also tried boiling the water, but that proved difficult to sustain. About three years ago, her mother-in-law resolved the problem by giving her a Prestige water filter.

According to Mrs. J., the stainless steel filter is easy to use, the capacity and flow rate is sufficient for her small family, and the cleaning process fits into her

daily routine. She also says that she likes the freshness of treated water and believes (incorrectly) that the filter removes fluoride.

Mrs. J. explained that she had been away for a week and therefore not used the filter recently. However, the research team observed that her filter had not been used in a very long time: the lid was covered in a thick layer of dust, the ceramic candles were dismantled, and the bottom chamber was being used to store lentils. When asked to demonstrate the filter, Mrs. J. installed the candles upside down and, by her own account, did not clean the candles correctly.

Parts.” Women reported that they stopped using their filters when the ceramic candles cracked or they ran out of filter granules and they found that replacement parts were not readily available.

While low-income participants often thought durables were better than consumables at treating water, they concluded that they were not willing or able to pay for them, especially given the ongoing cost of replacement parts and repairs. The general consensus among people from all income levels was that water filters and purifiers were appropriate for higher-income families and more educated women who stay at home.

Purchasing decisions. Some women received stainless steel water filters as gifts from their mothers-in-law or aunts. Water filters are a common wedding present because they go well with the steel vessels that newlywed couples routinely receive.

Among people who had purchased a water filter or purifier, common sources of information were television, neighbors, and family members (see case study above on “Making the Purchase”). They were also influenced by door-to-door sales agents and shopkeepers in nearby towns. Some people decided to buy a filter or purifier after observing it at a neighbor’s or relative’s house and asking how well it worked. Many study participants pointed out that the filters were attractive assets to have in a home. A few said that the poor quality of local water prompted their purchases. While women often decided on the purchase by themselves, men sometimes participated in the decision or took the lead.



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Women like stainless steel filters because they are durable, easy to clean, and match their other serving vessels and kitchen utensils.

Implications for the Safe Water Project

Product Design

People have a clear idea of what constitutes good quality water. They value clarity, lack of odor and discoloration, sweet taste, and cool temperatures in summer. When treated water does not meet these standards, households are less likely to adopt or continue using a HWTS product. People also know what problems they want solved, such as seasonal turbidity or fluoride contamination. Products should meet as many of these consumer expectations as possible. This means, for example, designing products that can:

- Remove visible debris.
- Remove the chlorine odor and taste from treated water.
- Keep stored water cool.

- Remove fluoride from water.

Convenience, as measured in time and effort, is important.

Depending on the product, people complain about wait times following treatment, complicated treatment steps, slow flow rates, labor-intensive maintenance, and the need for frequent replacement of parts. Designers need to develop and refine HWTS products that:

- Are easy to use.
- Work quickly.
- Require little maintenance.
- Have durable and long-lasting components.

Ceramic candle filters are especially problematic, because they have slow flow rates, need frequent cleaning, are vulnerable to cracking and breaking, and need to be replaced periodically. Developing an affordable alternative to ceramic candle filters that does not share

these shortcomings should be a priority.

When assessing consumer durables, people care about looks as well as practical features. People are extremely sensitive to the quality of the materials used in a product. For example, they recognize distinct trade-offs between stainless steel and plastic. Polished steel offers strength and durability, but it may be considered old-fashioned. In contrast, plastic looks attractive and modern, and its transparency permits users to check the water level in filters and purifiers. However, people worry that it is fragile and may impart a bad taste or odor to water.

When choosing materials, designers and marketers need to consider both aesthetics and practicality. Compromises are possible and desirable, for example, installing a water level indicator in a stainless steel water filter or using a more durable grade of plastic in a multistage purifier. Simple changes, such as producing filters in different sizes to meet the needs of small and large households, also can help attract customers.

Visual cues let people know that a product is working. If water is not dirty or malodorous to begin with, there may be little obvious difference between treated and untreated water. Indeed, this is one reason why some households stop treating their drinking water. One way to fight this

problem is by incorporating visual cues that suggest that the treatment process is making a difference. For example, people appreciated chemical treatments that effervesced or caused particles to settle out. They were also enthusiastic about a transparent purifier that displayed a colorful mineralization chamber.

Products need to address storage as well as treatment needs. Customary water storage and handling practices in Andhra Pradesh make stored water vulnerable to recontamination. Water filters and multistage purifiers address the problem of recontamination by building in a storage space for treated water. Water is stored in a closed chamber that is only accessible by a tap. However, poor families may only be able to afford consumables. To prevent recontamination of chemically treated water, consumables need to be marketed along with safe storage vessels, i.e., specially designed containers with narrow openings, tight-fitting lids, and taps. This raises two more questions: Can poor families afford to purchase safe storage vessels? And are they willing to switch to a different kind of vessel that will change the way they manage water in the home?

