



PROMOTING ZINC AND ORS FOR THE MANAGEMENT OF CHILDHOOD DIARRHEA IN INDIA: A RESEARCH BRIEF

EXECUTIVE SUMMARY

We have known for many years that oral rehydration therapy (ORT) through the use of oral rehydration salts (ORS), recommended home fluids, or increased fluid intake saves lives by preventing dehydration caused by diarrhea. The benefits of zinc treatment for the management of childhood diarrhea have only been established more recently. Zinc is an important micronutrient that helps support the function of a healthy immune system. For many children in developing countries, zinc deficiency leads to increased incidence and severity of diseases, including diarrhea. Clinical research suggests that if children take 20 mg of zinc (10 mg for children under six months of age) for 10 to 14 days, the outcome is up to a 25 percent reduction in the duration of acute diarrhea and a 42 percent reduction in treatment failure or death cause by persistent diarrhea. In addition, this treatment leads to a reduction in the recurrence of diarrhea for about three months.

The United States Agency for International Development (USAID) through the Point-Of-Use Water Disinfection and Zinc Treatment (POUZN) project has supported the introduction of zinc treatment, in conjunction with ORS, to reduce child illness and death from diarrhea. Although POUZN projects have taken many forms in the three countries in which they have been implemented, the approach remains the same: to use public-private

partnerships to increase knowledge of the appropriate use of ORS and zinc, and to promote increased use of ORS and zinc to reduce diarrhea. Since 2005, POUZN-India, implemented by the Academy for Educational Development (AED), has worked with the private sector to increase zinc production while simultaneously promoting increased zinc awareness, knowledge of appropriate zinc use, and behavior change by working closely with the partnering zinc manufacturers and non-governmental organizations (NGOs) to introduce zinc treatment to providers first, then to caregivers. The partner NGOs have achieved strong penetration in target audience communities (urban and rural poor) by working directly with rural medical providers (RMPs) and drug sellers, as well as with caregivers.

This evaluation brief of the POUZN-India project will summarize efforts to promote zinc prescription and use for the management of childhood diarrhea in urban slums around Lucknow and nine rural districts in Uttar Pradesh. It also examines zinc use rates among caregivers who are members of self-help groups (SHG) in a pilot project in Ambedkar Nagar. The evaluation design attempted to capture information at key points in the distribution, prescription, and use of zinc. Evaluation findings include:

- Zinc prescription rates among providers (RMPs and chemists) in the intervention area were significantly higher than providers in a comparison district (58.0% versus 19.7%).
- In addition, there was a difference of more than 22 percentage points between the comparison and intervention districts in RMPs and chemists, who stated that they prescribe zinc for childhood diarrhea in general.
- Zinc awareness rates among RMPs/chemists were significantly higher in the intervention district (85%) relative to the comparison district (29%).
- Zinc was stocked at significantly higher rates by both chemists and RMPs in the intervention district compared to the comparison district (69% versus 24%).

- Zinc use rates among women who were members of self-help groups and participated in a pilot study of demand creation increased from 0 percent at baseline to 50 percent at end-line.
- In spontaneous response questions, awareness of zinc as an appropriate treatment for diarrhea increased significantly among pilot study caregivers (from 0% to 56.3%).
- In spontaneous response questions, awareness of ORS as an appropriate treatment for diarrhea increased significantly among pilot study caregivers (from 15% to 56.3%).
- Of those caregivers whose children had diarrhea in the previous two weeks, zinc treatment increased significantly from 0 percent to 50 percent.
- Of those caregivers whose children had diarrhea in the previous two weeks, a combined ORS/zinc treatment also increased significantly from 0 percent to 31.3 percent.

I. INTRODUCTION

The World Health Organization (WHO) estimates that up to 1.8 million children under the age of 5 die annually due to diarrhea. In 2004, WHO and the United Nations Children’s Fund (UNICEF) issued a joint statement that low-osmolarity ORS and zinc taken together is effective for managing childhood diarrhea. Clinical trials have shown that zinc treatment can reduce both the severity and the duration of diarrhea when zinc supplements are taken for 10 to 14 days (Harvey, 2005).

Toward this end, the Point-Of-Use Water Disinfection and Zinc Treatment (POUZN) project, a USAID Private Sector Program (PSP) initiative co-managed by AED, supports the introduction of zinc treatment in conjunction with ORT for diarrheal reduction. The ultimate goal of the project is to promote the long-term sustainability of ORT/ORS with

zinc treatment by expanding commercial production, sales, and use of zinc products in three target countries—India, Tanzania, and Indonesia—over a five-year project lifespan. POUZN was designed to engage the private sector in the development, marketing, sale, and local acceptance of zinc treatment for diarrheal episodes.

The POUZN project in India started with the premise that the private sector could play a key role in creating demand for the zinc, ensuring supply at an affordable price, and, ultimately, increasing usage. POUZN-India implemented an innovative approach, creating partnerships between zinc manufacturers and NGOs in the state of Uttar Pradesh (UP). To do this effectively, POUZN targeted both patient and provider behaviors with regards to treatment of diarrhea, while creating a viable marketplace for the product. This evaluation briefing reports on studies conducted to assess the impact of the POUZN intervention in India. It examines whether or not providers and caregivers are using zinc for the treatment of diarrhea.

II. PROGRAM CONTEXT

The POUZN project was particularly appropriate for the India context due to the high incidence of water-borne illness leading to diarrhea and the high mortality rates of children under 5 years of age due to diarrhea. These rates are highest in rural areas and among the poor. Located in northern India, 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 urban and rural poverty make approaches to improved health services especially challenging.

Diarrhea is one of the leading causes of under-five related illness and death in India. UP accounts for one in six under-five deaths and diarrhea and diarrhea-related illness is one of the major causes of this high rate of under-five mortality. Child mortality in India is described as “alarmingly high” with UP being 35% higher than the India average (MHFW, 2006).

Care seeking for diarrhea is relatively low in India and treatment is inadequate. According to the third National Family Health Survey (NFHS-3) conducted in 2005–2006, 9 percent of children country-wide reportedly had diarrhea in the preceding two weeks. Among these children, approximately 60 percent were taken to a health facility (slightly higher in urban than rural areas) but only 39 percent were treated with some kind of ORT, including 26 percent with an ORS solution and 20 percent with homemade gruel. More than one-quarter of children with diarrhea did not receive any type of treatment at all, and many received treatments that were inappropriate. Qualitative research by the independent research agency AMS in UP, Jharkhand, and Uttaranchal showed that most caregivers initially tried home remedies to treat diarrhea before seeking medical care and often used anti-diarrheals (which can be harmful) and antibiotics (which are unnecessary except for bloody diarrhea). In Uttar Pradesh, according to NHFS-3 data, only 12 percent of children under age 3 who had a recent case of diarrhea were given ORS. This is one of the lowest rates in the country and reflects a decline since 1998–1999.

