

# Willingness to pay for zinc treatment of childhood diarrhoea in a rural population of Bangladesh

Shamima Akhter<sup>1\*</sup> and Charles P Larson<sup>1,2</sup>

<sup>1</sup>Health Systems and Infectious Diseases Division, ICDDR,B, Dhaka, Bangladesh and <sup>2</sup>Centre for International Child Health, BC Children's Hospital and Dept. of Pediatrics, University of British Columbia, Vancouver, British Columbia, Canada

\*Corresponding author. Research Investigator, Health Systems and Infectious Diseases Division, ICDDR,B, 68 Shaheed Tajuddin Ahmed Sharani, Mohakhali, Dhaka 1212, Bangladesh. Tel: +88-2-886-0523-32, ext. 2543. Fax: +88-2-881-1568. E-mail: sakhter@icddr.org

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**Introduction** Young children in the developing world continue to experience a median of between two and four episodes of diarrhoea each year. To better understand adherence to the WHO/UNICEF-recommended diarrhoea management guidelines, which now include zinc, this study aimed to determine how much caregivers were willing to pay for zinc treatment and to explore the characteristics of actual users of zinc in a rural community of Bangladesh.

**Methods** Initially we conducted a contingent valuation survey among primary caregivers of children aged 6–36 months. We assessed their willingness-to-pay (WTP) for 10 days of zinc treatment per diarrhoea episode at Tk.15 (US\$0.26) and at Tk.20 (US\$0.34), followed by an open question on the highest WTP amount. Next we conducted a cross-sectional survey in the same area to identify households with children who had received zinc during their most recent diarrhoea episode within the previous 3 months.

**Results** Field workers interviewed 111 primary caregivers to explore WTP for zinc in childhood diarrhoea. Of these, 92% were willing to pay US\$0.26 and 85% of these positive respondents were also willing to pay US\$0.34. The mean WTP was US\$0.50. We found that higher socio-economic status, better educated fathers and lower mother's age positively influenced the expressed WTP. Actual users, the 51 households whose child received zinc in their most recent diarrhoea episode, were more likely to have educated parents, higher socio-economic status and to have sought care from qualified providers for diarrhoeal illness.

**Conclusion** The expressed WTP results indicate a high demand for zinc in childhood diarrhoea management in this rural community of Bangladesh. Safety net measures and targeted communication activities specifically aimed at the poor and less educated population could be beneficial to achieve more equitable use of zinc as part of the standard treatment with oral rehydration solution in childhood diarrhoea management.

**Keywords** Diarrhoea, zinc, willingness to pay, actual user, Bangladesh

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## KEY MESSAGES

- Households among the study population were usually willing to pay for zinc treatment as part of childhood diarrhoea management; however, adequate information about the product should be provided.
- One way to scale up the demand for zinc in all socio-economic groups in Bangladesh could be to initiate future research on targeted communication strategies.
- To increase zinc use among the poor and less educated segments of the population, there is a need for safety net measures, including free or subsidized supply of zinc, in addition to national programmes.

## Introduction

Worldwide, diarrhoeal diseases are responsible for 59 million disability-adjusted life years (DALYs) lost annually and 1.6 million under-5 deaths (Lopez *et al.* 2006). Although deaths due to diarrhoea have fallen substantially over the past four decades, there has not been a concurrent decrease in morbidity rates attributable to diarrhoea (Bern *et al.* 1992; Kosek *et al.* 2003). Young children in the developing world continue to experience a median of between two and four episodes of diarrhoea every year (Bern *et al.* 1992; Kosek *et al.* 2003). In Bangladesh, diarrhoea accounts for a large share of mortality and morbidity among children under 5 years; the prevalence of diarrhoeal illness is 8% and is responsible for more than 5% of deaths (NIPORT *et al.* 2005).

