POINT-OF-USE WATER TREATMENT AMONG LOWER INCOME HOUSEHOLDS IN INDIA

A RESEARCH BRIEF

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EXECUTIVE SUMMARY

The United States Agency for International Development (USAID) designed the Point-of-Use Water Disinfection and Zinc Treatment Project (POUZN) to scale up these two evidence-based child health interventions. POUZN-India targeted the use of water disinfection methods and products at the household level through integrated community level activities through which commercial, micro-finance, and NGO sectors complement each others' resources. Point-of-use (POU) interventions to improve water quality may lead to diarrhea reduction across all age groups.

POUZN's strategy for POU interventions was to create public-private partnerships and expand the knowledge and use of several available POU methods and products. AED implemented POUZN-India activities in seven districts of Uttar Pradesh, to increase awareness, accessibility, affordability, and use of POU methods and products.

This evaluation brief summarizes POUZN's experience in promotion of multiple POU methods: boiling water, solar disinfection, chlorine disinfection, and filtration, thereby allowing individual households to choose the most convenient method. The comparison-group design of the evaluation captures differences between intervention and comparison districts at end-line. Key findings include differences in:

- **Patterns of use among POU methods and products.**
  The proportion of households who ever used a POU method was significantly higher among the intervention group (97%) than the comparison group (71%).

Urban residence was significantly associated with whether a household ever used a POU product within the comparison group; however, no such difference was found among the intervention group.

Over three-quarters (76%) of households in the intervention districts *currently use* at least one project-promoted POU method, compared to 22 percent of households in the comparison district. The difference was especially striking in the case of liquid chlorine for disinfection: there was no current use in the comparison district but 50 percent use in the intervention districts.

Nearly half (49%) of households in the intervention districts used at least one POU method regularly, compared to just 5 percent of households in the comparison district. While no households in the comparison district used chlorine products *regularly*, 35 percent of intervention district households used liquid products and 8 percent used

tablets. The difference in current use rates between urban and rural dwellers was smaller in the intervention group than the comparison group.

- **Awareness of POU methods and products.**
  At the end-line survey, a higher proportion of households in the intervention group knew about at least one POU method than in the comparison (100% versus 90%). With the exception of boiling, the respondents in the intervention districts were more likely than those in the comparison district to know about all POU methods promoted by the project: liquid chlorine—51 percent versus 0 percent, tablet chlorine—26 percent versus 5 percent, and filteration—9 percent versus 3 percent. A smaller proportion of rural households knew about at least one POU method when compared to urban households in the comparison district; this difference was not significant among the intervention group. Similarly, while those who live below the poverty line knew less about POU methods in the comparison area, this difference was not found in the intervention area.

- **Purchase of POU products.**
  While availability of products was difficult to deduce from household survey data, there were significant differences in POU product purchasing patterns between intervention and comparison districts. In the intervention group 98 percent had purchased at least one kind of disinfection product (chlorine liquid or tablet) versus 32 percent of the comparison group. Households in the intervention group were also more likely to purchase chlorine products and filters from NGOs than from a commercial source; this is a by-product of the POUZN intervention that facilitated partnerships of NGOs with the commercial sector in order to promote the adoption of POU.

- **Increased affordability of POU products.**
  Affordability of water filters (which are otherwise outside the reach of poor households) improved during the project through involvement of micro-finance institutions, and also (toward the end of the project) by the roll-out of new lower-cost filters by two manufacturers in the "acceptable range" of Rs. 1,000. Although filter purchases remain fairly low relative to other products, chlorine products were considered affordable by both urban and rural respondents.

I. INTRODUCTION

The United Nations Children's Fund (UNICEF) and World Health Organization (WHO) estimate that up to 1.5 million children under the age of 5 die annually due to diarrhea,[1] and 386,600 of these are in India, primarily in rural and poor communities and families. Among interventions that can reduce diarrhea, the WHO promotes water treatment at the point-of-use (POU), which research indicates can reduce diarrhea episodes and morbidity due to diarrhea by almost 50 percent.[2]

In 2005, the United States Agency for International Development (USAID) designed the Point-of-Use Water Disinfection and Zinc Treatment (POUZN) project to promote these two new evidence-based child survival interventions. Though zinc reduces the severity and duration of diarrheal episodes, point-of-use (POU) water treatment prevents diarrhea through improved drinking water quality.

POUZN-India's aim was to develop and evaluate a comprehensive strategy that addressed barriers to household use of POU water treatment products among urban and rural poor and to create a sustainable market for POU water disinfection methods to those at the base of the pyramid. The project promoted a choice of

POU methods, including boiling, water filters, chlorine disinfection tablets, and liquid and solar disinfection (SODIS). This allowed the end-user to choose the most convenient method, rather than only adopt(or not) the single method typically promoted in health projects. In this brief, we describe POUZN-India's program context, list program goals, summarize program implementation, and present evaluation results.

[1] UNICEF/WHO (2009) *Diarrhea: Why Children Are Still Dying and What Can Be Done*. WHO Press: Geneva

[2] WHO (2007) *Combating Waterborne Disease at the Household Level*. WHO Press: Geneva.

II. PROGRAM CONTEXT

Located in northern India, Uttar Pradesh (UP) is the most populous of India's 28 states with an estimated population of over 190 million people. High population density, along with high levels of both urban and rural poverty, poses significant challenges to improving environmental and healthcare services. Child mortality has been described as "alarmingly high" in UP[3]—and at a rate of 96 per thousand for children under 5[4] it is the highest rate of any Indian state. Diarrhea is a leading cause of morbidity and mortality and research indicates this accounts for between 18 to 20 percent of under-five mortality in some areas of UP.[5] According to the third National Family Health Survey (NFHS-3) conducted in 2005-2006, nine percent of households reported having a child with diarrhea in the two weeks preceding the survey.

In India, availability of POU technologies was limited or non-existent in poorer communities at the start of the project. Indeed, products like water filters are still not affordable to a large proportion of the population living below the poverty level. Furthermore, there has been little awareness among poor communities of the extent of water quality problems in both urban and rural areas of India, resulting in overall low awareness and demand for water treatment. Commercial producers of POU have concentrated their efforts on the more-educated, easily reachable, urban middle-class. One of the objectives of POUZN project was to convince POU manufacturers of the existence of a sizeable potential market at the bottom of the socio-economic pyramid, in both rural and urban areas.