The NFHS-3 for UP shows that 52 percent of caregivers in all socio-economic status (SES) groups who seek medical care for their children’s diarrhea went to private providers, 9.5 percent went to a pharmacy, and 5 percent to other shops, while 5.5 percent seek care in the public sector. If over three-quarters of poor caregivers seek care from the private sector, this is a strong justification for POUZN-India’s focus on private providers to increase zinc use among caregivers.

III. PROGRAM GOALS

POUZN’s goal in India was to introduce zinc treatment and low-osmolarity ORS as a standard childhood diarrhea treatment by increasing access to the product, improving knowledge and correct use of the treatment, and supporting an enabling environment for these changes. The project sought to achieve these ends through approaches that could be both scalable and sustainable. While the ultimate objective was to reach caregivers and improve the health of their children, the project targeted the many individuals and groups

whose behaviors have an impact on caregivers, including pharmaceutical companies, doctors and other health professionals (both formal and informal), and a wide range of drug sellers. One specific goal to ensure constant supply and access to zinc treatment was for the project to enlist national pharmaceutical manufacturers to produce and market zinc treatment nationwide. Joint goals related to providers and drug sellers were:

- To create awareness for zinc and ORS as the first-line treatment for childhood diarrhea
- To increase the prescriptions of zinc and ORS for cases of childhood diarrhea
- To introduce and increase availability of zinc treatment in drug stores

Specific goals for caregivers were:

- To achieve a 20 percent zinc use rate among caregivers in intervention areas
- To sustain and increase ORS use rates among caregivers in the intervention areas
- To create greater awareness among caregivers about zinc as an appropriate and effective treatment for diarrhea in children
- To reduce the use and prescription of antibiotics and antidiarrheals
- To increase access to zinc for diarrhea treatment in children

IV. PROGRAM IMPLEMENTATION

The zinc component of the POUZN-India project began in 2005 and was implemented in three phases. In the first phase, POUZN focused on stimulating a sufficient and sustainable supply of zinc to the marketplace nationwide. Early work included assessing the capacity of pharmaceutical companies to produce zinc. In the first year, seven contacted firms agreed to begin producing zinc for commercial distribution, reaching 30 companies by May 2010. Simultaneously, POUZN began a campaign to raise the awareness of zinc treatment by providing information to pediatricians through the training of zinc companies' medical

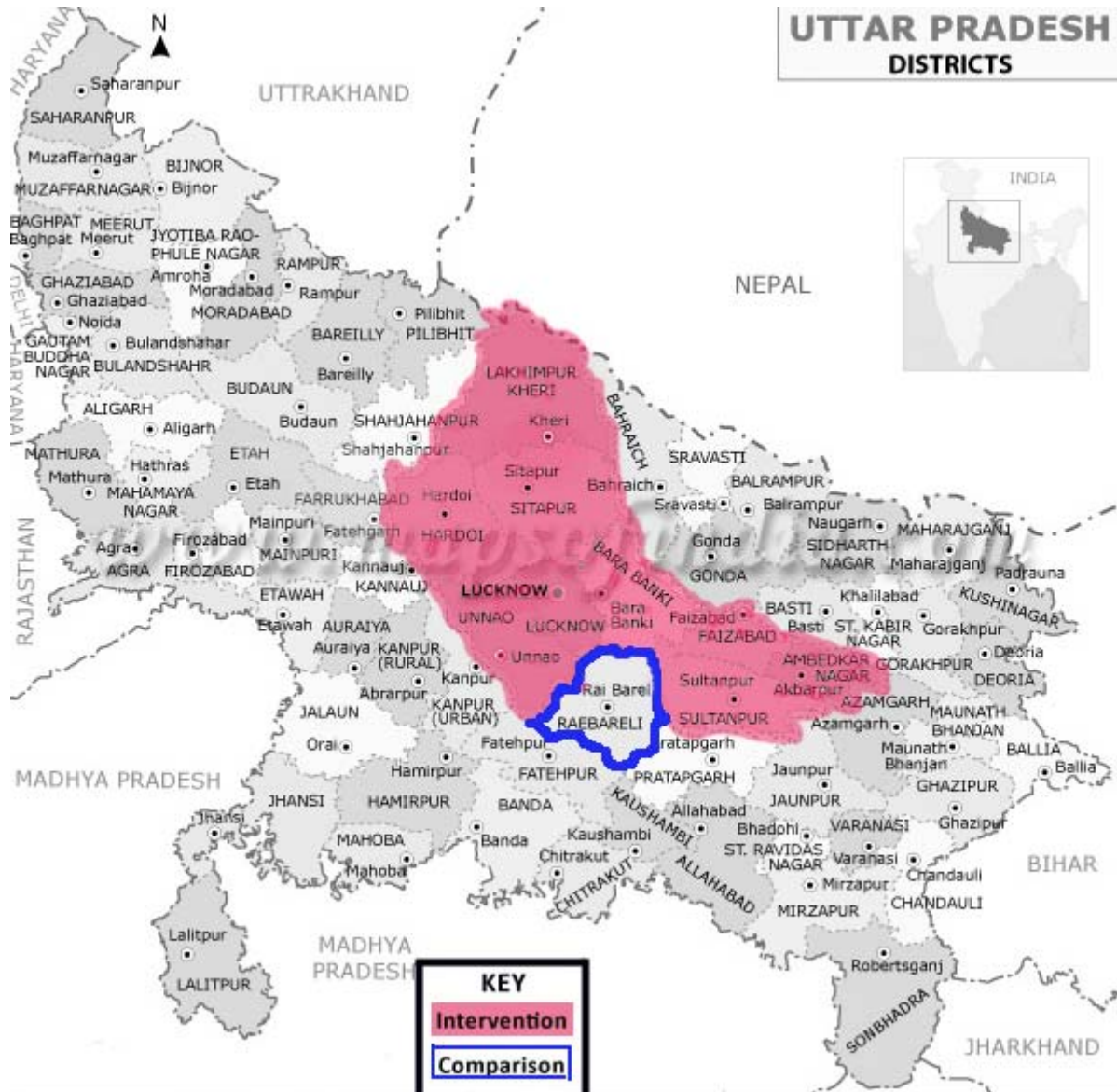
representatives on the use of zinc and ORT in treating diarrhea. In the first year of the project, POUZN-India trained over 1,200 medical representatives from the partnering zinc producers. These “reps” reached out repeatedly to the doctors nationwide. Since then, 15,000 pediatricians and nearly 75,000 general practitioners nationwide have been reached regularly by the medical reps. While POUZN-India began by investing in these activities to support commercial marketing of zinc, private sector companies invested over an estimated \$15 million relative to USAID’s investment of \$1.52 million over the life of the project once they recognized potential returns.

