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## QUALITY OF HOME USE OF ORAL REHYDRATION SOLUTIONS: RESULTS FROM SEVEN HEALTHCOM SITES

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**Abstract**—This study examined the volume of oral rehydration solutions given to children during diarrhea and the length of time the solutions are administered. It also attempted to test the importance of individual and contextual factors—especially mothers' knowledge—in explaining the administration of oral rehydration solutions. Data about the treatment of an episode of child diarrhea within the last three months were collected from large samples of mothers in seven sites in Africa, Asia, and Latin America. The results showed that oral rehydration solutions were given in smaller volumes and for shorter periods of time than recommended. The majority of children received at least a glass (200–250 ml) of solution on the first day, but few received more than that. Daily administration of packet-based solutions or of sugar-salt solutions (promoted in two of the countries) during diarrhea was generally quite low, ranging from 16 to 60% of cases given an oral rehydration solution. However, in four out of six sites, at least half of the children with diarrhea for more than one day were given an oral rehydration solution for more than one day. The majority of children were given some form of other fluids (e.g. more water, special teas, or continued breastfeeding), but their value in preventing dehydration was not clear because the volume of other fluids given could not be assessed. Few of the hypothesized predictors of administration explained the variation in volume or duration of ORS/SSS administration within any specific country or across sites. The research points to the need for more information on the decision process used by mothers when treating their children's diarrhea and on outside factors influencing this process.

**Key words**—oral rehydration therapy, diarrhea, developing countries, health communication, knowledge

### INTRODUCTION

During the 1980s oral rehydration therapy (ORT) emerged as one of the most promising technologies to prevent death from diarrheal disease, a leading cause of infant mortality in developing countries. Approximately 4 million children die from diarrhea-associated causes annually around the world [1, 2]. The potential danger of diarrhea, combined with the apparent simplicity and cost-effectiveness of ORT, has led to widespread production and promotion of oral rehydration salts (ORS) packets and sugar-salt solution (SSS).

Use of oral rehydration therapy has increased significantly (globally from 12% of episodes treated with ORT in 1984 to 35% in 1989) [1]. However, to improve programs in the future, we must go beyond assessing whether mothers use ORT at all to focus on *how* they use it.

Reviews of studies of oral rehydration programs throughout the world suggest that the solutions prepared and administered at home generally are not used as recommended [3, 4]. If oral rehydration solutions are not mixed accurately, the resulting fluids may be ineffective or, worse, dangerous. Efficacy also depends on a child being given sufficient quantities of fluids to replace those already lost through diarrhea

and to maintain the child's hydration as the episode continues. According to the World Health Organization (WHO) policy on oral rehydration therapy, this requires starting fluids early in the episode and, when oral rehydration solutions are given, administering sufficient daily volumes of solution and giving the solution every day that the child is losing fluids through diarrhea.

Mothers' behavior in administering oral rehydration solutions has been linked to a number of factors. Those most frequently discussed in the literature are related to mothers' beliefs and knowledge—about treatment of diarrhea, about the function of oral rehydration solutions and the concepts of dehydration and rehydration, about ORS or SSS as a satisfactory treatment, and about how to use the solutions. These findings suggest that communication or educational programs have an important role in improving rehydration behavior.

This study compares the quality of administration of oral rehydration solutions (packet-based and sugar-salt solutions) across seven sites in Asia, Latin America and Africa and examines possible predictors of higher quality use (giving greater volumes of oral rehydration solutions and giving the solution for more than one day). In particular, the study addresses whether knowledge about diarrhea and oral rehydra-

tion is related to volume or duration of oral rehydration solution administration in order to assess the potential role of education or communication programs in improving ORS or SSS administration.

#### *ORS or SSS administration*

The World Health Organization stresses the importance of giving a child more fluids as soon as diarrhea starts. WHO policy has recommended ORS packets for the *treatment* of dehydration but states that, although not necessary, ORS may be used, along with home-available fluids and SSS, to *prevent* dehydration in early-stage and milder episodes [5]. For acute diarrhea, WHO recommends administering 100 ml/kg body weight per day of oral rehydration solutions until the diarrhea stops [6].

