



PROMOTING ZINC AND ORT FOR THE MANAGEMENT OF CHILDHOOD DIARRHEA IN TANZANIA:

A RESEARCH BRIEF

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EXECUTIVE SUMMARY

The World Health Organization (WHO) estimates that globally up to 2 million children under the age of 5 die each year from diarrhea. In Tanzania, diarrhea is estimated to account for around 5 percent of deaths among children under the age of 5. Until recently, the majority of Tanzanians went to informal, uncertified drug stores, or *duka la dawas*, for their treatment and prescription needs for all ailments, including diarrhea.

The POUZN project in Tanzania was first initiated in 2005. During the first four years of the project, actions were focused on creating an enabling national environment for the introduction of zinc therapy, establishing private-public partnership, and gaining the support of health providers, including accredited drug dispensing outlets (ADDOs), the newly certified drug sellers. Starting in 2009, actions focused on the creation of consumer demand for zinc treatment through a multi-pronged strategy that included interpersonal and mass media communication.

POUZN changed a broad range of provider behaviors. Research showed that prescription rates improved significantly from 2007 to 2010 among pharmacies (0% to 34%) and drug shops (0% to 27%). In 2010, 33 percent of all certified ADDOs targeted by the POUZN project recommended zinc for the treatment of diarrhea for a child under 5 years of age; in comparison, 21 percent of *duka la dawas* that received a less intensive intervention prescribed zinc. ORS prescription rates in ADDOs (62%) were significantly higher than both *duka la dawas* (40%) and licensed pharmacies (46%). While among all providers, antibiotics are still the first line treatment, followed by ORS and then zinc, overall antibiotic prescription by ADDOs (77%) is significantly less than *duka la dawas* (93%)

Knowledge of zinc and zinc use among caregivers is still low and did not increase significantly from 2009 to 2010. In 2010, zinc use among children who had been sick with diarrhea in the last two weeks was 9 percent, and 12 percent of caregivers knew zinc was an

appropriate treatment for childhood diarrhea. The main source of zinc information (76%) was interpersonal communication by health workers, reflecting POUZN's strategy of focusing first on health professionals.

Based on the findings above, the following implications for practice are presented to help improve the program for the future:

- A critical strategy is to create demand among caregivers through both interpersonal and mass media channels.
- Since the intervention among providers increased prescription rates of both ORS and zinc, it is suggested that the intervention should continue its work with drug sellers and public sector providers, strategically expanding its reach.
- To supplant antibiotics as the drug of choice among all providers for children with diarrhea, the program should continue targeting providers to educate them until zinc, in conjunction with ORS, becomes the accepted first line of treatment.
- The program should continue to work with private partners to address issues of supply and demand to ensure a sustainable market. However, the program should intensify the work with the public sector where large proportions of Tanzanians seek care.

I. INTRODUCTION

The World Health Organization (WHO) estimates that up to 2 million children under the age of 5 die each year from diarrhea. In 2004, WHO and UNICEF issued a joint statement that low-osmolarity oral rehydration salts (lo-ORS) and zinc taken together is an effective approach to managing childhood diarrhea. Clinical trials have shown that ORS and zinc reduce the severity and duration of diarrhea when zinc supplements are taken for 10 to 14 days.¹

To this end, the Point-Of-Use Water Disinfection and Zinc Treatment (POUZN) project, a USAID Private Sector Partnerships for Healths (PSP) initiative co-managed by AED, supports the introduction of zinc treatment in conjunction with oral rehydration therapy (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.

In Tanzania, POUZN has effectively engaged various stakeholders, including the government of Tanzania, the private sector, the non-governmental (NGO) sector, and donors. Private sector partners were quickly found to create supply, supported both by retailers and the public sector's continued procurement, and to develop demand for the product among health providers and drug retailers. The public health sector, a critical player in Tanzania, has revised its integrated

¹ Harvey, P. (2005): "Cost-effectiveness of zinc supplementation as an adjunct treatment for childhood diarrhea." Submitted to USAID. The USAID Micronutrient Program (MOST): Arlington, VA. Retrieved from:

http://www.mostproject.org/ZINC/Zinc_Updates_Apr05/costeffectivenesszinc.pdf

management of childhood illness (IMCI) guidelines and is now stocking zinc treatment for health posts across the country. NGOs acted as community-based organizations influencing local adoption, and more importantly, as partners on the Tanzanian Zinc Task Force. Donors', including USAID, have been important in lobbying for zinc adoption.

This evaluation briefing reports on studies conducted to assess the impact of the POUZN intervention in Tanzania. It examines whether or not providers and caregivers are using zinc for the treatment of diarrhea.

II. PROGRAM CONTEXT

In Tanzania, diarrhea is estimated to account for around 5 percent of child deaths. While the overall health situation has improved for Tanzanian children in the last two decades, the mortality rate due to diarrhea has remained constant. According to the most recent Tanzania Demographic and Health Survey (DHS), about 13 percent of children experienced diarrhea in the two weeks prior to being surveyed. This shows no change in more than a decade.

Approximately 60 percent of mothers whose child suffered a recent bout of diarrhea said they sought care, according to the most recent DHS. A majority of those who sought care did so at a public facility (39 %), followed by pharmacies (13%), and private/religious facilities (7%). Careseeking patterns did not vary much by household wealth, mother's education, or between urban and rural families. Until very recently, the majority of Tanzanians sought health care at informal, uncertified drug stores called *duka la dawas*. While there are approximately 375 licensed pharmacies in all of Tanzania (mostly concentrated in urban areas), there are nearly 6,000 *duka la dawas*. Because of this, Tanzania's large rural population relies heavily on *duka*

la dawas. Lack of oversight resulted in low quality and counterfeit drugs, which have been recognized as a problem not only in Tanzania, but across the continent.