Other than information on source of household water supply, there has been little on no data available on POU method usage in Uttar Pradesh. Thus in June 2009, a cross-sectional survey was conducted to examine POU use and patterns, and better understand the context in which the program was to operate. The survey was conducted with 1,100 households randomly selected from the urban area of Lucknow (500 households), and from rural villages in the Basti and Faizabad districts (600 households). Data from this survey indicated that only 3 percent of households had “ever”’ used an approved POU method.[6] In addition, 47 percent said they knew about water treatment methods and 39 percent were able to identify any single source spontaneously, or unprompted.

There are little publicly available data on ownership of water filters; however, sales estimates from the private sector show

[3] Ministry of Health and Family Welfare (2006) *State of Urban Health in Uttar Pradesh.* MHFW:New Delhi.

[4] International Institute for Population Sciences (IIPS) and Macro International. 2006. *National Family Health Survey (NFHS-3), India, 2005-06: Uttar Pradesh.* Mumbai: IIPS.

[5] Awasti, S. and S. Aggarwal (2003) Determinants of childhood mortality and morbidity in urban slums in India. Indian Pediatrics. 40.1145-1161 and Awasti, S., Pande, V.K. and H. Glick (1996) Under fives mortality in the urban slums of Lucknow. *Indian Journal of Pediatrics* 63 (3) 363-368.

[6] Boiling water, solar disinfection, chlorine disinfection, and filtration

major differences in POU product ownership based on socioeconomic status and geographical region. The bulk of filter sales come from the middle to upper classes in urban areas.

III. PROGRAM GOALS

POUZN's goal was to achieve a 40 percent regular use rate of a POU method in urban areas and 30 percent regular use rate in rural areas. Project objectives included increasing the following key indicators among households with children under the age of 5:

- % of respondents who are aware of one or more POU methods
- % of respondents who "ever treat" drinking water using POU methods
- % of respondents currently using approved POU methods to treat their drinking water
- % of respondents regularly (daily) drinking water treated using approved POU methods
- % of respondents who know diarrhea can be contracted from contaminated water
- % of respondents who can cite one or more water treatment methods/products promoted by POUZN

IV. PROGRAM IMPLEMENTATION

Operating within a framework of public-private partnerships and integrated community activities, POUZN-India sought to: a) expand the supply of affordable POU products; b) raise awareness of the relationship between diarrhea and poor drinking water quality, show how POU methods for treating water can reduce occurrences of diarrhea; and c) increase demand for, and use of, POU products to treat water. The primary POU methods promoted by POUZN in UP were: boiling water, chlorine tablets and liquid, available commercial devices, and solar disinfection (SODIS).

AED developed a multi-stakeholder partnership framework involving NGOs and commercial partners to assist in the implementation of the POUZN project. Project activities are described in the Implementation Timeline table below. During the pilot phase, AED conducted formative research and developed and used culturally appropriate and innovative communication material, including H2S water testing kits to demonstrate to users that their water is routinely contaminated. AED also identified qualified NGOs, trained their staff on water purification, and encouraged them to work closely with manufacturers. Above all it aimed at providing multiple choices for POU products, including chlorine tablets and liquids (on a cost-plus-margin basis), water filters (with micro-loans), information on boiling, and SODIS.

Table 1: Intervention Implementation Timeline

Phase 1: Pilot (July 2006 - September 2009)	Strategy design and testing with focus on demonstration project Selection of 2 NGOs and microfinance institutions Marketing and field visits with NGO and manufacturer partners Pilot implementation with self-help groups (SHG) Water testing kits used systematically as behavior change tool Mid-project assessment Development of 3-day activity model Formation of *Jal Mitra* Alliance PATH studies, including price sensitivity study Formative survey with a population cross-section
Phase 2: Scale-up (October 2009 - September 2010)	Scale up to the general population Outcomes survey, including a comparison group New low-cost filters are launched on the market NGO partners form social marketing division to sell basket of products

AED implemented the POUZN-India project from 2006-2010 in two phases. Phase 1 was a Pilot Phase (July 2006–September 2009) covering self-help groups (SHG) members in urban slums of Lucknow and rural districts of UP. SHGs are small groups of 10 to 20 women who seek improvement of their conditions through income generating activities, and have joint access to small loans from micro finance institutions. The pilot was scaled up in January 2009 to 480 slums of urban Lucknow and 1,025 villages in Basti, Ambedkar Nagar, Sultanpur, and Faizabad Districts of UP. Phase 2 (October 2009–September 2010) focused on strengthening the partnerships that were developed among private sector, NGO, micro-finance institutions, and self-help groups to scale up reach of the project. In Phase 2 more than 674,000 households were directly reached by partners, representing over 4 million people.

During the pilot phase of program, the project focused on identifying companies and agencies for creating public-private partnerships. Due in part to the initial partnership composition, project activities focused on awareness and use of water filtration. As more companies got involved, additional products were added and program activities expanded. Using an integrated community approach, education methods, product promotions, and demonstration activities began in earnest. Results from a mid-project formative assessment led to the development of a new approach to raising awareness of the need for water treatment and of the various options available in POU methods and products. In 2008 and 2009, the program expanded from the original four districts (Lucknow, Faizabad, Amabedkar Nagar, and Sultanabad) to three additional districts (Basti, Allahabad, and Kanpur). During the 2009-2010 project period, several key studies were undertaken, including a price sensitivity study (in collaboration with Program for Appropriate Technology in Health, or PATH), a formative study, and an outcomes study utilizing comparison groups.

PROGRAM COMPONENTS

AED began implementing POU activities with two NGO partners in urban and rural settings in Uttar Pradesh in 2006. The project trained the NGOs that were working with SHG in the communities to increase awareness of the issues and evidence-based solutions to the problem of contaminated drinking water. The promoters demonstrated and made available for immediate purchase a range of four methods (boiling, SODIS, chlorine, and POU devices) to give all SHG members a choice for treating their water, and offered immediate financing for those households opting for filters, which have a higher initial cost. The NGOs, with their social mandate, were focused on the poor; this project not only provides them with solutions to a serious health problem, but also used communication materials to promote safe water and improved hygiene. The project also established distribution links that allow for improved access to POU products by the rural and urban poor populations, and helped negotiate commissions for SHG sales to members of their communities.