However, in practice, many countries have focused on promoting ORS or SSS (where packets are unavailable) for essentially all episodes of diarrhea to prevent dehydration. In almost all the countries in which this research took place, the general policy was to give ORS or SSS for all cases of diarrhea and to start administering the solution immediately. In these countries, the WHO recommendations on the volume of solution to give have been translated into instructions to administer one liter of ORS or SSS for each 24-hr period or one-half to one cup of solution after each loose stool (depending on the child's age).

Many studies have shown that children tend to be given less than the recommended volumes of ORS or SSS, ranging from only a few spoonfuls or doses of the solution per day to a mean of 300–400 ml a day [8–14]. Few studies have reported whether children are given oral rehydration solutions early in the episode or for an extended number of days (but see Bentley, and Coreil and Genece [15, 16]). However, the assumptions in the literature are that these practices also do not meet the standards. Previous research has identified a number of factors that explain mothers' administration of oral rehydration solutions in lower volumes and for fewer days than recommended: lack of knowledge; current preferences, beliefs, and practices related to the treatment of diarrhea; poor access to ORS packets or SSS ingredients; and the realities of the mothers' everyday lives, particularly availability of free time.

One common explanation for the low volumes of ORS or SSS administered is that mothers assume that ORT solutions are like any other medicine and should be administered in small doses [4, 9–11]. In some cases, the distinction between ORS and SSS and other treatments for diarrhea may not be made clear by health providers, as was the case in villages in Mozambique where mothers received pharmaceutical drugs, ORS packets and instructions for both at a busy pharmacy window [9]. Levine suggests that the broader promotion of ORT as having a curative function has contributed to mothers' confusion about administration [4].

Another major explanation for nonuse and for administration of low volumes of oral rehydration solutions is that mothers have insufficient knowledge about dehydration as a dangerous consequence of diarrhea and about the rehydrating function of ORS or SSS [4, 10, 15]. It is assumed that, if mothers knew that these solutions do not stop diarrhea, but prevent dehydration, they would be more likely to give a child ORS or SSS and to administer it as recommended. This assumption is reflected in the attempts of many ORT programs to teach mothers about loss of fluids and rehydration. However, support for this view is mixed. Levine's review of ORT evidence concluded that there is no substantial relationship between knowledge of the purpose of ORT and its use [4]. However, recent analyses from seven sites participating in the HEALTHCOM project showed that mothers with a basic knowledge of rehydration were significantly more likely to have used ORS or SSS at all for the last diarrheal episode in one of their children [17]. Bentley found that northern Indian mothers who knew the function of ORS were more likely to have given ORS at the start of the episode [15], but Coreil and Genece found that Haitian mothers with an understanding of rehydration delayed giving ORS [16].

A number of studies point out that mothers often do not know how much oral rehydration solution to give or how long to give it, suggesting that educational efforts need to emphasize proper administration [9–11]. In Mozambique, instructions given to mothers about ORT use varied from no information; to information about ORS mixing only; to information about mixing, administration, and fluids. Mothers who received full information about ORS gave greater volumes of ORS than those with no instruction [9]. However, mothers have been found to give lower than recommended volumes of ORS even after careful training about ORS administration [12–14]. It is not clear whether mothers in the latter studies knew how much ORS to give when they left the clinic, if they agreed with the instructions, or if other factors besides lack of knowledge influenced their ORS administration practices.

Low volume and short duration of ORT administration have also been associated with dissatisfaction with ORT and particularly with its lack of efficacy in stopping diarrhea [4, 9, 10, 15, 18]. Mothers' primary concern in treating diarrhea is to stop it. However, oral rehydration solutions do not stop diarrhea and may even seem to exacerbate the symptoms, increasing the number of stools and leading to vomiting. In a study in Mexico, anti-diarrheal drugs that yielded symptomatic relief had a much higher compliance rate, suggesting that disappointment with the curative efficacy of ORS may have prompted lower compliance [4]. Higher compliance rates for other drugs compared to ORS also were found in Mozambique [9]. Dissatisfaction with ORS or SSS can influence mothers' intention to use the solutions at all and can

also result in their stopping administration earlier than recommended, when they see that the diarrhea has not stopped.