Until recently, *duka la dawas* were tolerated by the Tanzanian government as long as they sold a restricted list of drugs. However, several years ago, with the support of the World Bank and the Gates Foundation, the Tanzanian government began implementing a training and accreditation program for *duka la dawas*, which became accredited drug dispensing outlets (ADDOs) after their certification. In 2007, the government of Tanzania, in collaboration with USAID through Management Sciences for Health (MSH), decided to scale up the accreditation program by systematically working with each district in Tanzania. *Duka la dawas* that were willing to be trained would be accredited and those that were not are to be closed down by the end of 2010. As of 2009, there were 1,300 ADDOs and it is estimated that there are now 3,000 ADDOs.²

III. PROGRAM GOALS

The goal of POUZN in Tanzania was to introduce zinc along with low-osmolarity ORS nationwide as the new approved treatment for childhood diarrhea. The project aimed to work simultaneously with both the public and private commercial sectors, building on their respective strengths, facilitating communication, and creating synergies among their different processes. This dual focus was essential given the care seeking patterns of Tanzania's most vulnerable groups as well as the complex interdependence of roles between the public and private sectors in introducing and sustaining use of this new treatment. The following sections describe the program implementation activities to achieve these goals as well as the results of these activities.

² Communication with TFDA, Aug 2010

IV. PROGRAM IMPLEMENTATION

The POUZN project in Tanzania was initiated in 2005 when POUZN joined and supported a Zinc Task Force formed by representatives from the government, WHO, UNICEF, and international NGOs to advocate for adoption of new diarrhea treatment guidelines. During the first four years of the project, actions were focused on creating an enabling national environment for the use of zinc therapy. These included creating adequate supply of the product by providing support to local manufacturers, promoting policy changes such as the designation of zinc therapy as an over-the-counter medicine, incorporating zinc into national protocols and programs for the treatment of diarrheal disease, promoting the product among retailers, and promoting the adoption of zinc treatments by public providers and facilities, among others. POUZN partnered with the ADDO program to add a diarrhea module to the training given to the *duka la dawas*. In parallel, POUZN focused on creating caregiver demand for zinc treatment through a strategy that included radio advertisements and shows, and one-on-one counseling with health care workers.

The following highlights key events of the POUZN program implementation timeline:

Creating Enabling Environment

- In October 2005, POUZN joined and supported a Zinc Task Force.
- In November of 2007, the government of Tanzania adopted a revised list of essential medicines (including zinc and lo-ORS).
- In July 2009, the government granted over-the-counter status to zinc after extensive consultations with experts on its safety.

Creating Supply – Private and Public Sectors

- On March, 2007, Shelys Pharmaceutical Company signed an MOU with POUZN agreeing to engage its medical representatives (med reps) to reach health professionals, and to “co-promote” zinc with ORS.

- In April 2007, Shelys produced the first African-manufactured zinc treatment for diarrhea: dispersible tablets branded as PedZinc. POUZN carried out refresher training for all of Shelys medical representatives.
- In April 2009, the first government supplies of zinc reached regional warehouses facilitated by POUZN's request to UNICEF to fund an initial six-month supply.

Stimulating Demand – Public Sector Providers

- Between April 2007 and September 2010, Shelys' medical reps repeatedly visited hospitals, maternal-child health (MCH) centers and other health facilities and carried out seminars in several regions across the country .
- Between September 2008 and 2010, POUZN provided trainings on the new diarrhea module to the government bodies responsible for drug budgets at local health facilities (Counsel Health Management Teams—CHMTs) and for health workers in 16 regions: Morogoro, Mwanza, Mbeya, Ruvuma, Mtwara, Lindi, Rukwa, Shinyanga, Tanga, Dodoma, Iringa, Pwani, Kigoma, Kagera, Mara, and Singida.

Stimulating Demand – Private Sector Providers

- In May 2007, a baseline mystery client survey was conducted to assess current prescription patterns among pharmacies and *duka la dawas* in Dar es Salaam and Mwanza.
- Between 2007 and 2010, Shelys detailers visited drug outlets on a monthly basis across the country to ensure that they have received information on lo-ORS and zinc treatment and are aware of which wholesalers could re-supply them with zinc and lo-ORS.
- Between September 2008 and September of 2010, POUZN collaborated with the Tanzanian Food and Drug Administration (TFDA) and MSH to introduce new diarrhea treatment management guidelines into the training of ADDOs. Two thousand four hundred thirty-three ADDOs in the regions of Morogoro, Mbeya, Lindi, Mtwara, Pwani, Rukwa, Ruvuma, and Singida were reached by September 2010.

- In June and July 2009, POUZN collaborated with the Pharmacy Council of Tanzania to provide updated guidelines to pharmacies in five major cities: Dar es Salaam, Mwanza, Mbeya, Tanga, and Arusha. A total of 375 pharmacies were targeted.
- In May 2010, an end-line mystery client survey was conducted in the regions of Dar es Salaam, Mwanza, Morogoro and Mbeya.

Stimulating Demand – Changing Caregiver Attitude and Behaviors

- In April 2009, the project conducted a baseline study of caregiver attitudes and practices in three regions (Dar es Salaam, Mwanza and Morogoro).
- In July 2009, POUZN created generic radio advertisements and four jingles for both zinc and ORS and started broadcast on five major national radio stations (TBC 1, Radio One, Clouds FM, Zenji FM, and Radio Free Africa). The T-MARC project, in collaboration with POUZN, developed storylines mentioning improved diarrhea management for its popular Mama Ushauri radio soap opera, which reaches 1.1 million listeners nationwide. POUZN also participated in a Q&A radio session to improve consumer understanding. These were aired four times weekly on Radio One, Radio Free Africa, Radio Tanzania, and Zenj FM achieving nationwide coverage with similar intensities across the regions.
- Between July and September of 2009, T-MARC, using informational materials from POUZN, had reached about 40,000 people through market day “activations”³ in four regions (Tabora, Singida, Shinyanga, and Mara).
- In March 2009, POUZN contracted with five NGOs in both urban and rural areas to train village health workers (VHWs) and promote zinc through performances. POUZN funded activities (including road shows) in 80 villages reached 12,000 households in five districts in Morogoro Region.
- In April 2010, a follow-up evaluation of caregivers was conducted in Dar es Salaam, Mwanza, and Morogoro.

³ At market activations, music and skits attract visitors to counseling tents where a promoter supplies information about health products and their benefits.