Distribution

Sustained use requires ready access to supplies, spare parts, and repairs. Women often fail to correctly maintain water filters or stop treating their water altogether because fresh

supplies, spare parts, and repairs are not readily available or are too expensive. To encourage sustained use of HWTS products, firms need to:

- Make sure purchasers understand the full cost of using a method, including recurring costs.
- Build a supply chain and distribution system that makes consumables and replacement parts available at convenient local outlets.
- Establish a system to make maintenance and repair available and accessible.
- Design replacement parts that last longer and cost less.

Demand Creation and Marketing

Many people believe their current water source is clean and safe. This creates a false sense of security that deters them from treating their water. To motivate people to purchase and use HWTS products, marketers need to promote the generic benefits of safe water along with the specific products they are selling. One option is to test water at the source or in the home and share the results, following the model set in communities with fluoride problems. Disseminating the results of fluoride tests has succeeded in raising awareness of the need to treat water in those communities.

Since people judge the safety of their water on how it looks, tastes, and

“Women stop maintaining water filters or treating water when supplies and repairs are not readily available or affordable.”

smells, another approach could be to use HWTS products to demonstrate that local water contains germs and impurities. Observing a coagulant at work convinced many study participants that there were invisible impurities and germs in their water. Showing people what accumulates on filters might have a similar effect.

Another strategy is to exploit seasonal changes in the visible quality of water as an opportunity to introduce HWTS products. Many people already filter or disinfect their drinking water at certain times of year when it becomes especially muddy or dirty. Convincing these people to treat water year-round may be difficult, however.

Marketers should promote other advantages of treating water along with its health benefits. People recognize the health benefits of safe water, especially in areas with high fluoride levels. They even treat water for people who are sick. However, the study identified other motivations to which marketers can also appeal. These include:

- Improved taste and clarity of treated water.
- Convenience of being able to store treated water for longer.
- Lower doctors' bills as a result of less waterborne disease.
- Enhanced social status.

Appealing to people's social aspirations is likely to be especially effective in selling multistage water purifiers. People consistently commented on their attractive and contemporary appearance. Many said that if they could afford to buy one they would put it on display where visitors could see it as evidence of their social status

and modern attitudes. This kind of appeal will not work with the very poor, however, who cannot afford these kinds of products or aspirations.

Men, mothers, and mothers-in-law impact the adoption and sustained use of HWTS products. Most of the men interviewed helped transport water home and voiced strong opinions regarding the importance of safe water for their family's health. In some instances, men also participated in the decision to purchase a HWTS product. Support from men may be an important factor in changing behavior around household water.

While often overlooked by researchers, mothers and mothers-in-law also play a role in the adoption and use of HWTS products. Most directly, these older women may give their daughters and daughters-in-law water filters as wedding presents. Their attitudes and beliefs may encourage or discourage women from regularly treating the household's drinking water.

Demand drops quickly as prices rise. Both low- and middle-income households are extremely concerned about the affordability of HWTS products. They worry not only about up-front costs but also the recurrent costs associated with resupply, replacement parts, and repairs. Keeping prices low is important. Many households use installment plans to purchase water filters and multistage purifiers. This kind of consumer financing could be a major driver for HWTS purchases.

Consumers should be segmented by income level and class. There was little difference in water-related

needs, preferences, and behaviors based on residence. However, income and class have a large impact. Not surprisingly, the study found that low-income households are not willing or able to spend as much money on treating water as more affluent households. Equally important, however, low-income households are not willing or able to spend as much time on treating water because women have heavy workloads, often involving agricultural work outside the home. In addition, lower caste women may already be spending more time on collecting water than other villagers because they are forced to go to more distant sources. There are also attitudinal differences between income groups, with low-income participants being more fatalistic about their ability to improve their drinking water. Thus firms should develop products to fit the different lifestyles and outlooks of various income groups, not just their budgets.

Both interpersonal communication and the media can influence household water management.

People acknowledge that it is difficult to change their preferences and practices, for example, their fondness for water from a particular source or the habit of dipping a tumbler to serve water. Study results suggest that both interpersonal and media communication may affect people's knowledge and attitudes towards treating water and help bring about behavior change. Findings suggest that:

- Relatives and neighbors who are early adopters may serve as role models.
- Authority figures, such as doctors and government officials, may

persuade mothers that their water is unhealthy and needs to be treated.

- Door-to-door sales agents and local shopkeepers may provide potential customers with practical information about HWTS products.
- Advertising on television and in other media may disseminate information and help change social norms regarding when it is appropriate to treat water.
- Product demonstrations and educational sessions may mollify suspicions that HWTS products are not effective or safe and show that the products are easy to use.

Product demonstrations were an integral part of the IUT study. The study found that oral presentations and visual demonstrations had a great impact on the low-literate and non-literate women who are primary targets of the Safe Water Project. Demonstrations proved especially effective at teaching women how to measure consumables, assemble durable products, and use products correctly. Thus product demonstrations should not just be considered a marketing tool: they are a highly effective way to ensure the consistent and correct use of HWTS products.

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