The attitudes and practices of health providers are also important factors. In many countries, health workers and doctors continue to prescribe antibiotics and anti-diarrheals, with or without fluids or oral rehydration solutions [7]. Physician or clinic attitudes about oral rehydration solutions and their recommendations may influence mothers' views of what is appropriate or good treatment of diarrhea. In addition, use of other, often ineffective drugs is seen as taking attention away from the use of ORT and the rehydration of the child [7, 19].

One of the most important predictors of diarrheal treatment may be the mother's assessment of the specific episode. Diarrhea is very common among children in developing countries, and most cases are mild and self-limiting. Based on their experience, mothers first assume an episode is mild and wait to see if symptoms and duration warrant treatment and what kind [9, 15]. Treatment may vary according to the mothers' interpretation of the episode's cause and/or to their assessment of its physical characteristics and severity. Children with diarrhea that is considered more serious are more likely to be given ORS or SSS at all [8, 20, 21] and to have received the full, recommended volume [14].

After calculating that it would take a mother over 3 hours to give a child a liter of ORS at the rate of 1 teaspoon a minute, Riyad and colleagues concluded that a mother's time may be the "final limiting factor" in giving the recommended volumes of ORS [12]. Oral rehydration solutions should be administered in small amounts, throughout the day, until an adequate volume has been consumed. Compared to other treatments available, giving oral rehydration solutions is inconvenient and time-consuming. Because of work or other demands, mothers may be hard-pressed to allot the time necessary for ORT preparation and administration [14, 22, 23]. Mothers have appraised ORT preparation or administration as too demanding on their time [15] and the solutions as cumbersome to mix and difficult to administer [18]. A recent study in Bangladesh found that mothers were twice as likely to use a sugar-based ORS, that was easier and less time consuming to prepare and that did not require fuel, than they were to use a rice-based solution that was more readily available than the ORS packets and was also seen to stop diarrhea [24].

Access to and direct or indirect costs of ORS packets and sugar and salt also constrain use of oral rehydration solutions [10, 18, 25]. Mothers may not be given sufficient ORS packets to give the recommended volume of the solution for the entire episode [26, 27]. In addition to requiring the mother to go back for more packets, giving her only one or two packets may indirectly suggest how much she is expected to give the child during the episode of

diarrhea. Research in Nepal has also suggested that the size of the packet may influence the volume given. Mothers using one-liter, half-liter, and quarter-liter packets gave progressively lower total volumes for each smaller packet [28].

The literature indicates that, in addition to structural factors such as access and time availability, beliefs (about diarrhea and its treatment, and about the efficacy and function of ORS) and knowledge about how to administer the solution play a large role in determining ORS administration behavior during diarrhea. This suggests that programs attempting to change beliefs and increase knowledge will have some impact on ORS or SSS administration. In this study, we examine the importance of these different factors, particularly knowledge, in explaining ORS or SSS administration.

## METHODS

### *Description of study sites and programs*

This study compares the administration of oral rehydration solutions (packet-based or SSS) for each of seven sites in Asia, Latin America, and Africa. The data were collected as part of the evaluation of the USAID-funded Communication for Child Survival (HEALTHCOM) projects in Ecuador, Guatemala, Lesotho, the city of Lubumbashi in Zaire, the provinces of Central Java and West Java in Indonesia, and four areas in the Philippines. In all seven sites, HEALTHCOM assisted the local government in promoting the use of ORT for children with diarrhea either before or after this research took place.

Although all the individual projects were carried out under the larger HEALTHCOM project and used the same general methodology, each was tailored to the specific site [see 29, 30]. This resulted in promotion of packet-based solutions in Indonesia, the Philippines, Ecuador, and Guatemala and sugar-salt solutions (with some later promotion of packets) in Lesotho and Zaire. Different communication strategies and messages were developed and pretested for each site [see 29]. Table 1 describes the major messages of each country's program and the administration instructions for oral rehydration solutions.