V. EVALUATION RESULTS

This report is based on findings from two evaluation activities conducted for this project:

- Provider survey: A non-equivalent group pretest-post test survey of ADDOs (intervention group) and *duka la dawas*, or drugstores (comparison group) conducted in regions of Morogoro, Mbeya, Dar es Salaam, and Mwanza.⁴ While all *duka la dawas* were targeted by the POUZN project mainly through Shelys medical reps, ADDOs received more intensive intervention with the goal of affecting more significant change. Licensed pharmacies were included in the study for comparison purposes both over time as well as to ADDOs and *duka la dawas*. The mystery client survey employed female interviewers, posing as mothers of children less than 5 years of age, who visited pharmacies/drug stores to ask for a treatment recommendation for a child who had been suffering from watery diarrhea for the last two days. This mystery client approach is especially useful as it gives a more accurate representation of actual prescription behaviors, especially when compared to individual interviews.
- Caregivers survey: This study employed a cross-sectional design looking at trends over time at the regional level, in which information was collected from random samples of caregivers of children 5 years old or under at two different points in time: in April 2009 (before the caregiver component of the intervention began), and one year later, in May 2010.

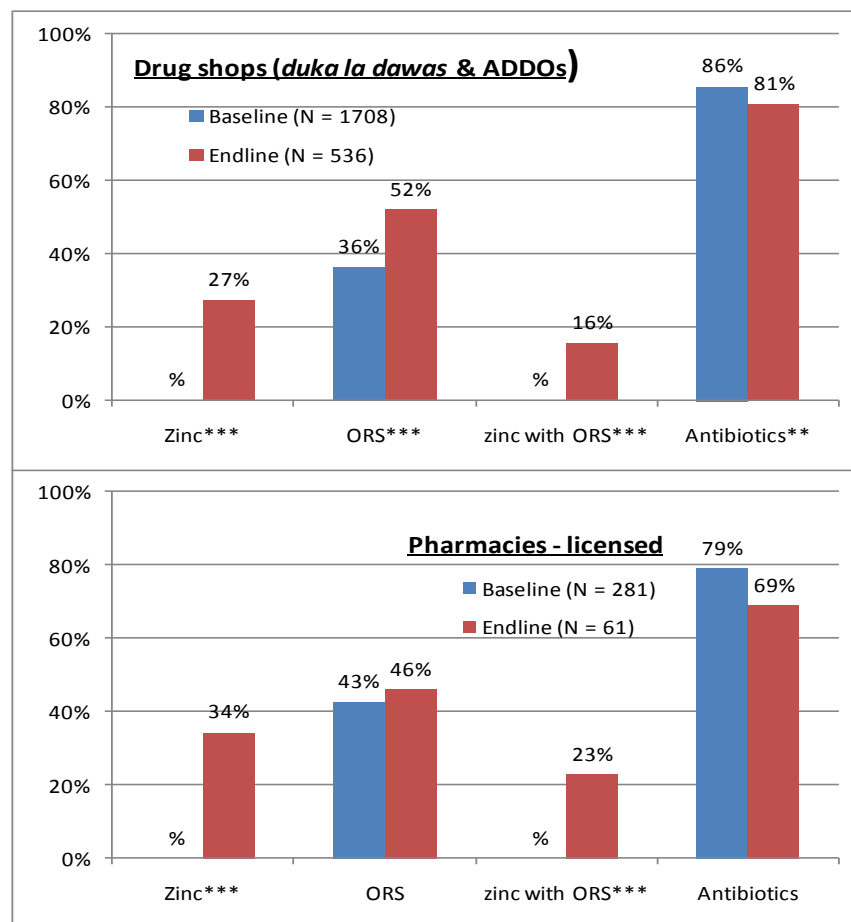
⁴ Due to the nature of the roll-out of the ADDO intervention, which targets complete coverage in each region, in 2010 among the surveyed regions, *duka la dawas* were found only in Dar es Salaam and Mwanza, and ADDOs were found only in Morogoro, Mbeya. Baseline survey was conducted among *duka la dawas* in Dar es Salaam and Mwanza.

The following are key and relevant findings from the two studies:

A. IMPROVING PROVIDER KNOWLEDGE AND PRACTICE OF ZINC TREATMENT

The POUZN intervention among drug sellers and pharmacies has improved zinc prescription rates (Figure 1). Both zinc and zinc with ORS prescription rates had significantly improved among pharmacies as well as drug shops. In addition, while ORS prescriptions rates remained the same among pharmacies (a desirable goal), it improved among drug shops.

FIGURE 1: PRESCRIPTION PATTERN CHANGE OVER TIME⁵



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

⁵ Drug shops (*duka la dawas* and ADDOs) were combined for this analysis to present the overall effect of the program since both received a more or less intensive intervention. Subsequent analysis stratifies ADDOs /*duka la dawas*.

Another interesting question was whether or not the more intensive intervention among ADDOs did indeed result in higher prescription rates. Table 1 below shows zinc prescription rates by drug sellers in 2010. While 33 percent of all certified ADDOs recommended zinc for the treatment of diarrhea for a child under 5 years of age, only 21 percent of uncertified *duka la dawas* prescribed zinc; this difference in recommendation rates was statistically significant. The zinc recommendation rate of ADDOs was very similar to that of licensed pharmacies (34%).