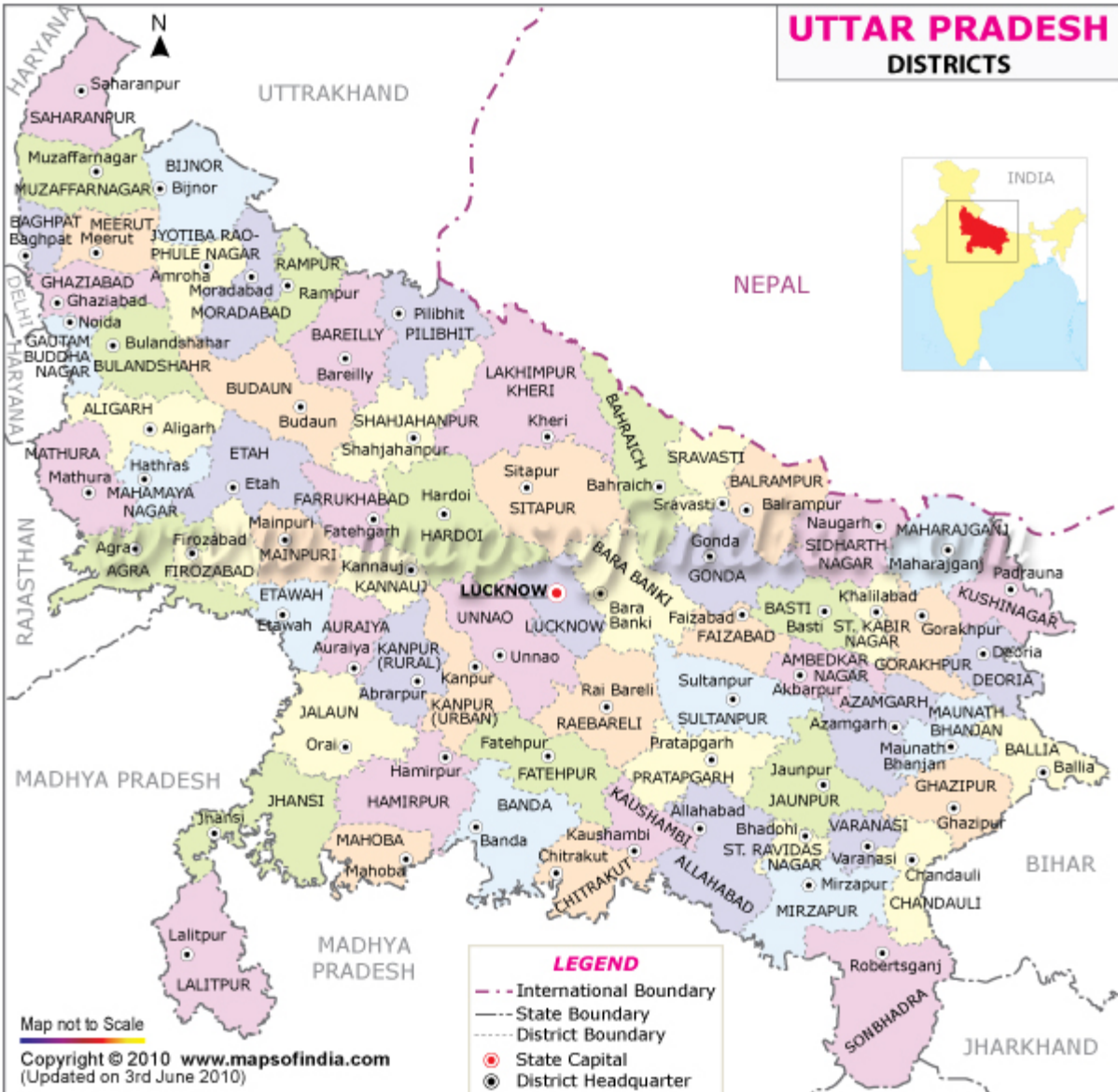
In the second phase of the project, in 2007, POUZN adopted a rural approach—promoting zinc in rural areas directly to the health providers and drug sellers on whom caregivers rely. Early successes in reaching formal practitioners demonstrated a gap in coverage of rural areas. POUZN then decided on a new approach to reach rural children who are most prone to diarrhea, by directly promoting zinc treatment to rural medical providers and chemists. POUZN encouraged zinc companies to expand their marketing to rural areas. However, most companies were reluctant to invest due to the high cost of developing the dispersed rural market. Therefore, POUZN decided to try a new model to “prime” the market by enlisting three NGOs: People’s Action for National Integration (PANI), Pratinidhi, and Shashwash Sahbhagi Sansthan (SSS).¹ This phase of the program began as a pilot in one block (about 100,000 people) in UP, a state in Northern India where POUZN’s other intervention—point-of-use (POU) water disinfection—was active.

In the third phase of the project, the pilot was scaled-up to 100 blocks in 10 districts in UP, covering a catchment area of approximately 13 million people with an estimated two million children under 5 years of age. POUZN trained the NGO staff in pharmaceutical marketing, organized the schedule of the grassroots medical representatives, and produced culturally appropriate promotional material, including a DVD showing a highly reputable pediatrician giving advice on diarrhea treatment. The activities of these three NGOs in

¹ For the rest of this brief, we will refer to these three as either NGOs or as part of the Naya Daur campaign.

promoting zinc usage were termed Naya Daur (meaning *new dawn* in Hindi). Trained staff targeted the unlicensed rural medical practitioners (RMPs) and rural drug sellers or chemists.





During the third phase, POUZN also launched a pilot project in Bhati Block of Ambedkar Nagar in UP to directly reach out to caregivers through interpersonal communication and a word-of-mouth campaign. This demand creation pilot was implemented by the NGO PANI. It integrated into existing networks of about 100 village self-help groups, each of which include about 10 to 20 women. During a series of meetings, women were provided with information about zinc and ORS as a treatment for childhood diarrhea. Furthermore, PANI promoters carried zinc and ORS products to supply immediately in case of demand.

The remainder of this brief will focus on this third phase of the project, which dealt primarily with the tangible results of work by local NGOs to reach communities and build supply and change prescriber habits to build a market for zinc. The brief will also present results from the caregiver pilot project in the Bhati Block an attempt to glean lessons for direct promotion to caregivers and implications for scale-up.

V. EVALUATION RESULTS

The project used two evaluation instruments: a provider survey and caregiver survey.