Almost all of the programs promoted ORS or SSS for every episode of diarrhea. However, in West Java, radio messages told mothers to give ORS "if diarrhea continues," and health volunteers were trained to recommend ORS only when signs of potential dehydration were seen (although all the volunteers surveyed about the last diarrhea case treated reported recommending ORS regardless of symptoms) [31]. The communication messages in these programs generally focused on explaining and promoting ORT (particularly oral rehydration solutions) through mass media channels, and depended on specially-trained health workers and volunteers to give specific administration instructions. Only in Ecuador did the

mass media (television and radio) carry messages specifying the volume to give (one cup of ORS after each stool). In all countries, ORS packets included printed instructions on the volume to give children of different ages. In Lesotho, we were unable to determine the specific content of radio messages because radio logs or scripts were unavailable. In the two baseline-only sites, Guatemala and the Philippines, no specific information is available about ORT activities that occurred before the surveys.

#### Procedure

The impact of the communication programs on changing the treatment of diarrhea and use of oral rehydration solutions at all, the major focus of these ORT programs, has been reported elsewhere [30]. Even though the data reported here come from the same health communication evaluations, we cannot use them to discuss whether these programs directly affected mothers' ORS or SSS administration practices because of the discrepancies between the countries in their programs and evaluations and because most of the programs did not focus on the details of ORS or SSS administration. Instead, this study reports on cross-sectional analyses of data from

a single survey from each country, documenting mothers' administration of ORS or SSS and examining predictors of their behavior.

The data from five sites (Ecuador, West Java, Central Java, Lesotho and Zaire) come from surveys carried out after HEALTHCOM-supported communication and other ORT-related activities were conducted. For the Philippines and Guatemala, the data used were collected before HEALTHCOM-assisted communication activities began, but after other ORT promotion activities were underway.

In each site, a sample of primary caretakers (generally the mother) of children under five years old was drawn from existing sampling frames developed for the census or from sampling frames developed by commercial research organizations. The samples were drawn through two- or three-stage cluster procedures. In three-stage samples (Central and West Java, and the Philippines), districts or other large geographic units in target areas were chosen randomly in proportion to population, then census areas within districts and caretakers within census areas were selected randomly. Two-stage samples consisted of random selection of census areas, then of caretakers (Lesotho, Zaire, Ecuador and Guatemala).

Table 1 Messages about treatment of diarrhea and administration of ORS or SSS\*

Country	Channels	Major messages	Specific ORS administration instructions
Ecuador	Television Radio Health workers Pamphlets	Get ORS packets as soon as diarrhea starts. ORS replaces fluids Dehydration is dangerous. Signs of dehydration. Take the child to the health center if the diarrhea worsens or lasts more than two days. Continue feeding	Give one cup of solution after each stool. Give a spoon at a time until solution is gone. Discard remaining solution after 24 hr Do not force child to drink. (all channels)
Central Java	Radio Local health volunteers Manuals for volunteers	Give lots of fluids. Continue breastfeeding Continue feeding. Give ORS. ORS replaces fluids lost through diarrhea Go to the health center if diarrhea continues	Give fluids and ORS immediately (radio). Give ORS after every stool (radio). Give 3 glasses in first 3 hours (half for small babies), then give 1 glass after every stool (ORS packet).
West Java	Radio Health center workers and local volunteers Counseling cards Film Advertisements	Diarrhea is dangerous. Children lose fluids. Give more fluids. Give ORS if diarrhea continues. ORS is the best fluid for diarrhea. Continue breastfeeding.	Give 1 glass of ORS after each loose stool, $\frac{1}{2}$ for children under 1 year (ORS packet, health volunteers). Give the solution a little at a time until the child finishes the entire glass (packet, health volunteers).
Lesotho	Radio Health center workers and village health workers	Give ORS packets if available. Use SSS if unable to obtain packet. Give home fluids if neither is available.	Pour solution into a cup and give with spoon or out of cup (printed brochure).
Zaire	Health workers	Dehydration is loss of water. Signs of dehydration. SSS replaces lost water. Give SSS for all types of diarrhea. Continue breastfeeding.	Give SSS as soon as diarrhea starts. Give one glass of SSS after each stool or when child is thirsty.

\*The data used in this study from Guatemala and The Philippines were collected as part of the baseline assessment. Specific information about these countries' ORT programs before the HEALTHCOM-assisted activities is not available. The specific content of radio messages in Lesotho is not known.