The partnership approach, having proved successful for several public health projects in other countries (i.e., malaria prevention in Africa, hand-washing promotion in Central America, zinc treatment introduction in India, Indonesia, and Tanzania), required some local adaptation in order to penetrate urban and rural poor communities. Working as a catalyst, POUZN-India connected

manufacturers, such as Hindustan Unilever and Medentech, and with NGOs like PANI and Pratinidhi. Such partnerships were mutually beneficial for manufacturing companies and NGOs. POU product manufacturing companies that relied on NGOs to create micro-distribution networks expanded their markets to include previously underserved markets. NGOs benefited by creating a small amount of income from product commissions to augment operational budgets and sustain community activities. Over the period of the project, partnerships developed into a more formal network of companies and organizations now called *Jal Mitra* Alliance.

The NGOs targeted SHGs[7] in rural areas and community groups in urban areas using socially and culturally appropriate means to reach poor communities with messages, training, and products. The most promising approach seemed to be the "3-day model." The NGOs worked with community groups to conduct a water testing demonstration that often resulted in a finding of contaminated drinking water unsafe for consumption. Then, the NGOs conducted follow-up sessions where they focused on raising awareness of the need for clean drinking water while providing a set of options for treating water. This "integrated community approach" also presented information to community members at weekly *haats* (markets or fairs), home visits, and at meetings of community organizations like SHGs.

POUZN – India Partners		
	Initial Partners	**Jal Mitra Partners in 2010**
Private Sector	Hindustan Lever, Medentech, Eureka-Forbes	Hindustan Lever, Medentech, Eureka-Forbes, Ion-Exchange, Vestergaard-Frandsen, Halopure, Usha Britta
NGO	PANI, Pratinidhi	PANI, Pratinidhi, SSS, Sathi, PATH, Water Aid, international foundations
Development Partners	USAID	USAID, PATH, Water Aid, Other International organizations, i.e. Unicef

Despite comparable poverty levels, there were major differences between target audiences in urban and rural areas. For example, urban slums often have public taps, while rural areas are more likely to have boreholes or wells. Similarly, SHGs are common in rural areas, but urban areas were more likely to have joint liability committees. These differences, and others, such as degree of water contamination, availability of credit for financing POU products, access to information, and access to products, were critical factors in determining which products would be more successfully promoted according to geography.

[7] Both Joint Liability Group members and Resident Community Volunteers were primarily found in urban areas whereas self-help groups were found primarily in rural areas, and only limited parts of UP.

V. EVALUATION RESULTS

This section presents the results of the POUZN outcome evaluation study, a cross-sectional survey conducted in August 2010. The study included a total of 1,410 households selected using probability-proportional-to-size (PPS) multi-stage sampling methodology. The survey was conducted in the intervention districts of Lucknow, Basti, and Faizabad, as well as in the comparison district of Gorakhpur (which includes households from urban and rural areas) to examine differences in outcomes that are potentially attributable to the intervention. Several questions guided the evaluation:

- What is the proportion of households that are aware of POU methods?
- What is the proportion of households that "ever treat" drinking water using POU methods?
- Did key drinking water behaviors change as a result of our intervention?
- Was there any change in awareness of water quality in the intervention districts?
- Did POU products become more readily available?
- Were POU products affordable in poor communities?

Results from a formative survey conducted in the intervention districts before full implementation of Phase 2 are also included to provide the reader with background and context.

A. USE PATTERNS OF POU WATER TREATMENT METHODS AND PRODUCTS

Through increased awareness, availability, and affordability, POUZN-India sought to increase the use of POU water treatment methods and products. The outcome evaluation posed four questions about usage patterns of POU water treatment methods: 1) Have respondents ever used POU methods? 2) Are they still using POU methods? 3) Do they use them regularly? 4) Was the rate of regular POU use increased through providing multiple options of methods? The results are presented briefly below.

"Ever used" a POU method

According to the results of the 2009 study, as Phase 2 of the project began, very few households reported having "ever-used" a promoted POU method (3%). Results from the outcomes study, after Phase 2, showed that a higher proportion of households in the intervention districts (97%) "ever used" any of the project promoted methods to treat drinking water (boiling, disinfection products, filtration, and radiation) than those in the comparison district (71%). The biggest difference in POU use between intervention and comparison districts was in the use of chlorine based liquid disinfecting products (57% versus 0%). Use of water filtration was similar between the two groups. For detailed comparisons, see Table 3 below.

Table 3: Water Treatment and Storage Methods

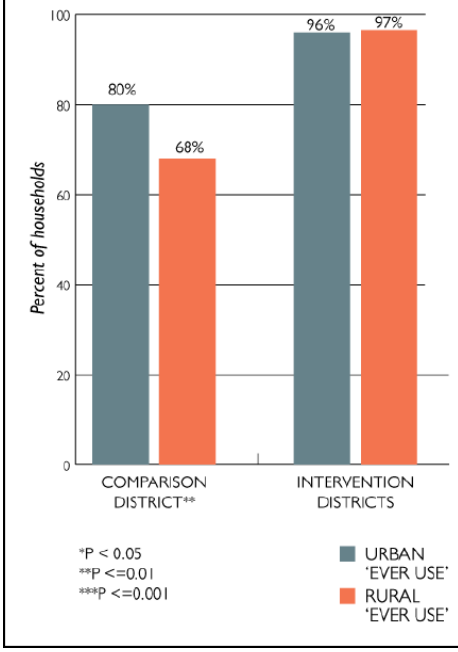
	"Ever Used"		Current Use (still using)		Regular Use (using daily)	
	Comparison district	Intervention districts	Comparison district	Intervention districts	Comparison district	Intervention districts
Boil water	68%	82%***	17%	30%***	2%	7%***
Use Alum	3%	3%	1%	1%	0%	0%
Add purifying soda to water	1%	2%	0%	0%	0%	0%
Chlorine-based liquid medicines	0%	57%***	0%	50%***	0%	35%***
Chlorine-based tablet medicines	6%	21%***	1%	13%***	0%	8%***
Use water filter	8%	7%	5%*	4%	3%	4%
Use SODIS method	0%	2%**	0%	1%	0%	1%*
Filtered thru cloth	19%	20%	13%	9%	4%	5%
Total number of respondents	*720*	*722*	*720*	*722*	*720*	*722*

* p < 0.05; ** p < 0.01; *** p < 0.001

Additional analyses were conducted to compare "ever use" rates of POU methods not only between intervention and comparison groups, but also urban versus rural use of products within each group. Urban households within the comparison group were significantly more likely to have used a POU product than their rural counterparts; however, no such difference was found between urban and rural households in the intervention area (Figure 1). This may be attributable to POUZN's heightened focus on the poor, regardless of urban/rural residence.