- Provider survey: A survey of RMPs and chemists in the Barabanki (intervention) and Raibareli (comparison) districts of Uttar Pradesh State was used to assess differences in provider knowledge and behaviors; while Raibareli may have benefited from the first phase of the project targeting the creation of a national supply as well as the sensitization of formal and licensed providers, it did not receive the third phase of this intervention that targeted rural and informal providers. A total of 400 RMPs and 200 chemists were interviewed, equally divided between the intervention district and the comparison district.
- Caregiver survey: This study evaluates the pilot program launched in Bhati Block of Ambedkar Nagar District in Uttar Pradesh targeting caregiving members of SHG. This study employed a cross-sectional design looking at trends over time, in which information was collected from caregivers to children under 5 years of age selected randomly from among members of the SHGs who had participated in the study and who had a child sick with diarrhea in the last three months. The baseline survey was conducted in March 2009 with 120 caregivers and the end-line survey was conducted a year later, in August 2010, with 128 caregivers.

A. IMPROVING PROVIDER KNOWLEDGE AND PRACTICE OF ZINC TREATMENT

Survey data suggest that RMPs and chemists in regions where POUZN provided an intervention are more likely to prescribe zinc and are more knowledgeable about the use of zinc for childhood diarrhea; they also report greater overall exposure to information about zinc.

RMP and Chemist Prescription Patterns

When RMPs and chemists were asked if they in general prescribe zinc to children under 5 with diarrhea, 78.0 percent of the intervention district (Barabanki), compared to 27.0 percent of the comparison district (Raibareli) responded in the affirmative (see Table 1). When asked what they prescribed in the last case of diarrhea, 58 percent of RMPs and chemists in Barabanki and 19.7 percent of RMPs and chemists in Raibareli responded that they prescribed zinc (Figure 1). A similar proportion responded that they prescribed both ORS and zinc for the last case of diarrhea (55.7 percent in Barabanki and 19.7 percent in Raibareli). In addition, significantly less proportion of RMPs and chemists prescribed antibiotic for the last case of diarrhea.

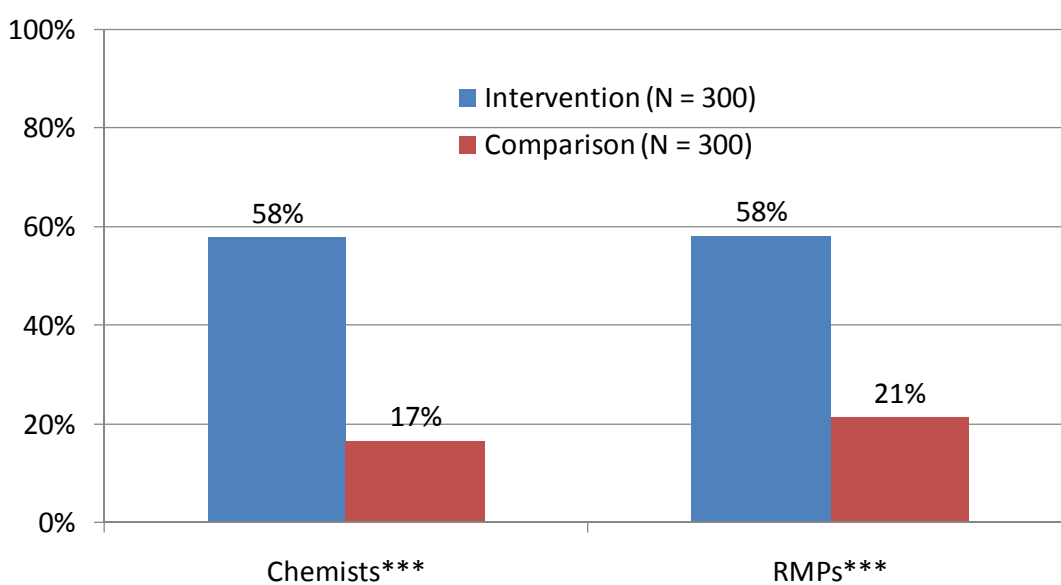
Table 1 - Primary Outcome Indicators

| | Intervention (Barabanki) | Comparison (Raibareli) |
|--|-------------------------------------|-----------------------------------|
| % who state (prompted) that they generally give zinc to children under 5 with diarrhea *** | 78.0% | 27.0% |
| % who stated (spontaneous) they gave ZINC <u>in last case of diarrhea</u> *** | 58.0% | 19.7% |
| % who stated (spontaneous) they gave ORS <u>in last case of diarrhea</u> *** | 89.0% | 96.0% |
| % who stated (spontaneous) they gave ORS with ZINC <u>in last case of diarrhea</u> *** | 55.7% | 19.7% |
| % who stated (spontaneous) they gave antibiotic <u>in last case of diarrhea</u> ** | 70.0% | 79.0% |

| | Intervention (Barabanki) | Comparison (Raibareli) |
|--|-----------------------------|---------------------------|
| % who stated (spontaneous) they gave antimotility drugs in last case of diarrhea** | 36.0% | 42.3% |
| Total number of providers | 300 | 300 |

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

Figure 1 - Comparison of Zinc Prescription Rates (last case) of RMPs and Chemists