Table 2. Description of the samples

Country	Date of survey	Sample population	Sample size (entire)	Sample size (mothers with a case of diarrhea in a young child in last 3 months) <sup>a</sup>
Ecuador	1986	National	2702	598 (cases in last 2 weeks)
Guatemala (baseline)	1987	National	5127	5091
Central Java	1990	Two regencies	800	257
West Java	1990	Five regencies	1000	424
Philippines (baseline)	1987	Two regions, low SES households	800	459
Lesotho	1990	National	1016	447
Zaire	1990	City of Lubumbashi	1153	724

<sup>a</sup>The sample consisted of mothers with a child with diarrhea in the last 3 months except for Ecuador, where the questions about treatment of the last case of diarrhea were only asked for cases occurring within the last 2 weeks.

In most sites, the sampling frames were chosen to measure change in behavior in specific target areas, not to strictly represent the entire population of the country or province. Specifically, the surveys in Zaire were carried out only in the city of Lubumbashi; in Central Java only two regencies were sampled; in West Java five regencies were covered; and in the Philippines four regions were included. Although the results cannot always be generalized to the entire country, the data can provide some useful insights into mothers' administration of oral rehydration solutions. Details on the population sampled and the sample sizes are in Table 2.

In each site, mothers or caretakers were asked about the most recent episode of diarrhea in one of their children under 5 years old [32]. They were then asked whether the diarrhea had been treated or had gone away on its own, whether the episode had been treated at home or outside the home, and about what treatments had been given and what drinks the child had received. Those who reported giving ORS packets or SSS were then asked several questions about administration of the solution, including volume given on the first day and number of days the solution was given.

This study used a subsample of each survey's respondents that included only mothers reporting on a child with an episode of diarrhea within the last 3 months. The decision to include episodes which occurred up to 3 months before may be disputable. There is some question as to mothers' ability to accurately recall details about episodes occurring more than one month ago, or even 1-2 weeks ago [33, 34]. Earlier research in the countries studied here found that mothers were more likely to report giving ORS or SSS at all for episodes occurring more than one month before the interview than for those within the last month [35]. We found similar results for use of oral rehydration solutions at all in the samples used in this study. However, among mothers in each sample who used an oral rehydration solution at all, there was no significant difference in volume and

duration of ORS or SSS use for recent (within the last month) versus less recent episodes. This indicated that including the later episodes would not greatly distort the results. On the other hand, it assured an adequate number of cases for the analyses in each site. The only exception is in the case of Ecuador; where only mothers dealing with a case in the last two weeks were asked the detailed questions about the last case of diarrhea in one of their children. The proportion of episodes occurring within 3 months of the interview are listed in Table 2.

#### Variables

The goal of this study was to carry out comparable analyses in each site and examine the results across the seven sites. Because of variations in the context in each country, the survey questions were not identical in all the sites, although every effort was made to develop similar survey instruments. For these analyses, we attempted to create variables that are comparable across the sites, realizing that comparability may result in somewhat cruder measures of a concept.

Data on the volume of ORS or SSS given were available for six of the sites (excepting Ecuador, where questions about volume were not asked). In all the sites, mothers were asked how much the child was given on the first day he/she was given ORS or SSS. Because of differences between countries in the containers and utensils available to mothers and those recommended for mixing and giving the solution, it was not possible to use a standard method for measuring volume across the sites. In each site, we allowed the mothers to report the volume given in reference to the container they had used. In Central and West Java, mothers were shown the standard 200 ml drinking glass used by 92% of the mothers to mix and administer ORS and asked to show the level of ORS given referring to the glass (for partial glasses) or to say how many glasses the child was given. Responses were coded in ordinal categories (less than one-half glass, one-half to one glass, one full glass, etc.). In the Philippines, mothers were

asked to show the interviewer the drinking vessel used to give ORS, the level to which it was filled, and how much the child drank. Interviewers filled the vessel accordingly and measured the contents. In Lesotho and Zaire, mothers were first asked what container they used to give the solution, then how many of these the child drank on the first day. In Guatemala, mothers were asked how much solution was given and the interviewers coded the responses directly (e.g. two tablespoons, one liter).