TABLE 1: ZINC AND ORS PRESCRIPTION PATTERNS AT END-LINE

	Licensed Pharmacies	<i>Duka la Dawa</i> (Comparison)	ADDOs (Intervention)
% who recommended zinc for diarrhea	34.4%	21.0%**	32.6%
% who recommended ORS for diarrhea	45.9%*	39.5%***	61.7%
% who recommended zinc along with ORS for diarrhea as first line treatment	23%	10.5%**	19.8%
Total number of providers	61	238	298

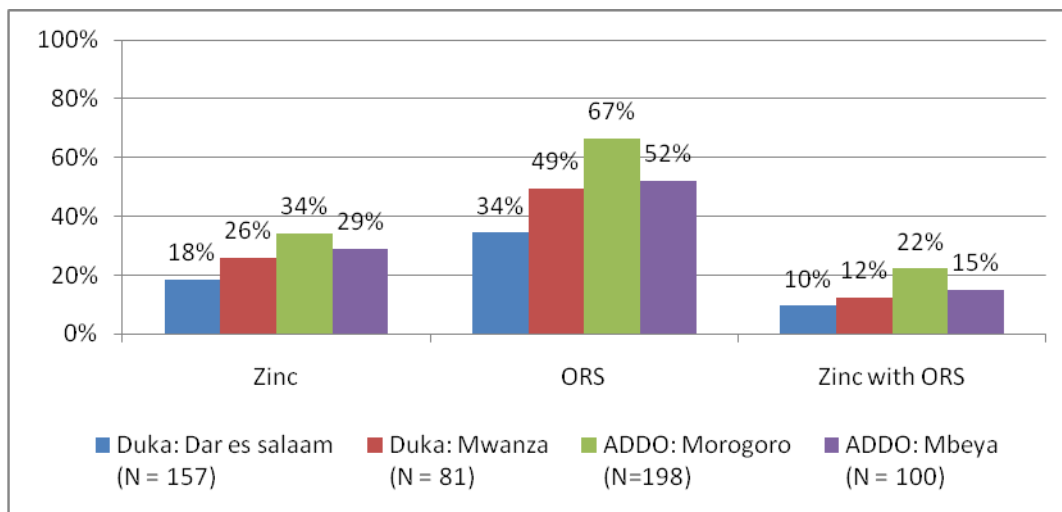
Comparing to ADDOs: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

A multivariate analysis of zinc prescription rates among providers surveyed in the mystery client survey confirms the finding that zinc prescription rates are indeed higher among ADDOs that received the intensive intervention, compared to *duka la dawas*. After controlling for region, location (urban/rural), and gender of the drug seller, the odds that an ADDO provider would recommend zinc was 2.1 times that of a *duka la dawa*. There were no significant differences in prescription rates of zinc by region, location, or gender.

The higher prescription rate of zinc among ADDOs does not happen at the expense of ORS. ORS prescription rate in 2010 by ADDOs (62%) was significantly higher than both *duka la dawas* (40%) and licensed pharmacies (46%). In addition, 20 percent of ADDOs prescribed zinc along with ORS, compared to 11 percent of *duka la dawas*. While zinc with ORS prescription rates were higher among pharmacies (23%), this difference was not statistically significant. ORS prescription rates among those who prescribed zinc was comparable between *duka la dawas* (50%) and ADDOs (61%).

While there were some regional differences in zinc prescription rates, these differences were not statistically significant either among ADDOs (34.3% in Morogoro versus 29.0% in Mbeya) or *duka la dawas* (18.5% in Dar es Salaam versus 25.9% in Mwanza) (Figure 2). The only significant difference in ADDO prescription rates between the regions was with ORS; ADDOs from Morogoro prescribed ORS at a significantly higher rate than those in Mbeya (66.7% versus 52.0%), and *duka la dawas* from Mwanza prescribed at a significantly higher rate than those in Dar es Salaam (49.4% versus 34.4%).

FIGURE 2: DRUG SHOPS PRESCRIPTION PATTERNS BY REGION (END-LINE)



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

Another success of the program is that antibiotic prescription among all drug shops decreased from baseline (85.5%) to end-line (80.8%). Furthermore, in 2010 antibiotic prescription by ADDOs is significantly lower than *duka la dawas* and very similar to licensed pharmacies (Table 2). Prescription of anti-motility drugs is minimal among both *duka la dawas* and ADDOs.

TABLE 2: ANTIBIOTIC AND ANTI-DIARRHEAL PRESCRIPTION PATTERNS AT ENDLINE⁶

	Licensed Pharmacies	Duka la Dawa (Comparison)	ADDOs (Intervention)
% who recommended antibiotic for diarrhea	68.9%	87.0%***	75.8%
% who recommended anti-motility for diarrhea	3.3%*	0.4%	0.3%
Total Number of providers	61	238	298

Comparing to ADDOs: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

The most commonly cited first line of treatment for diarrhea by drug sellers (*duka la dawas* and ADDOS) still continue to be antibiotics, followed by ORS, then zinc (Figure 3). However, antibiotic prescription as a first-line treatment has decreased significantly over time for both drug shops and licensed pharmacies (Figure 4); in parallel, ORS prescription among *duka la dawas* increased (8% vs. 13%; $p < 0.01$). It is worth noting that antibiotic prescription rates were significantly lower among ADDOs (which received the more intensive POUZN intervention) compared to *duka la dawas* (56% vs. 73%; $p < 0.001$); there was no statistically significant difference between licensed pharmacies and ADDOs.

⁶ These figures excluded drug sellers who were told that the child had fever or blood in his/her stool.