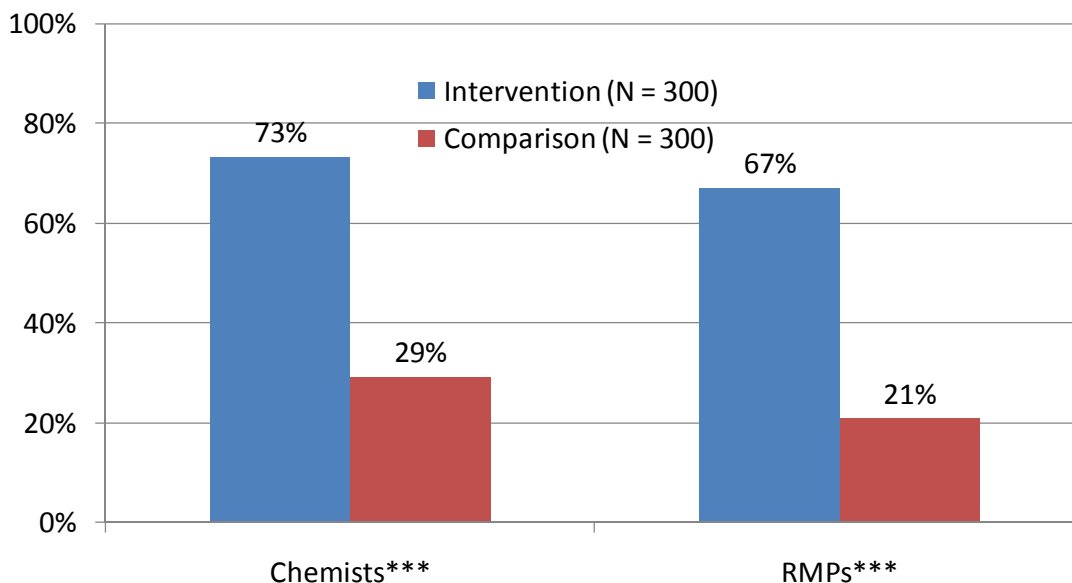
* p < 0.05; ** p < 0.01; *** p < 0.001

Multivariate analyses were performed to further explore the effect of the intervention on prescription behaviors. Both indicators of zinc prescription (prescribing zinc to children with diarrhea in general and prescribing zinc in last case of diarrhea) were significantly associated with the POUZN intervention, even after controlling for provider type (RMP versus chemist), length of service, clinical training, and daily average number of childhood diarrhea cases treated. The odds of an RMP/chemist in the intervention district saying that s/he prescribes zinc in general was 11 times greater than those in the comparison group. The odds of an RMP/chemist in the intervention district saying that s/he prescribed zinc in

the last case of childhood diarrhea treated was 6 times greater than in the comparison district.

Zinc availability was also significantly higher in the intervention district; 69 percent of the RMPs/chemists in the intervention district stock zinc, compared to 23.7 percent of their counterparts in the comparison district (Figure 2).

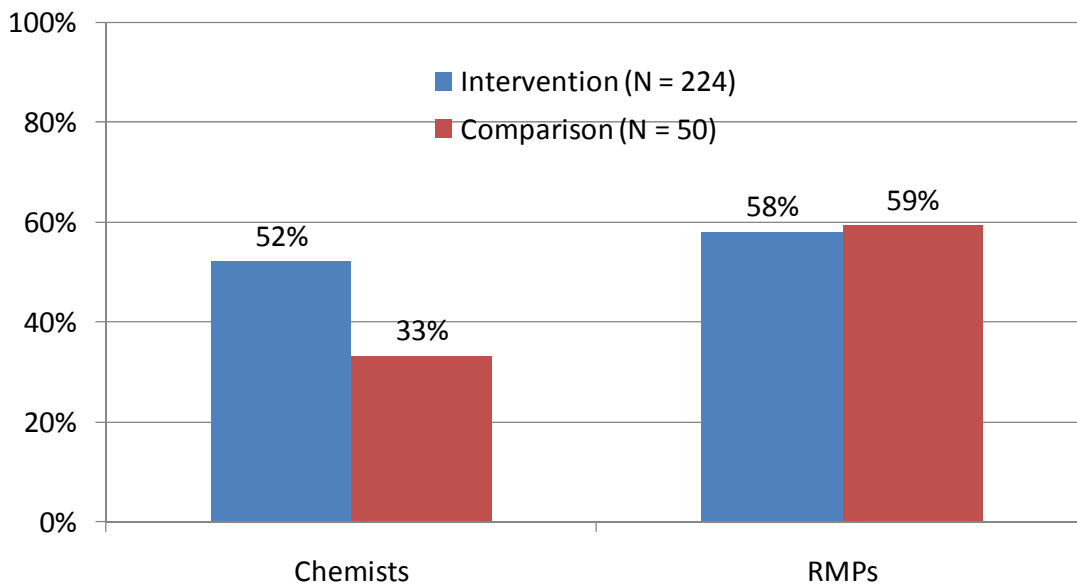
Figure 2 - Comparison of Zinc Stocking by RMPs and Chemists



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

Among those who state that they generally prescribe zinc, the average number of days of prescription was very similar in the two districts (intervention: 9.8 versus comparison: 9.2; $p = 0.44$). A little more than half (56.3%) of RMPs and chemists who prescribe zinc in the intervention district and half (50.0%) in the comparison district prescribe it for 10 days or more; the difference was not statistically significant (Figure 3).

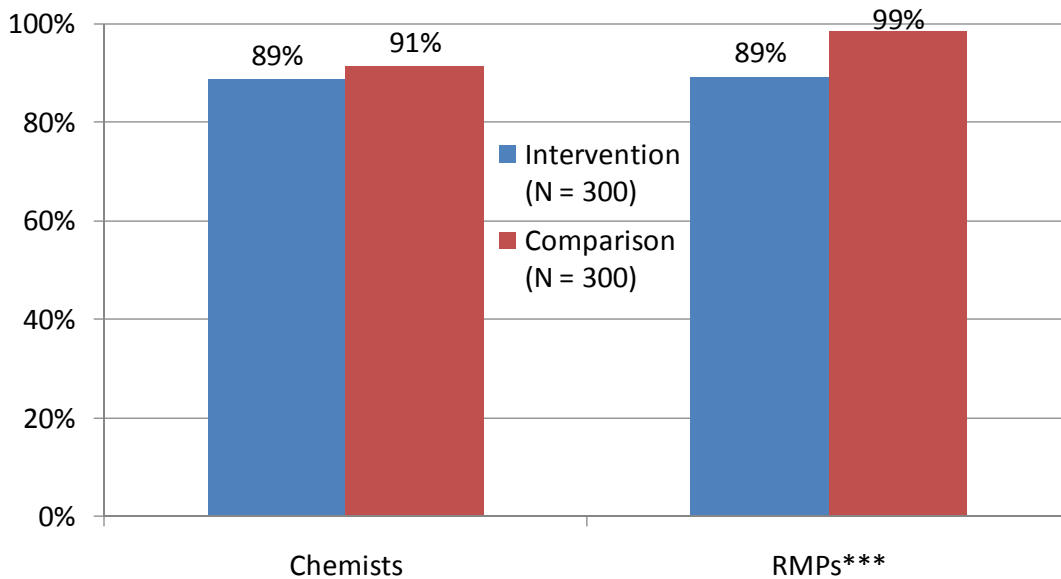
Figure 3 - Comparison of correct prescription (10 or more days) by RMPs and Chemists who generally prescribe zinc



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

ORS prescription rates are high for both the intervention and comparison districts and on the whole, there are no statistically significant differences between intervention and comparison district in ORS prescription or stocking behaviors. In general, 98 percent of RMPs/chemists in the intervention district and 99 percent in the comparison district stated that they give ORS to children sick with diarrhea and 85 percent of intervention district and 88 percent of comparison district RMPs/chemists stocked ORS. Interestingly, a higher proportion of RMPs in the comparison district (98.5%) than in the intervention district (89.2%) stated that they prescribed ORS in the last case of diarrhea in the comparison district (Figure 4).