Zinc treatment has been proved efficacious and effective in treating childhood diarrhoea. Zinc reduces the duration and severity in all types of diarrhoea episodes (Roy *et al.* 1998; Bhutta *et al.* 2000; Baqui *et al.* 2002; Bhandari *et al.* 2002; Strand *et al.* 2002; Bhatnagar *et al.* 2004; Gregorio *et al.* 2007), lessens the incidence rate (Bhutta *et al.* 1999; Baqui *et al.* 2002; Bhandari *et al.* 2002), reduces hospital admission and non-injury mortality (Baqui *et al.* 2002; Bhandari *et al.* 2008), prevents likelihood of recurrent diarrhoea (Roy *et al.* 1999; Bhandari *et al.* 2002) and thereby reduces the prevalence of childhood diarrhoea (Bhutta *et al.* 1999) among children under 5 years of age. Zinc treatment, along with standard oral rehydration therapy (ORT) and culturally appropriate health education, significantly reduces the use of antibiotics and other anti-diarrhoeal drugs in diarrhoea episodes (Baqui *et al.* 2004; Bhandari *et al.* 2005; Awasthi 2006; Bhandari *et al.* 2008). It does not adversely affect oral rehydration solution (ORS) use and often increases it (Bhandari *et al.* 2005; Awasthi 2006; Bhandari *et al.* 2008). Childhood diarrhoea episodes treatment with ORS and zinc leads to less health care seeking (Bhandari *et al.* 2005; Gregorio *et al.* 2007; Bhandari *et al.* 2008), and thus reduces the cost of treatment to households and societies (Bhandari *et al.* 2005; Gregorio *et al.* 2007).

Based upon the accumulated evidence, WHO and UNICEF have revised their diarrhoea management guidelines for childhood diarrhoea to include zinc for 10–14 days in every diarrhoea episode of children under 5 years (WHO/UNICEF 2004). Extensive application of this recommended dose of zinc as part of diarrhoea management will result in a reduction of the diarrhoeal disease burden and reduce societal expenditure on child health care (Gregorio *et al.* 2007).

Given that zinc is recommended for any diarrhoeal illness episode, the potential demand for zinc in childhood diarrhoea

in any particular community can be estimated on the basis of expected diarrhoea incidence rate among children under 5 years of age. The actual demand for zinc will vary from potential demand as a result of multiple factors, including household income and ability or willingness to pay (WTP). It is therefore highly relevant to better understand whether caregivers value this new treatment for childhood diarrhoea and how much they are willing to pay, which will give an estimation of the demand for zinc along with probable quantity needed for nationwide coverage.

The contingent valuation method has been widely used in health care services (Diener 1998; Klose 1999) to reveal the possible market demand curves for a health service through individuals' or households' perception of the economic benefit from that service (Olsen 1997; Mataria *et al.* 2007). This benefit perception, expressed in terms of WTP, can help decision-makers in prioritizing and designing better strategies for nationwide zinc scale-up programmes. Among several methods of contingent valuation, dichotomous choice is the preferred method for establishing demand curves, whereas open-ended enquiry is used to elicit the quantity demanded at a certain price (Heinzen and Bridges 2008).

Bangladesh is the first country to initiate a nationwide scale up of zinc use in childhood diarrhoea. Beginning in 2003, ICDDR,B initiated several activities in support of the planned scale up of zinc use along with ORS in diarrhoea management, under the Scaling Up Zinc for Young Children (SUZY) Project. The activities of the SUZY Project emphasized five key areas: technology transfer, formative and operations research, health system research, knowledge transfer, and mass media plus health care provider promotion. The scale up has involved extensive collaboration between and within public, private and non-governmental health care delivery system (Larson *et al.* 2008). At the outset, a number of knowledge gaps regarding zinc use and nationwide zinc scale up were identified and investigated. This study was one of the many research projects carried out to prepare Bangladesh for nationwide scaling-up activities to examine whether caregivers, usually parents, would be willing to pay for zinc along with ORS if their child had diarrhoea. As this study took place before implementation of scaling up activities through mass media, it is highly unlikely that the respondents or health care providers had any orientation on zinc use in childhood diarrhoea treatment with ORS.

This study aimed to determine households' WTP for zinc as part of childhood diarrhoea management, and to explore characteristics of actual users of this treatment strategy in a rural community of Bangladesh. We studied this research

question as an embedded part of a larger research project titled 'Effect of Introduction of Zinc Treatment to the NGO Health Care Providers in Managing Childhood Diarrhoea' (EZNHP), examining the operational aspects of using local NGO health workers to promote zinc in childhood diarrhoea management, and carried out prior to the launch of a national mass media promotion campaign.