Multivariate analyses that controlled for factors such as urban/rural locale and

Figure 1: POU 'EVER USE' IN URBAN AND RURAL AREAS[8]



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Respondents were asked if they had "ever used" a method; if they did, they were asked if they "still" use it (current use). If they are current users, then they were asked for frequency of use – daily users were defined as regular users." And be at the end of the table 1 title.
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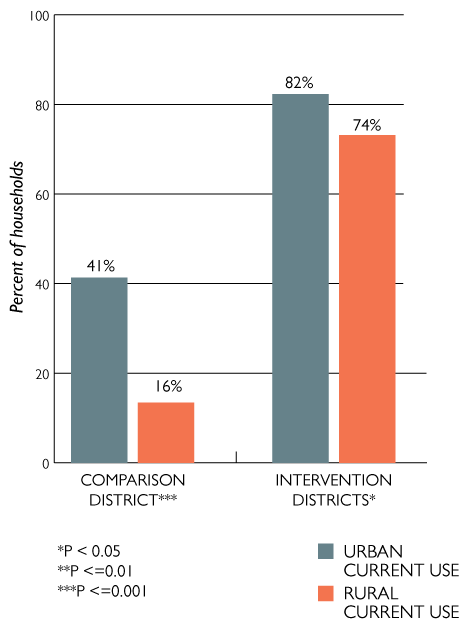
poverty [9] suggested that, on average, the odds that a household in one of the intervention districts ever used a POU method were 4 times the odds of a household in the comparison area. Poverty was not a significant determinant of whether a household ever used a POU method, regardless of intervention status.

Current use of POU methods

Respondents were asked if they were currently using at least one method of treating their water at present—regardless of the frequency or consistency of use. Over three-quarters (76%) of households in the intervention districts reported current use of at least one project-promoted POU method, compared to 22 percent of households in the comparison district. Though the proportion of households that boil water was significantly higher in the intervention districts than in the comparison district, this difference was especially striking vis-à-vis the use of liquid chlorine for disinfection, where there was no current use in the comparison district but 50 percent use in the intervention districts. See Table 1 above for details.

The study also explored differences in current POU use patterns between urban and rural areas and found significant differences between both the intervention districts and the comparison district: rural respondents were less likely to be current users compared to their urban counterparts. However, the gap between urban and rural use was smaller in the intervention districts than the comparison district (Figure 2). This difference, again, may be at least partly attributable to POUZN's focused efforts on

Figure 2: POU CURRENT USE IN URBAN AND RURAL AREAS



the poor, regardless of whether they reside in urban or rural areas.

Multivariate analyses suggest that on average, the odds that a household in one of the intervention districts is currently using at least one POU method were 13 times that of a household in the comparison district. Even after controlling for poverty status, urban dwellers were more likely to be currently using a POU method regardless of intervention status; however, the difference in current use rates between urban and rural dwellers was marginally smaller in the intervention districts compared to the comparison district. Multivariate results also suggest marginal differences between the intervention and comparison districts in POU use by whether a household falls above or below the poverty line. In the comparison district, households below the poverty line had slightly lower use rates compared to those above the poverty line; no such difference existed among households in the intervention districts.

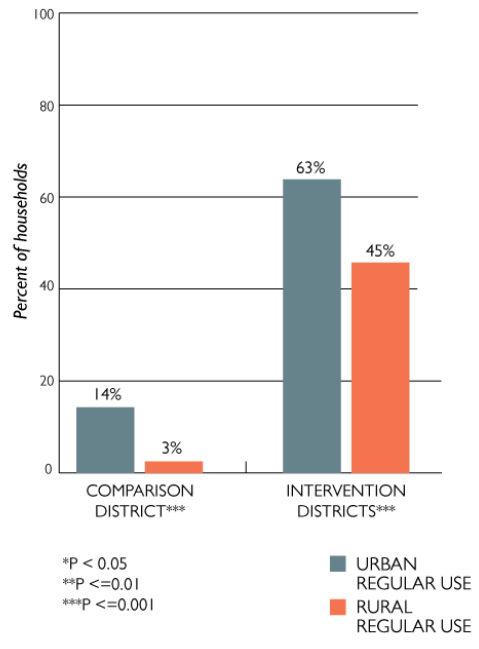
[9] Poverty status was defined by the householder's self-report to the question "Does your household belong to the Below Poverty Line (BPL) category?"

Regular use of POU methods

Although it is important that people access and use POU methods, it is most critical that these methods be used consistently in order to effectively reduce the incidence of diarrhea. A higher proportion of households in the intervention districts used products regularly (daily), compared to households in the comparison district. Nearly half (49%) of all households in the intervention districts used at least one POU method regularly, compared to just 5 percent of all households in the comparison district. As shown in Table 1, a higher proportion of households in the intervention districts (7%) boiled water regularly, versus 2.4 percent of households in the comparison district. And, though no households in the comparison district used chlorine products regularly, 35 percent of intervention district households used liquid products and 8 percent used tablets.

There were significant differences in regular POU use patterns between urban and rural areas in both the intervention districts and the comparison districts: rural respondents were less likely to be regular users compared to their urban counterparts (Figure 3). Though the percentage difference between urban and rural was less in the intervention districts than the comparison district, these figures suggest that the gains made by the project in equity between urban and rural localities of some POU use were not sustained for regular POU use.