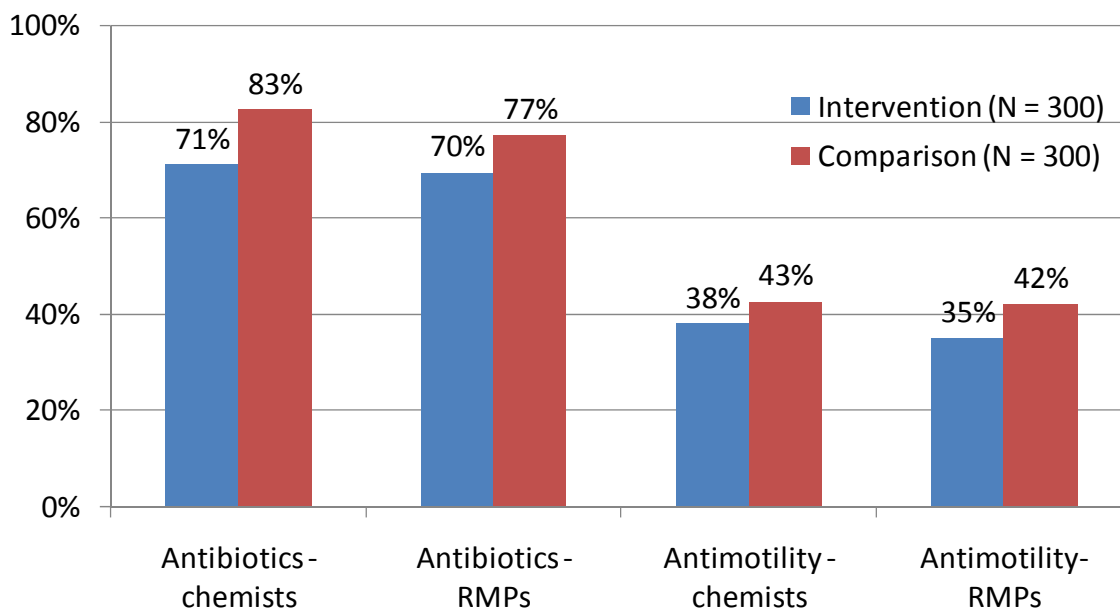
Figure 4 - Comparison of ORS Prescription Rates (last case) of RMPs and Chemists



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

Providers in the intervention district prescribed antibiotics and anti-motility drugs at about the same rates as their counterparts in the comparison district (See Table 1 above). This lack of difference held true during stratified analysis by provider type—there was little difference in prescription rates of antibiotics and anti-motility drugs between the intervention and comparison districts for either chemists or RMPs (Figure 5). We may then infer that RMPs and rural chemists have adopted zinc for the treatment of diarrhea but not at the expense of their prescription of antibiotics and antidiarrheals/ antimotility drugs. They seem to perceive zinc treatment as an adjuvant and not as a substitute for their established behavior of prescribing antibiotics.

Figure 5 - Comparison of Antibiotic and Anti-motility Drug Prescription Rates (last case) of RMPs and Chemists



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

Zinc Knowledge

Zinc awareness among RMPs and chemists in Barabanki was significantly higher (85.3%) than RMPs and chemists in Raibareli (29.0%). (Table 2 and Figure 6) This trend held true for knowledge of ORS in combination with zinc as an effective treatment for diarrhea (80.7% in Barabanki and 25.7% in Raibareli). While knowledge of ORS was high across all groups, a higher proportion of chemists in the intervention district were aware of ORS (100%), versus 90.3 percent in the comparison district.

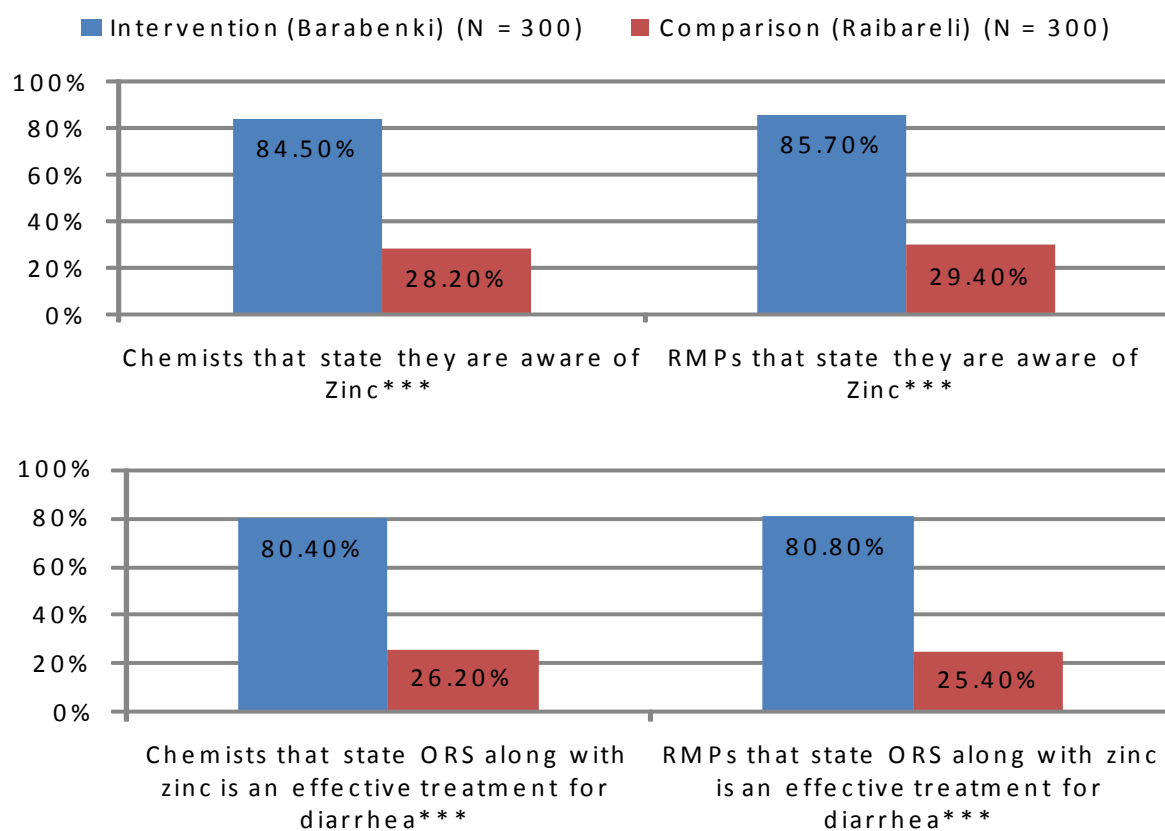
Table 2 - Zinc and ORS Awareness

| | Intervention (Barabanki) | Comparison (Raibareli) |
|---|-----------------------------|---------------------------|
| % of RMPs/chemists that state they are aware of ORS | 96.0% | 94.0% |

| | | |
|---|-------|-------|
| % of RMPs/chemists that state they are aware of zinc*** | 85.3% | 29.0% |
| % of RMPs/chemists that state ORS along with zinc is an effective treatment for diarrhea*** | 80.7% | 25.7% |
| Total number of providers | 300 | 300 |