## Methods

### Study design

We conducted this two-phase study in a rural sub-district of south-eastern Bangladesh. Initially we conducted a contingent valuation survey from August to September 2004 prior to zinc scale-up promotion activities in the villages. In the second phase, following local promotion and training of the non-governmental organization (NGO) community health workers, we conducted a cross-sectional survey from May to July 2005 to identify and interview the actual users of zinc for a childhood diarrhoea episode.

### Contingent valuation survey

During the contingent valuation survey, each day six trained field workers started from the house of one of the NGO community health workers and visited between 150 and 250 households who are eligible to receive selective primary health care services from that NGO health worker. Among these households the field workers identified families with at least one child aged 6–36 months who had experienced a diarrhoeal episode in the last 15 days. The aim and objectives of the study were explained to the primary caregiver, who was then requested to participate in an interview. Following written consent, the field worker conducted the interview. He/she then went to the next nearest household with a child aged

6–36 months who had not had a diarrhoea episode in the last 15 days and repeated the interview process with the primary caregiver. After that the field worker continued the selection process with the next diarrhoea case.

Using a structured questionnaire, the interviewer recorded demographic and socio-economic characteristics of the household, information on the most recent diarrhoea episode of the child and related health-care-seeking patterns and expenditures. Then the field worker described zinc treatment for childhood diarrhoea including reasons for recommending zinc in diarrhoea, expected treatment and preventive benefits of zinc, dosage, administration and possible side effects (see Box 1 for the detail scenario for WTP elicitation). To assess the incremental increases in WTP, first the interviewer asked the respondent to state whether they were willing to pay Tk.15 (US\$0.26) for 10 days of zinc treatment for each diarrhoea episode of their child. If a positive response was given, the interviewer then asked the respondent their WTP Tk.20 (US\$0.34) per diarrhoea episode. Finally, an open question asked what would be the highest WTP for zinc treatment per diarrhoea episode.

### Zinc user survey

In the second phase, we conducted a cross-sectional survey in the same communities. Field workers identified households with children aged 6–36 months who had a diarrhoea episode within the previous 3 months and had received zinc treatment as part of diarrhoea management. Field workers interviewed the primary caregiver of these identified children to explore the socio-demographic characteristics and health-care-seeking patterns.

### Data analysis

The principal outcome variable was the highest WTP amount for zinc treatment per diarrhoea episode. The binary (yes/no)

#### Box 1 Scenario to elicit willingness-to-pay for zinc

Interviewers were instructed to describe the following scenario to the respondent before starting questioning on willingness-to-pay.

'For the treatment of diarrhoea among children under 5 years of age, scientists have found zinc to be a very useful medicine. Clinical trials found this medicine effective in childhood diarrhoea in hospital and community settings. Children treated with zinc recovered earlier from diarrhoea compared with the children who did not receive this medicine. Now physicians and scientists recommend this medicine for every diarrhoea case among all children under 5 years of age. When you give zinc to your child in diarrhoea, you may notice several benefits: the child should recover earlier (fewer days with diarrhoea), the frequency of stools should have reduced, and there is a possibility that you will have to spend less time off work and might need less money for the treatment.

When your children have diarrhoea, you have to give ORS along with this new medicine "zinc" as usual. But other drugs like antibiotics or anti-diarrhoeal drugs may be less likely to be required—only as per a trained provider's advice. Zinc should be given to the child as one dose (1 tablet or 1 spoon) each day for 10 days. Zinc tablets are soluble ones that could be fed to the child after dissolving in water. Sometimes the child might vomit after initial doses of zinc, but this will not persist. One bottle of zinc syrup/one strip of zinc tablets is sufficient for one whole episode of diarrhoea.

Research has shown that apart from the above-mentioned benefits of zinc for the current episode of diarrhoea, zinc treatment also has some other benefits. Zinc reduces the likelihood of future episodes of diarrhoea. Even if your child does have diarrhoea, early zinc treatment might reduce the duration and severity of the episode, and therefore lower the possibility of visiting a health provider due to the diarrhoea.