Figure 3: POU REGULAR USE IN URBAN AND RURAL AREAS

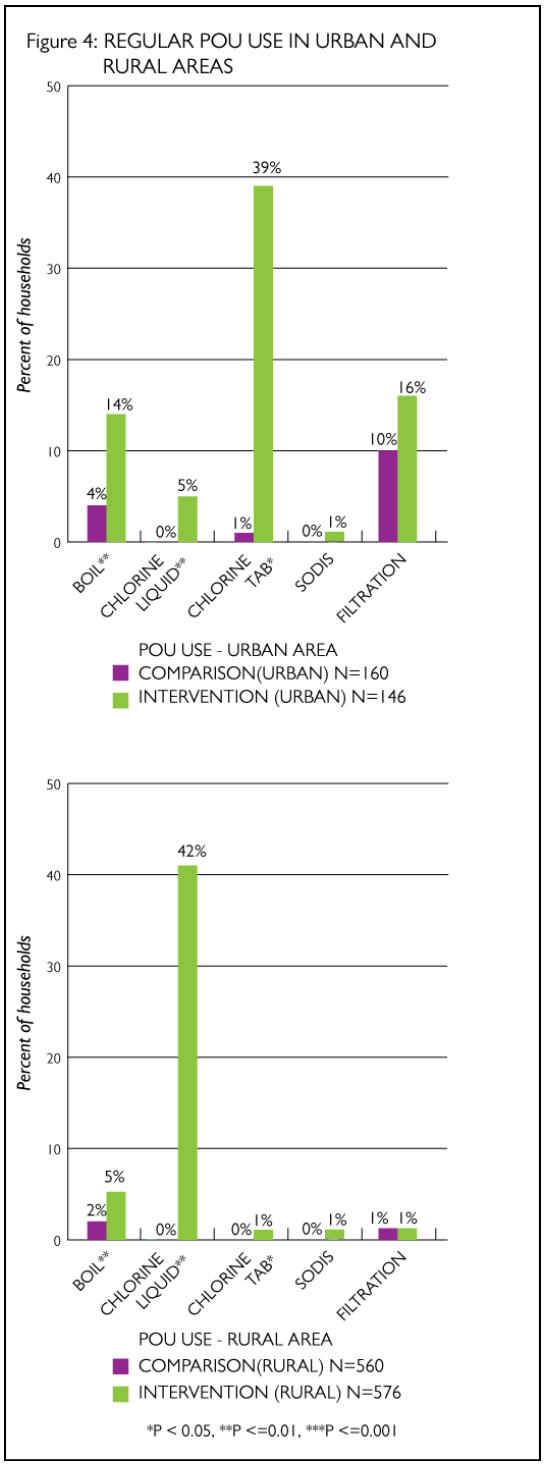


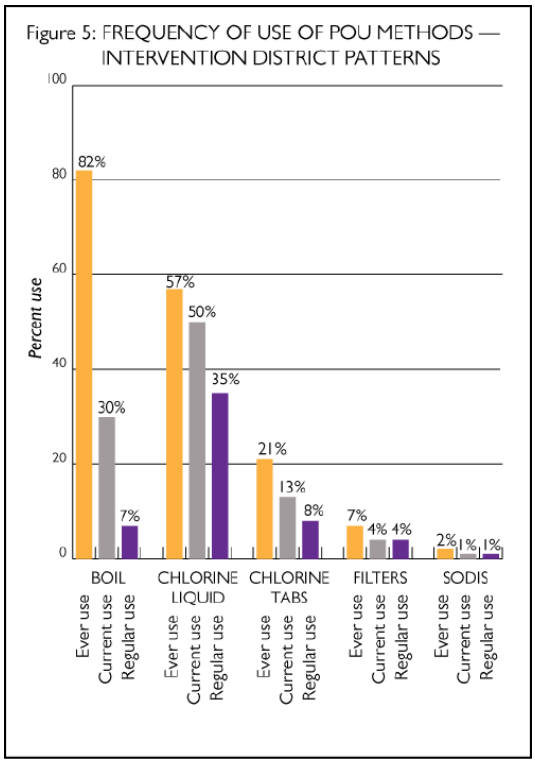
Households in the intervention group were more likely to boil and use liquid/tablet POU products regularly than those in the comparison group. This was true regardless of whether the household resided in an urban or rural area. Overall, while 63 percent of urban households in the intervention districts were regular users of POU methods, only 45 percent of their rural counterparts were regular users. Nevertheless, regular use rates of boiling or filtration were substantially higher among urban households than rural households within the intervention districts (see Figure 4). In addition, while urban households showed a preference for tablet chlorine products, rural households preferred liquid chlorine.

Multivariate analyses suggest that the odds that a household in one of the intervention districts is using a POU method regularly were 23 times that of a household in the comparison district. In both the intervention and comparison districts, urban dwellers were much more likely to be regular users of a POU method, all else equal. There was no significant difference in regular POU use between those living below versus those living above the poverty line in either the intervention or comparison districts.

Effect of Offering Multiple POU Options

To examine the effect of offering users multiple options in POU methods, the study examined changes in use patterns as well as the impetus for such changes. Figure 5, below, shows that an overwhelming majority (82%) of households in the intervention districts stated that they have ever used boiling to treat water, 31 percent currently boil their water, but only 7 percent do so regularly. In contrast, 57 percent of the same population said that they have ever used liquid chlorine based products, 50 percent are currently using liquid chlorine based products, and 35 percent do so regularly. This comparison suggests that some POU methods may be more consistently (regularly) used than others; chlorine liquid had by far the most consistent use rate.