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

Figure 6 - Comparison of Chemists and RMPs Knowledge



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

We explored the hypothesis that awareness of zinc results in prescription/provision of zinc by providers. There was a significant association of zinc prescription with

knowledge that ORS along with zinc is an effective treatment for diarrhea ($r^2 = 0.679$; $p < 0.001$); those chemists or RMPs who knew of the effectiveness of zinc to treat diarrhea were much more likely to have recommended zinc to the last case of childhood diarrhea they were consulted on.

Exposure to Messages

In determining the effectiveness of NGOs such as PANI and Pratinidhi in informing providers about zinc and zinc usage, RMPs and chemists were asked whether they had heard about zinc and if so, where. Of those who answered that they had heard about zinc, a majority (60%) of RMPs and chemists identified the POUZN intervention (i.e., Naya Daur field staff, NGOs, and PANI staff) as the main source of zinc information, compared to 4.6% for the comparison district. Because these NGOs work in many districts throughout Uttar Pradesh and continue to deliver information on clean water, ORS and zinc, we view the response that 4.6% of the comparison group had also heard about zinc perhaps due to leakage. This was the only information source that was found to have significant differences between intervention and comparison districts. (See Table 3)

Table 3 - Sources of Zinc Information (spontaneous, multiple-response)

| | Intervention (Barabanki) | Comparison (Raibareli) |
|----------------------------------|-------------------------------------|-----------------------------------|
| Mass media (radio/ TV/ paper) | 45.4% | 49.4% |
| Hoardings/ posters | 29.3% | 32.2% |
| Past experience | 25.4% | 25.3% |
| Doctors (private/ government) | 32.0% | 31.0% |
| ANM (auxiliary nurse or midwife) | 4.3% | 2.3% |
| Anganwadi worker | 3.9% | .0% |
| ASHA worker | 3.5% | 2.3% |

² Pearson's Correlation Coefficient

| | Intervention (Barabanki) | Comparison (Raibareli) |
|-----------------------------------|-------------------------------------|-----------------------------------|
| Friends/ relatives | 3.9% | 5.7% |
| Naya Daur / PANI / NGO *** | 60.2% | 4.6% |
| Medical rep | 32.8% | 33.3% |
| Other doctor | 13.3% | 19.5% |
| Books/ journals | 18.8% | 23.0% |
| Total number of providers | 256 | 87 |

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

We explored the association of various sources of zinc information (prompted and unprompted) with zinc prescription by providers and found very minimal correlations. The only sources that were significantly associated with zinc prescription were books/journals ($r = 0.211$; $p < 0.001$), mass media ($r = 0.172$; $p = 0.001$) and posters ($r = 0.132$; $p = 0.015$).

B. CAREGIVER KNOWLEDGE AND BEHAVIORS

The evaluation of the pilot project to create demand among caregivers should be viewed in the context of its limitations. Members of self-help groups (all of those surveyed) are not a typical cross-section of women in their communities, but rather more progressive and empowered, and their behaviors may not be predictive of those of other rural women. In addition, due to lack of a control group, the changes seen from baseline to end-line may not be attributable to the intervention. Others factors may also have affected the reliability of these data, including the fact that survey instruments had to be adjusted somewhat to help care givers identify drugs better. Therefore, while instructive, the results may not be generalizable.

Caregiver Use of Zinc

A comparison of baseline and end-line survey responses of caregivers reveals several important outcomes. First, the proportion of children who were sick with diarrhea in the last two weeks and received zinc treatment increased from 0 percent to 50 percent

between baseline and end-line surveys, while the proportion of those who received zinc and ORS increased from 0 percent to 31.3 percent, both highly significant results (Table 4). The increase in the proportion of children who received only ORS from baseline to end-line was not significant. Caregivers reported the most frequently used zinc brands are the ones locally marketed by PANI (75%), Gallop (12.5%), and Utopia (6.3%)

Table 4 - Diarrhea Treatment Using Zinc among Children under 5 Sick with Diarrhea in Last 2 Weeks

| Among children with diarrhea | Baseline | End-line |
|--|----------|----------|
| Treated with zinc *** | 0% | 50.0% |
| Treated with zinc plus ORS*** | 0% | 31.3% |
| Treated with ORS alone | 26.0% | 37.5% |
| Total number of children with diarrhea in last two weeks | 50 | 32 |

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

Caregiver Knowledge and Practice

Caregiver knowledge of zinc and ORS usage increased significantly between the baseline and end-line surveys as displayed in Table 5. When asked for appropriate treatments for diarrhea in spontaneous responses, the proportion of caregivers of children under 5 who mentioned "zinc" increased significantly (from 0% to 56.3%). Similar increases occurred for ORS as an appropriate treatment for diarrhea (from 15% to 56.3 %).

Table 5 - Knowledge that Zinc is Appropriate Treatment for Diarrhea

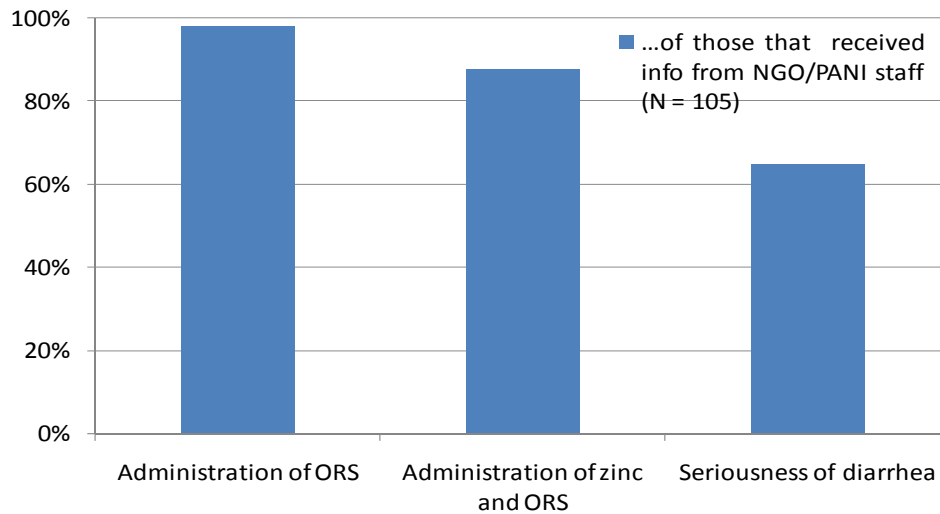
| | Baseline | End-line |
|--|-----------------|-----------------|
| Knowledge that zinc is appropriate treatment for diarrhea (spontaneous) ^{***} | 0% | 56.3% |
| Knowledge that ORS is appropriate treatment for diarrhea (spontaneous) ^{***} | 15.0% | 56.3% |
| Total number of caregivers | 120 | 128 |