FIGURE 3: FIRST LINE TREATMENT PATTERN OVER TIME

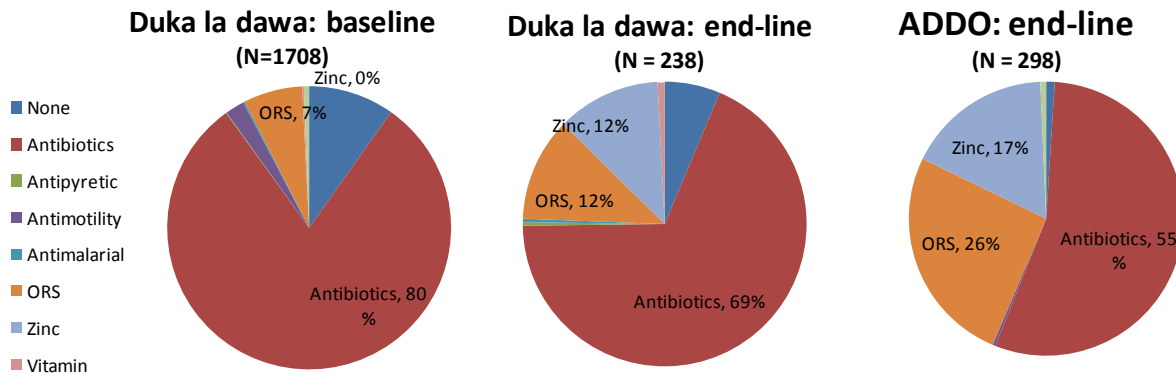
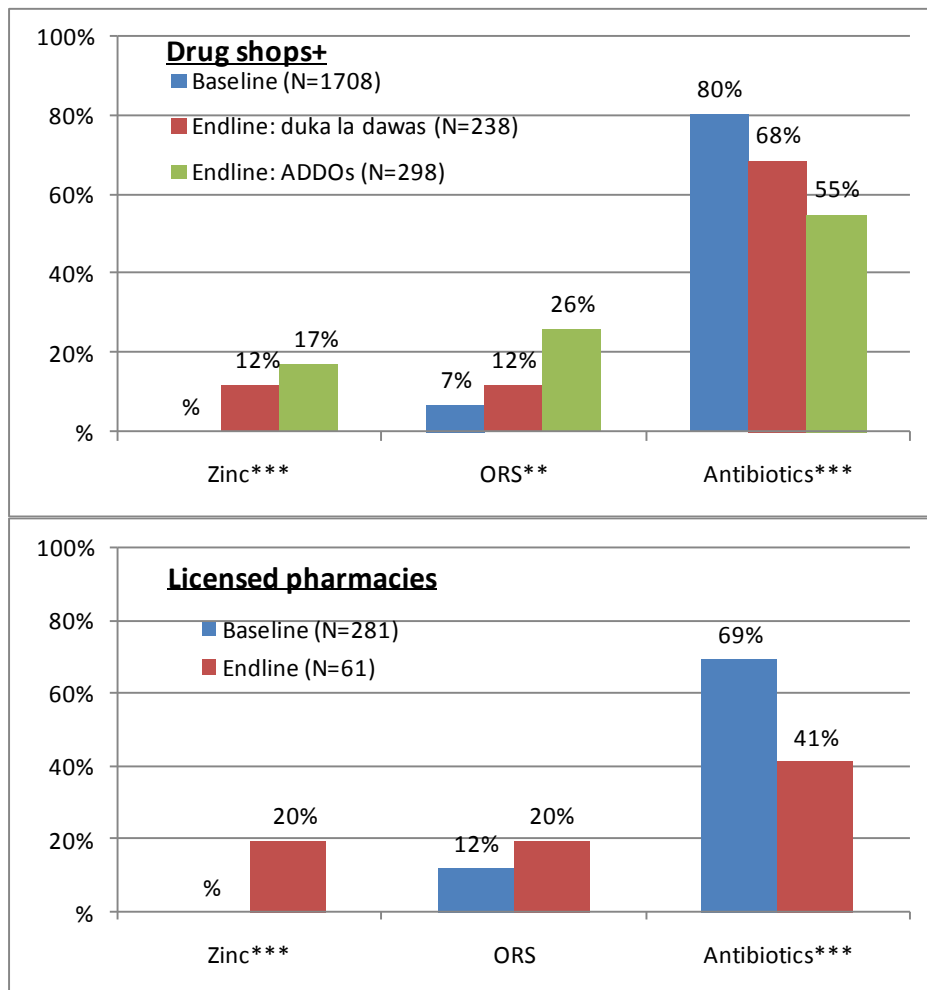


FIGURE 4: FIRST LINE ZINC, ORS AND ANTIBIOTIC PRESCRIPTIONS OVER TIME



* p <= 0.05; ** p <= 0.01; *** p <= 0.001; + comparing only *duka la dawas* baseline to end-line

B. EXPOSURE TO MESSAGES AND CAREGIVER KNOWLEDGE

Caregiver knowledge and exposure to intervention messages are critical factors in determining zinc use rates. Caregivers' exposure rate to zinc messages in the three months preceding the 2010 caregiver survey was 22 percent (Table 3). This rate varied significantly across the three regions, with Mwanza having the highest exposure rate (35%) and Dar es Salaam having the lowest (12%).

TABLE 3. EXPOSURE TO COMMUNICATIONS STRATEGY (2010)

	Total	Morogoro	Mwanza	Dar es Salaam
Care givers who have seen or heard any messages about treatment for diarrhea in the last three months***	50.8%	39.5%	64.8%	42.3%
Care givers who have ever heard any messages about ORS***	73.4%	74.3%	83.0%	61.4%
Care givers who have seen or heard a message about zinc in the last three months*	22.1%	15.1%	34.8%	12.1%
Number of caregivers	620	152	253	215

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

The main source of zinc information is interpersonal communications (IPC) with health workers (Table 4); This is a result of the joint intervention between POUZN and its partners. For example, in the public sector, POUZN organized training sessions with district health teams and Shelys continued to cover these health professionals.. IPC was highest in Mwanza, possibly indicating a more successful effort on the part of Shely's medical representatives in this region. On the other hand, the increased awareness of diarrheal treatments from health providers may have been a result of other external factors; in 2010 Mwanza had the highest rate of diarrhea among all the regions (35% versus Dar es Salaam at 19% and Morogoro at 14%). In fact, even

though overall rates of diarrhea did not change much from 2009 to 2010, Mwanza had a significant increase of 17 percent, compared to Morogoro, which experienced a significant decrease in diarrhea rates (11%).⁷ This may have increased caregivers contacts with their health care providers in the Mwanza region.

TABLE 4. SOURCES OF ZINC MESSAGES (2010)

	Total	Morogoro	Mwanza	Dar es Salaam
Radio*	36.0%	13.0%	42.5%	34.6%
TV ⁸	14.0%	4.3%	13.8%	23.1%
Interpersonal communication with health providers (doctors, nurses, midwives)*	75.9%	60.9%	84.1%	61.5%
Banner	10.3%	4.3%	10.3%	15.4%
Friends or relatives	27.7%	13.0%	28.4%	38.5%
Village health talk	4.41%	11.7%	0	5.76%
Local pharmacist (including <i>duka la dawa</i> or ADDO)	11.8%	17.4%	11.5%	7.7%
Number of caregivers who were exposed to zinc message	136	23	37	26

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

The next most common source of zinc messages was the radio, which included the Mama Ushauri show as well as public service announcements (PSAs) and twice weekly shows by pediatricians in Morogoro. This ranking of sources did not vary by region. The pharmacist or

⁷ Anecdotally, there was a cholera outbreak in Mwanza during this period.