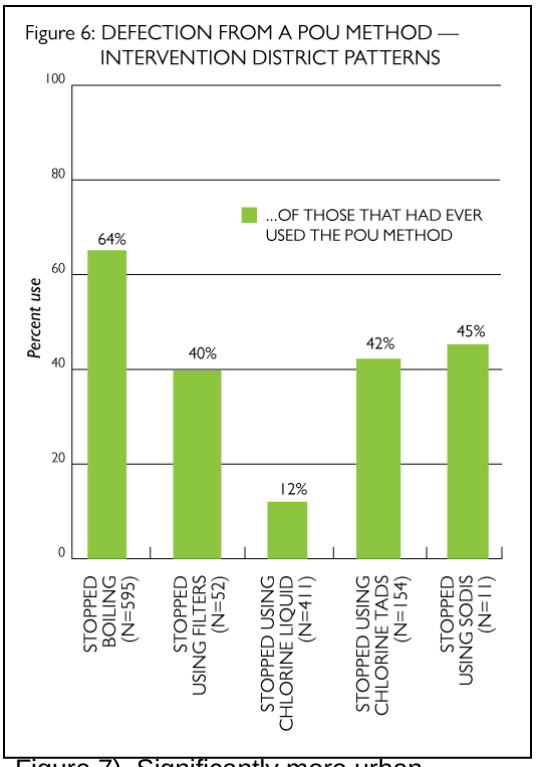


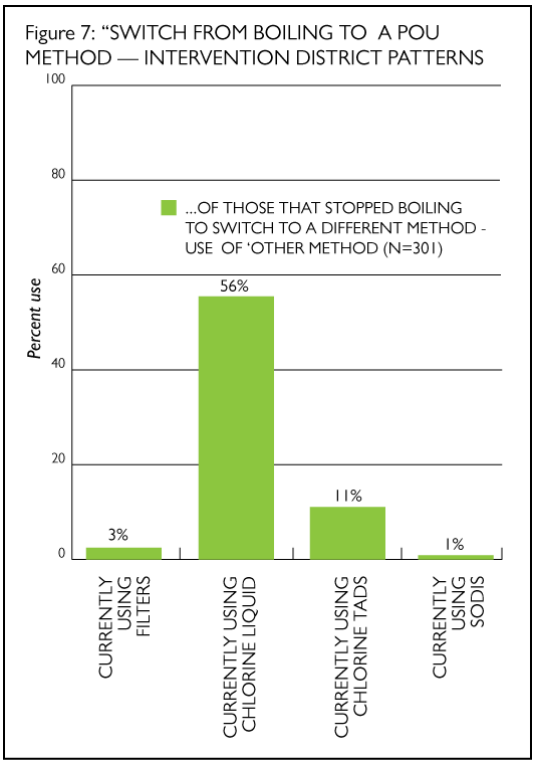


Further explorations of these trends suggested that, of the households that had ever used a POU method in the intervention districts, a significant proportion had stopped using a POU method at present[10]; boiling

[10]Respondents who had stated they had "ever" used a method were asked if they are "still" using it (current use).

had the highest proportion of households in the intervention districts that stopped using it (64%), and liquid disinfection products had the lowest rate of defection (12%) (Figure 6). Moving from boiling to another treatment method (particularly liquid disinfection), was the most common migration pattern; among the 301 survey households that stopped boiling to move to a different method,[11], most (56%) are currently using liquid disinfection products, most likely implying a “switch” to this method (see Figure 7). Significantly more urban households “switched” to tablet disinfection products compared to rural households (55% versus 2%) and significantly more rural households “switched” to liquid disinfection products compared to rural households (63% versus 15%).





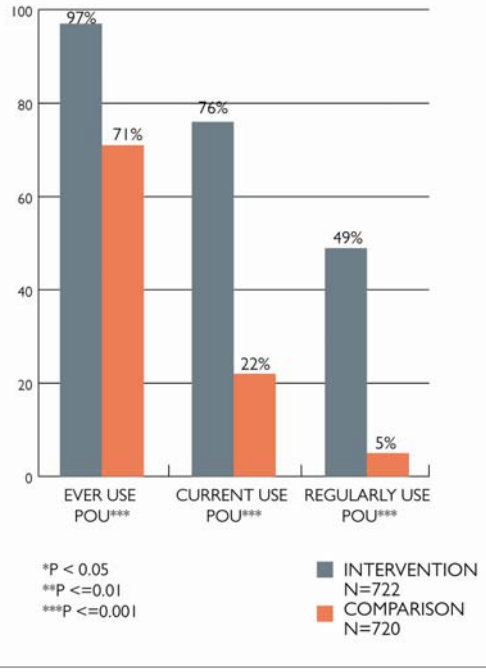
Liquid disinfection products were the method of choice, even among those households that had discontinued other POU methods. Of the 11 households that stopped using filters to switch to a different product, the majorities are now using liquid disinfection products (64%). All of these households were from rural areas. Of 19 households that used tablet disinfection products but no longer do so to switch to a different product, 14 (74%) are currently using liquid disinfection products, 4 (16%) are using filters and 1 is boiling; all those that switched to liquid products were rural households.

Finally, although the data show some drop-offs in the consistency of overall POU use among intervention households when examining use patterns by category of "ever use," "current use," and "regular" use (see Figure 8), this group surpasses comparison households’ use rates across each POU method and pattern of use category.

[11] Respondents who had stated they had “ever” used a method were asked if they are “still” using it (current use).

Overall, it is plausible that intervention households sustained significantly higher regular use rates versus comparison households, in part because of the multitude of choices available to them.

Figure 8: COMPARING OVERALL POU METHOD USE ACROSS USE CATEGORIES

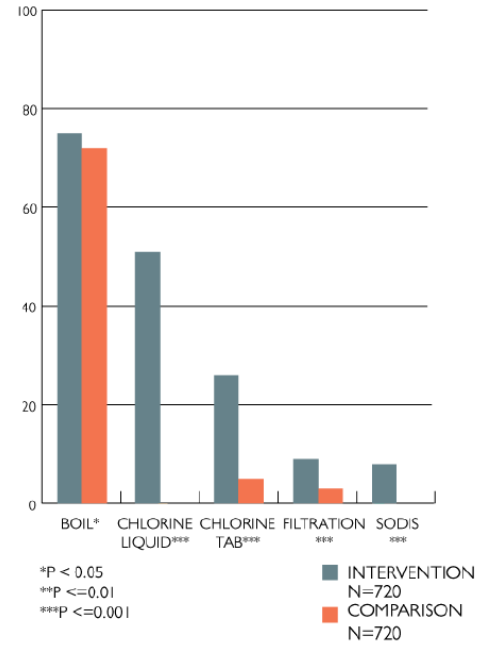


B. AWARENESS OF POU WATER TREATMENT METHODS AND PRODUCTS

By creating awareness and increasing knowledge of POU water treatment, POUZN-India sought to create a receptive environment for POU products and behavior change. Over the course of the project, POUZN-India reached over 674,000 households and an estimated 4 million people with messages about POU methods and products.