Based upon this background we want to find out, if zinc was available in the market, would it be acceptable to you, and if so how much you are willing to pay for this new medicine for childhood diarrhoea.'

answers of WTP Tk.15 (US\$0.26) and Tk.20 (US\$0.34) for zinc were considered as supportive outcome variables. The independent variables included demographic and socio-economic characteristics, most recent diarrhoeal illness history and health-care-seeking patterns for the diarrhoea episode. We defined qualified providers as the public/private/NGO doctors, nurses or paramedics, who are trained to treat childhood diarrhoea cases. Unqualified providers were defined as village doctors, drug vendors, traditional practitioners and other types of provider who are not formally trained to treat childhood diarrhoea cases. There was no training activity in place on treatment of diarrhoea with zinc and ORS for any health care provider at the time or before this study took place. We categorized the socio-economic status of the households by their asset score and percentile values (Filmer and Pritchett 1998), calculated for all sample households of the EZNHP study. We stratified the households into three groups: the lowest 40% made up the least advantaged (relatively poor) group, the middle 40% were included in the middle group and the highest 20% constituted the most advantaged (relatively less poor or rich) group.

The data management team entered data using Visual FoxPro (Version 5.0) software and then checked and cleaned the data set. We analysed the data set using SPSS 12.0 software to explore the influence of different socio-economic variables on the WTP for zinc in childhood diarrhoea and to explore the characteristics of the actual zinc users.

## Results

### Contingent valuation survey

Field workers interviewed 111 primary caregivers to explore WTP for zinc in childhood diarrhoea. The average age of the children was 19 months and 52% were male. Mothers were the most common caregivers with a mean age of 26 years. About half of these households had more than five members and 38% of children had another sibling under 5 years of age. More than two-thirds of mothers (71%) had some formal education, whereas almost half (45%) of the fathers had no education at all. About two-thirds of fathers were either low-wage workers or farmers. Sixty per cent of the surveyed households belonged to the least advantaged group according to the wealth index. In the most recent diarrhoeal episode, 21% of the children received care from qualified providers and another 45% from unqualified providers. Households incurred an average expenditure of US\$1.30 for the most recent diarrhoeal episode, with US\$0.90 (70% of the total cost) spent on medicines (Table 1).

Ninety-two per cent of households were willing to pay US\$0.26 and 85% of these positive respondents also expressed their willingness-to-pay US\$0.34 for zinc treatment per diarrhoea episode. The highest expressed WTP amount ranged from US\$0.0 to \$2.60. Only 1% of the caretakers stated that they were not at all willing to pay for zinc. The mean WTP was US\$0.50 and the median was US\$0.40 (Table 2).

Households of the most advantaged (less poor) socio-economic group were willing to pay nearly twice the average amount for zinc per diarrhoea episode than the least advantaged families (US\$0.79 vs. US\$0.46). The mean WTP for 10 days of zinc treatment per diarrhoea episode expressed

**Table 1** Socio-demographic characteristics of respondents and their children ( $n=111$ )

Characteristics	No. of children (%)
<b>Demographic</b>	
Age of children in months (mean $\pm$ SD)	19 $\pm$ 9
Mother's age in years (mean $\pm$ SD)	26 $\pm$ 6
Sex of child	
Male	58 (52%)
Female	53 (48%)
Respondent	
Mother	107 (96%)
Other family member	4 (4%)
No. of family members	
$\leq$ 5 members	57 (51%)
$>$ 5 members	54 (49%)
No. of under-5 children in household	
1	69 (62%)
$>$ 1	42 (38%)
<b>Socio-economic</b>	
Mother's education	
No education	32 (29%)
Less than secondary	75 (67%)
Secondary or higher	4 (4%)
Father's education	
No education	49 (45%)
Less than secondary	45 (42%)
Secondary or higher	14 (13%)
Mother's occupation	
Housewife	108 (97%)
Others	3 (3%)
Father's occupation	
Farmer	32 (29%)
Working abroad	16 (14%)
Business/Skilled worker	19 (17%)
Low wage worker	40 (36%)
Other occupation	4 (4%)
Socio-economic status	
Least advantaged group	68 (61%)
Middle group	35 (32%)
Most advantaged group	8 (7%)
<b>Health-care-seeking in last diarrhoeal episode</b>	
Provider consulted	
None	36 (33%)
Qualified provider	23 (21%)
Unqualified provider	49 (45%)
Total expenditure (mean $\pm$ SD), in US\$*	1.3 $\pm$ 1.8
Expenditure on medicine (mean $\pm$ SD), in US\$*	0.9 $\pm$ 1.2

\*Exchange rate in August 2004 was 1 US\$ = 58.64 Taka.