⁸ TV was not used by the POUZN intervention and no other TV zinc messages have been documented in the country; therefore these statistic from the survey cannot be explained.

drug seller was the highest source of zinc information in Morogoro; it is noteworthy that among the regions surveyed, the ADDO intervention was implemented only in Morogoro.

We explored whether one particular source of zinc messaging was associated with higher zinc use. TV, which was not used by the POUZN intervention, and radio were the only sources of zinc information that were associated with zinc use (TV: $r = 0.47$; $p < 0.001$ and radio: $r = 0.32$; $p < 0.001$). Among caregivers with a sick child in the last four weeks⁹, 47 percent of those who had seen a zinc message from TV gave their child zinc compared to 5 percent of those who heard it somewhere else. Among this same group, 25 percent of those who had heard a zinc message from radio gave their child zinc compared to 3 percent of those who heard it somewhere else. These associations are suggestive, but can not be used for drawing any conclusions about cause and effect with regards to the effectiveness of a particular communication channel. In fact, given that we could not find any documented use of TV to promote zinc by anyone, these findings may not be valid.

Finally, we assessed caregivers' knowledge of the uses of zinc. While 87 percent of caregivers stated that they know ORS is an appropriate treatment for diarrhea, only 12 percent said that they know that zinc is also an appropriate treatment (Table 5). Knowledge of zinc as an appropriate treatment for diarrhea was highest in Mwanza (15%) and lowest in Morogoro (5%). It is plausible that the high zinc message exposure rate in Mwanza through interpersonal communications by health providers has contributed to this finding (see Table 4 above).

⁹ Four weeks (instead of the standard two weeks) was used to increase the sample size for this particular analysis.

TABLE 5: AWARENESS AMONG CAREGIVERS OF ORS/ZINC AS A TREATMENT FOR DIARRHEA (2010)

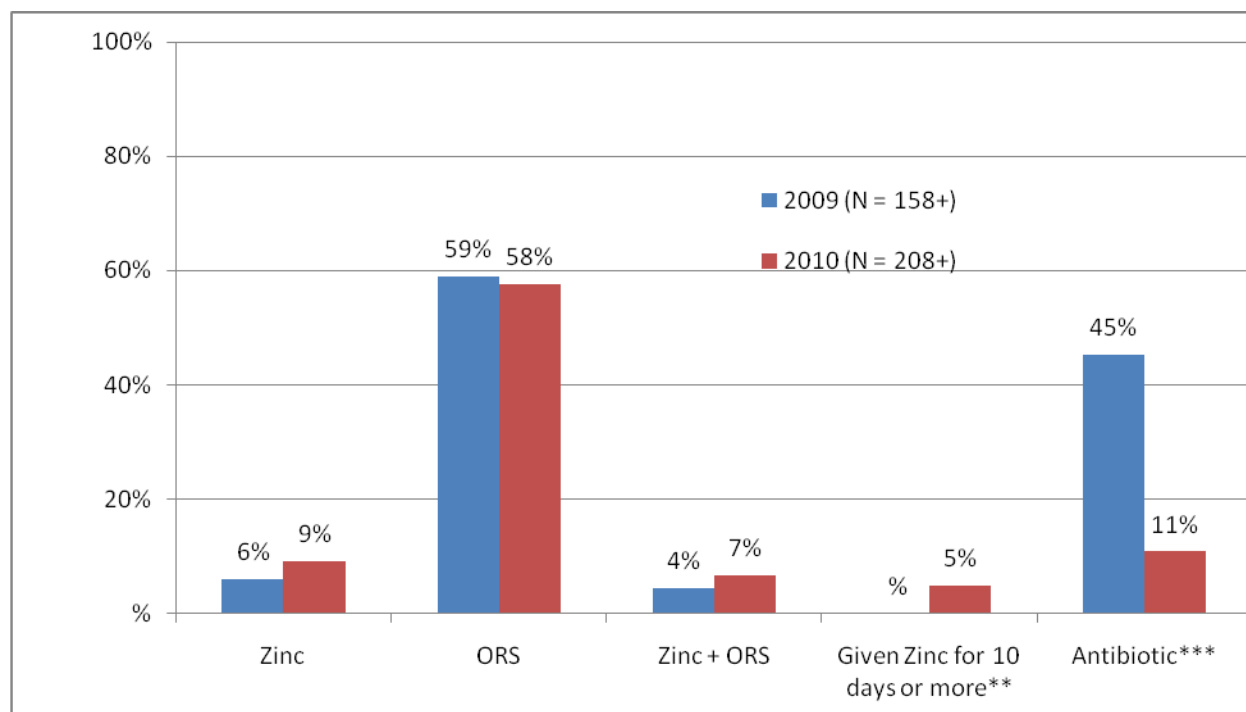
<i>Unprompted</i>	Total	Morogoro	Mwanza	Dar es Salaam
Caregivers who are aware that ORS is an appropriate treatment for diarrhea***	86.8%	78.3%	92.5%	86.1%
Caregivers who are aware that zinc is an appropriate treatment for diarrhea**	11.5%	4.6 %	15.4%	11.6%
Caregivers who know that zinc needs to be administered along with ORS/ORT	0.5%	0%	0.8%	0.5%
Caregivers who know where to obtain zinc***	39.8%	19.1%	36.8%	58.1%
Number of caregivers	620	152	253	215

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

C. USE OF ZINC FOR TREATMENT OF DIARRHEA IN CHILDREN BY CAREGIVERS

The caregivers' survey examined current zinc use rates among children sick with diarrhea and also assessed whether or not there was a positive trend in the rate of zinc use over the last year (Figure 5). In 2010, zinc use among children who had been sick with diarrhea in the last two weeks was 9 percent. While this represented an increase in the zinc use rate from 2009 (6%), this difference was not statistically significant. On the other hand, there was a statistically significant increase in zinc use for 10 days or more; in 2010, 63 percent of children that used zinc were given zinc for 10 days or more. ORS and ORS with zinc use rates remained the same over the last year. In addition, antibiotic use had reduced significantly.