To gauge the extent of awareness, surveys asked whether households know about water treatment. Results from the 2009 formative survey suggested that nearly half (47%) of households knew about water treatments and 39 percent could identify at least one project-promoted POU method. At present, the outcomes evaluation found over 90 percent of all respondents were aware that water should be treated, with a significant difference between those in intervention areas (99%) and in comparison areas (90%). With the exception of boiling, the respondents in the intervention districts were more likely than those in the comparison district to know about all POU methods promoted by the project (See Figure 9). In addition, 98 percent of respondents in the intervention districts had heard of a water treatment method, compared to 90 percent in the comparison district.

Figure 9: COMPARING AWARENESS OF POU



There are three major reasons why data in the comparison districts were so high when compared to data in the 2009 survey. These same factors probably influenced outcomes in the intervention areas. First several

international agencies were implementing water programs in UP at the same time (e.g., World Bank and UNICEF). Second, national and state attention on clean water also increased over the project period, as did messages in mass media (see results on where information was obtained). Third, POUZN-India successes have attracted considerable attention and NGOs already working in UP districts like Gorakhpur may have been influenced.

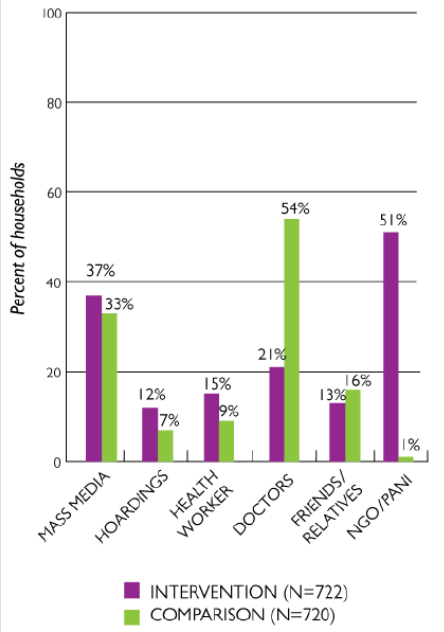
Over 80 percent of households did not identify a relationship between water quality and diarrhea; no significant differences were found between intervention and comparison districts

Multivariate analyses suggested that, on average, the odds that a household in one of the intervention districts knew about a POU method were 2 times that of a household in the comparison district. A smaller proportion of rural households knew about a POU method when compared to urban households in the comparison district; this difference was not significant among the intervention group after controlling for confounding factors. Similarly, although those who live below the poverty line knew less about the POU methods in the comparison area, this difference does not exist in the intervention area.

There were interesting trends in POU knowledge by location. While significantly more urban than rural households in the comparison district knew about any POU method for treating water (86% versus 69%), this difference was non-existent in the intervention districts (88% versus 88%). On the other hand, knowledge about tablet disinfection products was significantly higher among urban households in the intervention districts (compared to rural households), and knowledge of liquid disinfection products was significantly higher among rural households (see Figure 10). This suggests that the preference for liquid disinfection products among rural households seen earlier may simply be a function of the focus of the intervention.

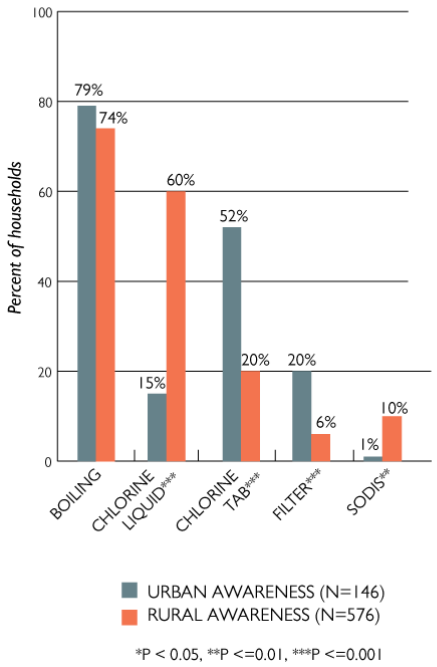
To get a clearer picture of the source of knowledge and awareness of water treatment methods and products, respondents were asked where they heard about water treatment methods (spontaneous/unprompted). There were substantial differences between the sources identified by comparison versus intervention households. Over half (54%) of comparison households cited doctors, versus 21 percent of intervention households. However, over half (51 %) of intervention households cited NGOs/PANI, versus 1 percent of comparison households (see Figure 11).

Figure 11: COMPARING MESSAGE SOURCES



Finally, community mass media was mentioned as an important source of information; the POUZN intervention used hoardings, banners, loudspeakers at events, and posters on field staff vehicles.

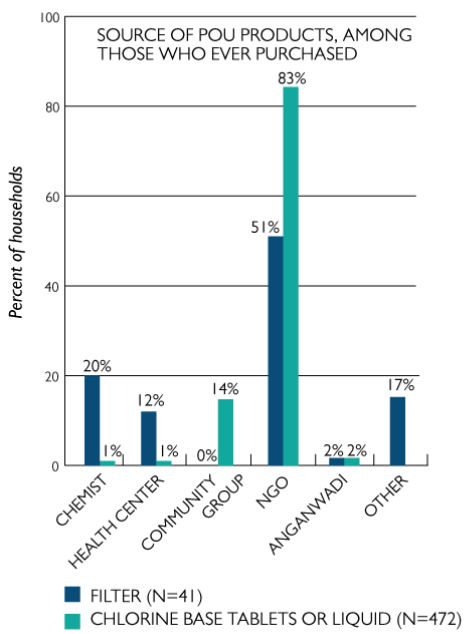
Figure 10: RURAL AND URBAN AWARENESS OF POU METHODS – INTERVENTION DISTRICTS



C. AVAILABILITY OF POU WATER TREATMENT PRODUCTS

Although use rates suggest that POU water treatment methods are available, the initial question of availability had more to do with the community penetration of ideas and products. Data from the private sector suggested that sales were very low in impoverished areas, and findings from the formative study suggested that few people had heard of POU methods and products. To determine product availability through a household survey, two questions were posed: 1) Have you ever purchased commercially available POU products? 2) If so, where? Although there were no significant differences between intervention and comparison districts regarding the purchase of filters, there were significant differences in the purchase of chlorine treatment products. Of households that had heard of these products, 98 percent of intervention area respondents versus 32 percent of comparison area respondents

Figure 12: COMPARING MESSAGE SOURCES



had ever purchased any chlorine liquid or chlorine tablets. Within the intervention districts, there were also interesting patterns around where respondents purchased these products. Majorities purchased filters (51%) and disinfectants (82%) from NGOs (see Figure 12). Of those that had purchased filters, 11 (28%) stated that they had obtained a loan to purchase it and most of those (73%) obtained their loan from an NGO. These figures may reflect the micro-distribution methods used by the POUZN partners where NGOs and members of community organizations were involved in both the awareness campaigns and the actual distribution of products.