In the analyses, volume of oral rehydration solution given is presented in two ways. The first measure is whether the child was given at least one glass (200 ml) of ORS or SSS on the first day the solution was given. This would indicate whether children were being given a substantial amount of the fluid, rather than only a few teaspoons full. However, we also attempted to estimate more specifically the volume of solution for those cases where the volume was not measured by converting the reported volumes into milliliters [36]. These estimates are crude, but they do give a clearer sense of the relative volumes of ORS fluids children were given in each of the six sites. Because of the differences in the way volume was measured in each site, the analyses focus on the broader measure of whether at least one glass of solution was given.

In countries recommending both ORS and SSS, no differences were found in volumes given of the two solutions. Therefore, the two were grouped to allow for more cases per cell. Where two solutions were available, one solution dominated (in Guatemala the vast majority used packet-based ORS; in Lesotho and Zaire, they used SSS).

Data on duration of giving ORS or SSS are available for all sites except Central Java. Two different measures are used: whether the mother gave the solution for at least as many days as the child had diarrhea (for cases of 4 days or less, after which children are supposed to be taken to health centers for treatment), and whether children who had diarrhea for more than one day were given ORS or SSS for more than one day.

In Ecuador, Guatemala, Lesotho, Zaire, and the Philippines, mothers were asked how many days their child had diarrhea and, later in the questionnaire, how many days they had given the child ORS or SSS. The ratio of days of ORS/SSS to days of diarrhea was computed for these cases. In West Java, mothers were asked instead how many packets of ORS they gave for the whole episode and how much they had given on the first day. From these two variables, we developed a broader measure of whether the mother had given ORS or SSS for at least more than one day.

## RESULTS

### *Volume of ORS or SSS given*

In general, mothers in these samples who used ORS or SSS gave their child more than a few spoonfuls of oral rehydration solution. In 4 out of 6 sites, a large majority of mothers who used ORS or SSS reported giving at least one 200 ml glass of an oral rehydration solution to their child during the last episode of diarrhea in the past three months (see Table 3). The Philippines and West Java are the exceptions, with only half or just over half the mothers reporting giving a child at least one glass of solution.

Table 3 also shows that use of oral rehydration solutions at all for the most recent episodes of diarrhea in the last three months varied widely between the sites, from 6% use in Guatemala to 67% in Lesotho. In general, around one-fifth to one-third of last episodes were given ORS or SSS.

Table 4 provides more detail about the volumes of oral rehydration solution given to children by converting the responses into standardized estimates of volume. Overall, children in the samples were given far below the WHO recommended daily volume of oral rehydration solution. Mothers in four of the six sites (Central and West Java, the Philippines, and Zaire) tended to give a maximum of one to two glasses of solution in a day.

There was wide variation among the sites, with mothers in the Philippines and West Java administer-

Table 3. Percentage of children given at least one glass of ORS/SSS in a day during last case of diarrhea (first day that solution was given)

Country	Solution (recommended volume for mixing)	Percent of children given oral rehydration solution	Percent of children given 200 ml or more (of those given ORS)
Ecuador	ORS (1 liter)	22.9 (n = 598)	na
Guatemala (baseline)	ORS or SSS (1 liter)	5.6 (n = 5091)	85.5 (n = 282)
Central Java	ORS (200 ml)	26.1 (n = 257)	76.1 (n = 67)
West Java	ORS (200 ml)	33.7 (n = 424)	51.4 (n = 144)
Philippines (baseline)	ORS (1 liter)	18.3 (n = 459)	46.4 (n = 84)
Lesotho	SSS or ORS (1 liter)	67.3 (n = 447)	80.7 (n = 301)
Zaire	SSS or ORS (1 liter)	35.2 (n = 724)	80.8 (n = 255)

Table 4. Estimated volumes of ORS/SSS given in one day for last case of diarrhea (first day that solution was given)