FIGURE 5: DIARRHEA TREATMENT AMONG CHILDREN UNDER FIVE



* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

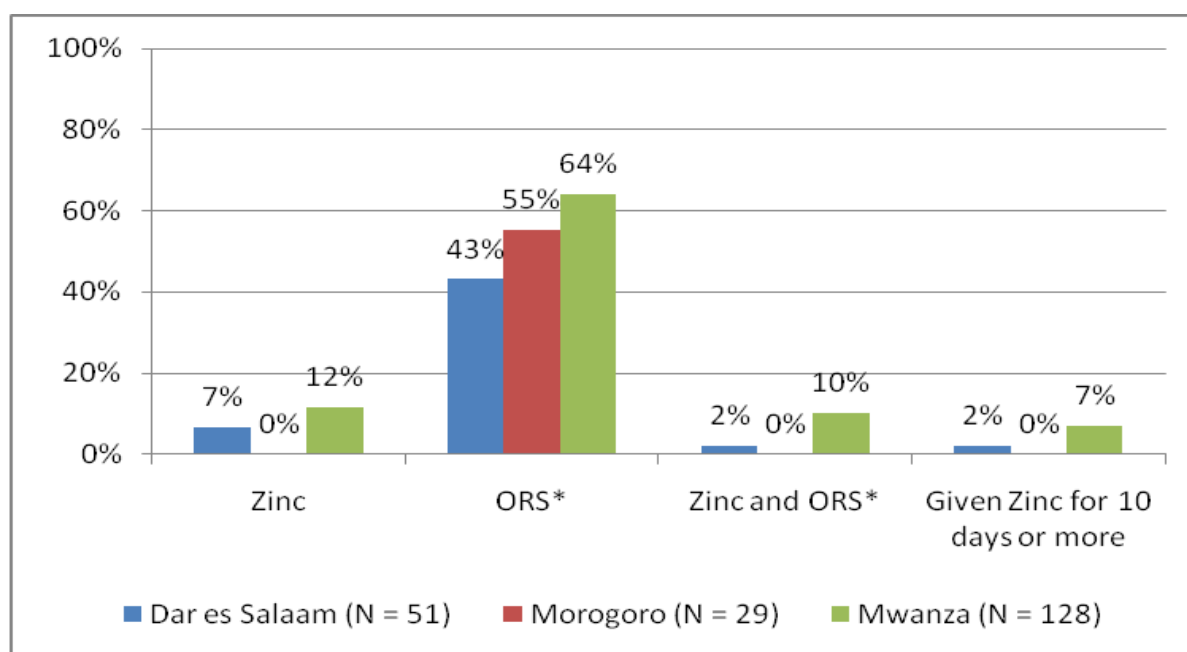
+ Respondents not sure they took zinc were excluded from zinc analysis – N at baseline = 117; N at end-line = 176

We explored the hypothesis that exposure to and awareness of zinc results in zinc use by caregivers. There was a significant association of zinc use with exposure to zinc messages in the last three months ($r = 0.24$; $p < 0.001$)¹⁰; those caregivers who were exposed to a message about zinc were relatively more likely to have administered zinc to a child who was sick with diarrhea. In addition, of those caregivers aware that zinc is an appropriate therapy for diarrhea, 27 percent gave zinc to their child who got sick with diarrhea in the preceding four weeks (compare to the 9% overall zinc use rate).

¹⁰ Pearson's Correlation Coefficient

A comparison of the key indicators by the different regions shows no statistically significant differences in either current zinc use rate or correctly prescribed zinc use (Figure 5). However, ORS use in Mwanza (64%) was significantly higher than in Dar es Salaam (43%); this difference in ORS use rate may be due to the increased awareness rate in Mwanza discussed above.

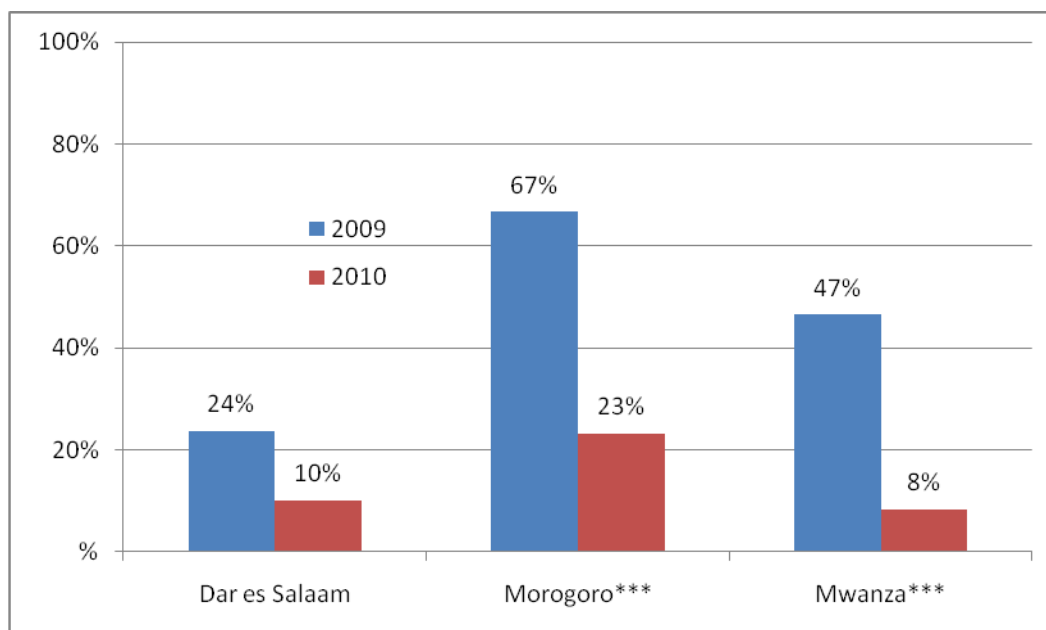
FIGURE 6: ZINC AND ORS USE AMONG CHILDREN SICK WITH DIARRHEA BY REGION (2010)



** p <= 0.05; *** p <= 0.001

While antibiotic use in 2010 in Mwanza (8.3%) was statistically lower than Morogoro (23.1%), both regions experienced reductions in use from 2009 to 2010 (Figure 7). Antibiotic use decreased by 44 percentage points in Morogoro and by 39 percentage points in Mwanza; decrease in antibiotic use in Dar es Salaam (already relatively low) was not statistically significant.