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

We explored the association of the knowledge variables with the key indicators of use and found that those caregivers who considered zinc to be an appropriate treatment for diarrhea were likely to think that ORS was also an appropriate treatment for diarrhea ($r = 0.312^{**}$; $p < 0.001$). They were also likely to give zinc to their child ($r = 0.216$; $p < 0.001$). Similarly, those caregivers who gave zinc to their child were also likely to give ORS to their child ($r = 0.297$; $p < 0.001$). It should be noted that these correlations are not indicative of cause and effect.

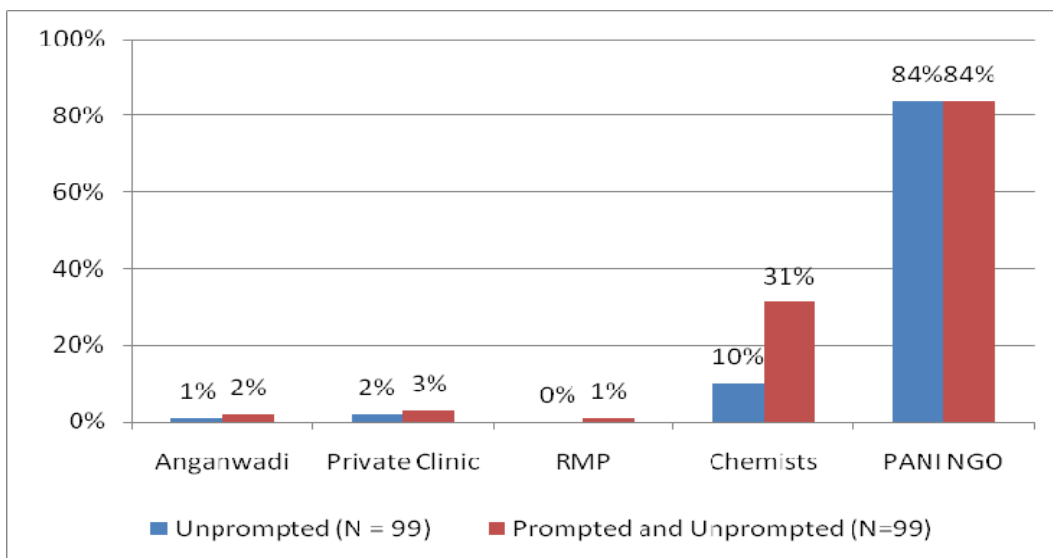
End-line data indicated that intervention Naya Daur/PANI staff were overwhelmingly the source of zinc knowledge (94.9% in spontaneous and 99% in prompted questions). Naya Daur/PANI staff provided knowledge to caregivers about the seriousness of diarrhea and the administration of ORS and zinc (See Figure 7).

Figure 7 - Information Given by NGO/PANI Staff (end-line caregivers' survey)



In addition, when asked in multiple-response spontaneous and prompted questions about where one might acquire zinc, the highest proportion of caregivers responded that the PANI NGO would be the source of purchase (see Figure 8). In this case we see that PANI has substituted for the role of the chemist. Can this new alternative supply route be scalable?

Figure 8 - Where do you think you can get zinc from? (end-line caregivers' survey)



Given that location could be a variable that impacts consumer decisions, the end-line survey also asked where the nearest source of zinc may be. Responses again favored the Naya Daur/PANI NGO with 90.9 percent responding that Naya Daur/PANI was the most accessible source followed far by 5.1 percent who responded that chemists were closest. On average, caregivers speculated they must travel 4 kilometers to acquire zinc (with a range of 0 to 22 kilometers being reported).

C. CONCLUSIONS AND IMPLICATIONS

In general, this evaluation documents that key project goals were met in terms of prescription rates, use rates, and increased awareness.

- The project created awareness of the importance of zinc treatment not only through the pyramid of influence approach that targeted the medical community generally, but also among informal providers (RMPs/chemists) in communities in UP.
- The awareness of zinc treatment was matched by significant differences in zinc prescription rates among RMPs/chemists.
- There are still challenges in decreasing the extent to which antibiotics and antidiarrheal medicines are used to treat diarrhea. Consistent behavior change communication and modification may be helpful in reducing the high antibiotic prescription rates.
- The Naya Daur approach that utilized local NGOs to penetrate communities and work closely with the providers of diarrhea treatment, as well as with caregivers self-help groups, created important results in those communities.
- The role of the NGO evolved from a promoter only to a more complete source of information and of product supplier for diarrhea treatment (and prevention). The project extended the supply chain of the product, establishing with the partnering NGO the last mile to reach the rural provider and caregiver.

- The project achieved significant increase (50%) in use of zinc among the surveyed caregivers who had a child sick with diarrhea in the previous two weeks. However, can this high use rate achieved in a pilot within three months of intervention be scaled up? It did require resources dedicated to this effort and a strategic decision on behalf of the NGO to market and distribute a basket of products including zinc and ORS. The project believes that the correct treatment behavior can be maintained in the intervention area now that PANI is committed to social market a range of products in the rural area. However, the question remains as to the scalability of this direct-to-caregivers approach

Behavior change at the ultimate level of the pyramid (low-income caregivers) are likely to be sustained because all intermediate steps in the cascade (the pyramid of influence) have been affected with the correct behavior change. Now that a majority of formal and informal providers and rural drug sellers provide the correct treatment of diarrhea, it is likely that a direct contact with caregivers will be credible and adopted, knowing that this information is supported by the people they trust for the care of their children.

Project achievements are beginning to spawn additional results. The National Rural Health Mission is keen to include zinc treatment in its dissemination through the Accredited Social Health Activists (ASHA). UNICEF is beginning work on zinc awareness as well. Thus, in terms of scalability, we know that manufacturers continue to produce and promote zinc products to formal providers nationwide. Partner NGOs, are continuing to promote zinc usage to RMPs and additional social marketing efforts are underway. Given the sustained interest, and based on the data, it may be reasonable to assume that similar activities would lead to similar scalable results.