**Table 2** Expressed willingness-to-pay for zinc by caregivers of children

Factors	Yes <i>n</i> (%)	No <i>n</i> (%)
Willing to pay US\$0.26 ( <i>n</i> = 111)	102 (92%)	09 (08%)
Willing to pay US\$0.34 ( <i>n</i> = 102)	87 (85%)	15 (15%)

  

Highest WTP amount in US\$ ( <i>n</i> = 111)	
Mean ± SD	0.50 ± 0.30
Median	0.40
Range	0.00 – 2.60
Willing to pay US\$0.00	2 (1%)

\*Exchange rate in August 2004 was 1 US\$ = 58.64 Taka.

by households with a more educated father (secondary or higher) was 1.7 times higher than that of households with a non-educated father. Younger mothers (aged 20 years or less) were willing to pay 1.4 times more for zinc than the older mothers (Table 3).

### Zinc user survey

The field workers identified 51 children aged 6–36 months who had received zinc as part of their diarrhoea management in the most recent diarrhoea episode during the previous 3 months. When compared with the contingent valuation survey population, those children who received zinc were more likely to be male, to be the only child of the family, to belong to a small family, have more educated parents and be from a least-poor household. However, none of this difference was statistically significant. Actual users were four times more likely to seek care from qualified providers and spent 1.5 times more during their last diarrhoeal episode compared with the households interviewed in the contingent valuation survey (data not presented).

## Discussion

The study findings showed that most of the households in this rural community of Bangladesh were willing to pay for 10 days of zinc treatment in childhood diarrhoea management. We found that the socio-economic status of the family, the father's education level and the mother's age all influenced the expressed WTP. The characteristics of actual users showed a similar pattern. These results are reassuring. They indicate the demand for zinc in this rural community and provide some direction for future zinc scale-up programmes in Bangladesh.

This study's findings are consistent with those of an earlier study that documented actual household medication expenditure per diarrhoea episode among rural children in Bangladesh (Larson *et al.* 2006). Both studies indicate that the cost of zinc treatment will not be a significant barrier to household demand for zinc treatment in childhood diarrhoea in rural Bangladesh. This also indicates that there is a high private demand for zinc treatment in childhood diarrhoea among the population studied (Klose 1999; Mataria *et al.* 2007). As part of the contingent valuation survey, we provided detailed information on the benefits of zinc treatment in childhood diarrhoea and the national guideline recommendations. This might have

**Table 3** Association of various socio-economic factors with caregivers' highest WTP amount for zinc treatment per diarrhoea episode of children (ANOVA test)

Characteristics ( <i>n</i> = 111)	Mean WTP (US\$)
<b>Socio-economic group by asset score</b>	
Least advantaged group	0.46*
Middle group	0.54
Most advantaged group	0.79
<b>Sex of child</b>	
Male	0.52
Female	0.49
<b>Child age</b>	
< 12 months	0.47
12–36 months	0.52
<b>No. of under-5 children in family</b>	
1	0.55
> 1	0.44
<b>Mother's age</b>	
≤ 20 years	0.66*
> 20 years	0.48
<b>Mother's education</b>	
No education	0.41
Less than secondary	0.54
Secondary or higher	0.53
<b>Father's education</b>	
No education	0.44*
Less than secondary	0.51
Secondary or higher	0.73
<b>Provider in last diarrhoea episode</b>	
None	0.44
Qualified provider	0.50
Unqualified provider	0.54
<b>Having diarrhoea in last 14 days</b>	
Yes	0.51
No	0.50

*P* value: \*\* ≤ 0.01; \* ≤ 0.05.

had some influence on this expressed WTP and the corresponding high demand for zinc.