D. AFFORDABILITY OF POU METHODS AND PRODUCTS

Two commercial product classes were highly promoted by the project—chlorine liquid/tablets and multi-stage water filters. Boiling water was considered a "method," but SODIS (solar disinfection) was not considered viable in rural areas, due to the need for hard-to-find multiple PET bottles. Thus, it was not actively promoted. Among those currently using disinfection with chlorine products in the intervention districts, 32 percent said that the product in use was affordable, and 63 percent said they found it to be cheap.

POUZN-India worked closely with PATH to conduct a price sensitivity study of commercial water filters. Results indicated that the generally acceptable price that would encourage purchases by poorer community members was between Rs 1,000 and Rs 1,200 (this differed by rural/urban residence and by SES). At the time of study, both Hindustan Unilever and Eureka-Forbes were selling filters for approximately Rs 2,000; thus, poorer community members needed a Rs 1,000 subsidy. In October 2009, the Tata Group launched a new filter called the Swach, priced at the lower end of the acceptable price range (Rs 999). Soon after, Hindustan Unilever put a compact filter on the market for Rs 1,000. This reduction in price of filters will make them more affordable to a larger proportion of the population. In general, there was very little difference in filter purchase behaviors from the time the formative study was conducted and the time the outcomes study was conducted.

The outcomes study showed no significant differences in filter purchases between intervention and comparison districts. However, among those currently using filters, 3 percent of households in the intervention district found it to be too expensive compared to 27 percent of households in the comparison district; in the comparison district, only 4 percent of households obtained loans to purchase their filters (compared to 27% in the intervention

districts). Due to small sample sizes, micro-financing data were not generalizable; therefore, the significance of loans, credit schemes, and other financing options are not reported.

The data from direct sales and distribution has important implications about affordability. Based on project records, from October 2009 to July 2010, over 115,000 POU products were sold (66,675 bottles of chlorine liquid, 48,038 boxes of chlorine tablets, and 1,499 filters). As noted in the figures above, chlorine liquid and chlorine tablets are widely distributed. Estimates suggest that the percentage of households converting to the use of chlorine liquid/tablets increased from 15 percent to 27 percent.

VI. DISCUSSION AND CONCLUSIONS

POUZN's primary strategy to increase the use of water disinfection products in India was to create public-private partnerships that could increase supply and accessibility of products, as well as expand the knowledge and use of several available POU methods and products by potential consumers. AED implemented activities in seven districts of Uttar Pradesh, and exceeded an overall target of 30 percent regular use of POU methods and products in the intervention districts. The end-line survey showed that POU methods and products are now being widely employed in the intervention districts; a significantly higher proportion of respondents in the intervention districts used POU methods and products at one point and/or regularly.

The end-line survey revealed interesting aspects of low-income household choices related to drinking water quality. In terms of adoption, increases in POU use were almost entirely due to an increase in the use of disinfection products, which are preferred by over 40 percent of intervention households.

Although it is important that people access and use POU methods, it is most critical that these methods be used regularly. Although intervention district households used disinfections methods more regularly (compared to comparison district), there was a large portion of households in both areas that do use a method but not regularly. This points to the need for additional analysis of the reasons behind lower rates of consistent use of POU methods, especially among households in rural areas.

Regular use is required to effectively reduce diarrhea rates, but consistent sustained adoption has been found to be difficult to achieve. A large proportion of households in the study replaced boiling with use of liquid disinfection products. This suggests that having more options available to poor communities may lead to more consistent use of the most convenient POU method.

Rural/urban distinctions played a part in POU method/product use patterns. POUZN improved the inequities in POU use in urban/rural localities; unlike the comparison district, in the intervention districts there were no differences between urban and rural areas in the proportion of households that have ever used a POU method and differences in regular use were smaller.

The results further suggest that given the level of diversity in India (and UP specifically) even among the poor, different approaches may be required to promote the goals of future POU projects elsewhere. POUZN should continue to focus on what is working in rural (and urban) areas—specifically, promoting the use of disinfection methods. As a sub-group, self-help groups, who have access to micro-finance, could be subject to a targeted strategy that includes filters in the product choice.

Awareness levels of POU products differed over time and between areas. Generally, the intervention had a positive impact awareness of water treatment options. The intervention also improved disparities in awareness of POU between urban and rural areas. Although intervention households cited NGOs (which were a regular part of the POUZN outreach during water testing, demonstration and household visits) as a primary source of information, in the absence of such a campaign, comparison households were more likely to hear about water treatment from a doctor. This implies that doctors may be an important target audience for future outreach and communications. Future project work might also include involving them in programming activities.

Despite successes in raised awareness of water treatment, the majority of respondents were not able to associate impure water with diarrhea incidence in children below age 5. This apparent disconnect between the need for water treatment and the understanding that dirty water could cause diarrhea is puzzling and suggests that future POU messages may need to be adjusted or refined. In particular, future training and messages should focus explicitly on identifying poor water quality and explicitly making the connection that water treatment is needed to create clean water and reduce rates of diarrhea.

Affordability (particularly of water filters) continues to be an issue that needs further examination. It is understandable that poor households opt for cheaper initial investments. However, as filtering devices have longer term returns and costs of filters are now within acceptable ranges, there should be additional efforts to determine how to recuperate dissatisfied chlorine users or water boiling consumers into the purchase and regular use of filters. Allied with micro-credit, the new low-cost filters may lead to higher uptake. In the start-up phase, POUZN-India was able to work closely with SHGs that had access to micro-credit options and saw a significant uptake of filters (27%), but as the program expanded to the general population to reach an estimated 4 million people, the same expansion did not take place in the micro-credit infrastructure. Early successes utilizing SHG members as early water filter adopters did not scale-up as the project expanded. This experience further establishes the critical need for micro-finance to allow access to the filter. Future efforts should continue to increase awareness and make other methods and products like water filters more affordable and accessible to rural populations.