FIGURE 7: ANTIBIOTIC USE AMONG CHILDREN SICK WITH DIARRHEA BY REGION



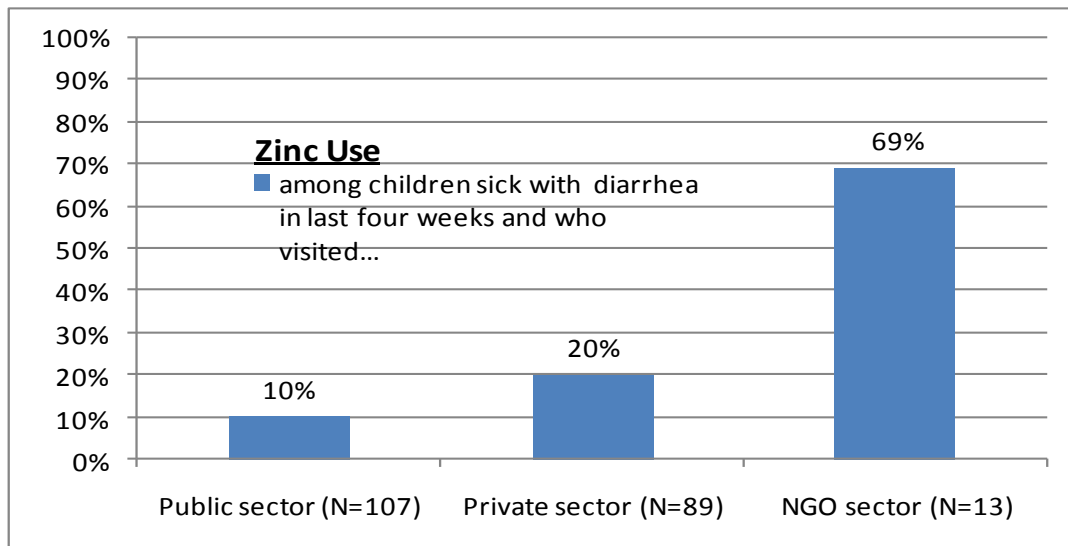
** p <= 0.05; * p <= 0.01; *** p <=0.001

D. SOURCE OF ZINC TREATMENT AND AFFORDABILITY

Source of zinc treatment for children with diarrhea was evaluated. Most of the zinc used for children with diarrhea in the last four weeks¹¹ was obtained from the private sector (68%) rather than the public sector (18%) and the NGO sector (14%). The private and NGO sectors were associated with higher rates of zinc use than the public sector. On the other hand, those who sought care in the private sector used zinc at a significantly higher rate (20%) when compared to those who sought care in the public sector (10%) (Figure 8); while the proportion of caregivers that sought care in the NGO sector was very small, they used zinc at a much higher rate (69%).

¹¹ Four weeks (instead of the standard two weeks) was used to increase the sample size for this particular analysis.

FIGURE 8: ZINC TREATMENT BY SECTOR (2010)



Almost all individuals who obtained zinc from the government obtained it for free. Of those who purchased zinc, 61 percent paid between 500 and 1,000 shillings (TZS) and 28 percent paid below 500 TZS. To assess the perceived affordability of zinc product, caregivers were asked if they had ever purchased zinc; if they had, they were then asked what they thought of the price. Of the 34 caregivers that had purchased zinc, 61 percent of those who had purchased zinc thought it was either not expensive or affordable, while 36 percent thought it was expensive.

E. CONCLUSIONS AND IMPLICATIONS

In this section, we provide key highlights from the findings of this evaluation and implications for practice to help improve the existing intervention, as well as to serve as important input for stronger implementation of similar programs in the future.

- The intervention among providers resulted in increased zinc prescription over time and in higher zinc prescription rates among ADDOs as compared to uncertified *duka la dawas*. In fact, zinc prescription pattern among ADDOS was similar to that of

licensed pharmacists. This suggests that the intervention should continue its work with drug sellers, strategically expanding its reach.

- ORS prescription rates have not suffered as a result of the introduction of zinc. In fact, they are significantly higher among ADDOs when compared to both *duka la dawas* and licensed pharmacies. One of the concerns that the program had was that zinc would supplant ORS as a treatment for diarrhea if the messages conveyed were not sufficiently clear. However, this did not happen, suggesting that no substantive changes need to be made to the message.
- Antibiotics are still the drug of choice among all providers for children with diarrhea. However, antibiotic prescription rates have decreased over time, and ADDOs are prescribing antibiotics as a first line of treatment at a lower rate than *duka la dawas*. Changes in longstanding practices can be difficult to effect; therefore, the program should continue targeting all drug sellers to educate them until zinc, in conjunction with ORS, becomes a universally accepted first line of treatment for childhood diarrhea.
- Zinc use and knowledge among caregivers is still very low suggesting that the program successes with providers have not yet translated to the target group. Moreover, it is very puzzling that Morogoro, which had the most intensive consumer related intervention, had none-the-less the lowest use rate. Therefore, it is recommended that more focused interventions targeting caregivers complement the efforts with the providers.

- The private and NGO sectors were associated with higher caregiver zinc use when compared to the public sector. This suggests that POUZN's strategy of engaging the private sector to increase zinc treatment is effective. However, as a large proportion of Tanzanians seeks care in the public sector, the program should accelerate this sector's adoption of zinc treatment.
- A majority of caregivers who had ever purchased zinc thought that zinc is affordable. The program should continue to work with private partners to increase competition and ensure affordable prices.
- Even though we could not find any documented use of TV to promote zinc by POUZN or other actors in the field, the data suggest that both TV and radio (used by POUZN) may have increased the reach of consumer information about zinc and that exposure to media was associated with zinc use. Coupling interpersonal communication through health providers and direct communication through mass media may be an effective way to influence caregivers' knowledge and behavior.