Use of any over-the-counter medicine depends on the knowledge and understanding of the patient and/or caregivers (Hughes *et al.* 2002). Receiving culturally appropriate education on zinc use plus ORS for diarrhoea treatment along with ensuring better access actually increase the use of both (Awasthi 2006; Bhandari *et al.* 2008). Furthermore, studies have shown that there is more positive uptake of over-the-counter medications if the initial exposure is recommended by a qualified health provider (Hughes *et al.* 2002). Dissemination of the information regarding zinc treatment of childhood diarrhoea to all types of health providers is therefore crucial (Bhandari *et al.* 2008). Hence, programmes to increase the use of zinc by parents might benefit from mass media communication activities. Notably, one-third of diarrhoea cases in rural

Bangladesh receive antibiotics (Larson *et al.* 2006), comprising a major portion of medication expenditure. Promoting the use of zinc in diarrhoea episodes could therefore facilitate more efficient use of a household's resources.

Our study identified least advantaged (poorest) households, households that had a non-educated father, and households with an older mother to be negatively associated with WTP for zinc treatment. Because children from the poorest households or with a non-educated father are most at risk (Gwatkin 2000), ensuring the use of zinc treatment will require that programmes using safety nets, such as alternative financing for child health care, providing free supplies of zinc in government health centres and/or lowering the market price of zinc. Apart from affordability, future research could explore the possible reasoning behind the 1% of the study population who refused to pay any money. Older mothers expressed lower WTP for zinc, which could be related to their experience of caring for multiple children for several years. Future research studies could explore this.

Our finding on higher WTP for a male child is consistent with reported variation in WTP amounts for male and female children for diarrhoea treatment (Amin and Khondoker 2004) and potential less health-care-seeking for a female child (Bhan *et al.* 2005). One study from India reported higher gender bias for hospitalization among more educated mothers (Bhan *et al.* 2005), though our study found no relation of WTP variability with mothers' education level.

We found that the actual users of zinc were different from the contingent valuation survey group. Households with more educated parents, belonging to the most advantaged (richest) group of society, were more likely to be the actual users. Four-fifths of zinc users sought care from qualified providers, and users spent 1.5 times more money per diarrhoea episode than the contingent valuation survey population. Poor people suffer from a higher disease burden and worse health outcomes whereas socio-economically better-off people usually use more health services (Gwatkin 2005). Even health services such as oral rehydration for childhood diarrhoea are more likely to be utilized by the better-off than by the poor (Gwatkin 2000). To achieve more equitable zinc use among different socio-economic groups, ways of reaching the least advantaged and middle groups need to be identified. Activities or programmes specifically targeted at them may help to increase zinc use along with ORS in home management of childhood diarrhoea.

Our study employed two contingent valuation methods to elicit household WTP for zinc in the management of childhood diarrhoea. The dichotomous question approach gave us a better estimation of demand for zinc and an open-ended question approach provided information on quantity demanded in the health care market (Heinzen and Bridges 2008). Therefore, along with private or household demand, this study also provided information to policy makers and government for the preparation of nationwide scaling up of zinc use in diarrhoea management. The respondents heard about the use of zinc with ORS for diarrhoea treatment for the first time during our survey, so we can presume that the estimated WTP is not an overestimation due to knowledge.

This was the first attempt to understand the perceptions of potential users of zinc and to estimate the realistic demand for

zinc treatment. However, this research activity was conducted on a small sample size in one sub-district of Bangladesh. This study only included caregivers of children aged 6–36 months as it was embedded in the EZNHP study. Therefore the results should be interpreted carefully and might not be generalizable.

## Conclusion

The expressed WTP results indicate a high demand for zinc in childhood diarrhoea management in this rural community of Bangladesh. However, this demand is contingent on provision of adequate information about the product. One method to increase demand and promote over-the-counter use of zinc in childhood diarrhoea management in all socio-economic groups in Bangladesh could be to initiate future research on communication strategies. This could also ensure access to information on zinc for all formal and informal health providers and to households. In addition to national programmes, safety net measures, including free or subsidized supplies of zinc, could achieve more equitable use of zinc as part of the standard treatment with ORS in childhood diarrhoea management. Every effort to make zinc acceptable, affordable and accessible will help in reducing the burden of diarrhoea among children in Bangladesh.

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