Country	Solution (recommended volume for mixing)	Range of volumes given	Median volume given in ml (estimated) <sup>a</sup>	Inter-quartile range of volumes given (estimated)
Guatemala	ORS or SSS (1 liter)	0-10 bottles	600 ml (n = 267)	250-1000 ml
Central Java	ORS (200 ml)	< $\frac{1}{2}$ glass-4 $\frac{1}{2}$ glasses	200 ml (n = 67)	200-400 ml
West Java	ORS (200 ml)	< $\frac{1}{2}$ glass-3 glasses	200 ml (n = 144)	135-200 ml
Philippines	ORS (1 liter)	0-1000 ml	150 ml (n = 84)	50-345 ml
Lesotho	SSS or ORS (1 liter)	0-6 cups	750 ml (n = 229)	300-750 ml
Zaire <sup>b</sup>	SSS or ORS (1 liter)	2 spoons to 8 glasses	250 ml (n = 173)	250-500 ml

<sup>a</sup>Median volumes and inter-quartile ranges are reported rather than means and standard deviations because the figures are general estimates, rather than specific measurements of volumes. These statistics also give a clearer picture of volumes that varied widely from country to country.

<sup>b</sup>A large number of mothers in Zaire (but not in the other sites) did not remember or know how many spoons or glasses of solution they had given. This table includes only those mothers who answered the question.

ing the lowest volumes of ORS. In the Philippines, one-quarter of the mothers may have given only several spoonfuls of solution (50 ml or less) to their children. The median volume given was 150 ml, less than a small glass full. In West Java, 22% of mothers gave their child up to half a glass of ORS (100 ml) and may have given their children only one or two spoonfuls in a day. Half the children in the West Java sample received from two-thirds to one 200 ml glass of solution in one day. In two sites, mothers gave much higher median volumes; in Lesotho the median volume of SSS was 750 ml, and in Guatemala the few children who were given ORS reportedly received a median volume of 600 ml.

Two other factors are important in discussing volumes of ORS or SSS given—the proportion of children receiving a rehydration solution at all and the proportion who were also given other fluids. Only in Lesotho did a majority of mothers give a rehydration solution to treat the most recent episode of diarrhea (see Table 3), resulting in 53% of all cases in which at least one glass of solution was given. In the other five sites, a minority of mothers gave any ORS or SSS for a child's most recent episode of diarrhea, resulting in 5-28% of all last episodes treated with at least one glass of solution.

These rates of giving oral rehydration solutions and of giving substantial volumes of the solutions may be appropriate. Only 10% of diarrheal episodes are estimated to require the complete oral rehydration solution [19]. In many episodes, dehydration can be prevented through giving other fluids available in the home. Table 5 shows the proportion of children with diarrhea in each site who reportedly received extra or special fluids (primarily water, rice water, tea, or milk) or breast milk, alone or in addition to oral rehydration solutions. Administration of extra or special fluids to a child with diarrhea varied considerably among the seven sites. From 18% to 88% of

children who did not receive oral rehydration solutions received such fluids, and between 21% and 91% of children who were given ORS or SSS also were given extra or special fluids. However, if continued breastfeeding is included as another form of fluids, we see that a large majority of mothers in every site gave children with diarrhea other fluids and/or breast milk during diarrhea. While we have no estimate of the volume given of these fluids, it is clear that some form of fluids is commonly given.

However, it should be noted that, in Ecuador, West Java, the Philippines and Lesotho, children who were not given oral rehydration solutions were significantly less likely than children who were given ORS or SSS to have received other fluids. In these sites, 20-40% of children not given ORS or SSS also did not receive extra or special fluids or breast milk. In Zaire, special attention to giving of other fluids during diarrhea was generally low, and 38% of children not given SSS did not receive breastmilk or more or special fluids.

The children at risk in these situations are those who are no longer breastfeeding. In each country, the vast majority (over 90%) of children who were breastfeeding at the time they contracted diarrhea continued to breastfeed during diarrhea whether they were given oral rehydration solutions or not. One exception is in the Philippines, where mothers were more likely to withhold breast milk during diarrhea. In the sample from the Philippines, 70% of currently breastfeeding children who did not receive ORS and 61% of those who did receive ORS continued breastfeeding during diarrhea.

#### Explanations for low or high volumes of ORS or SSS

To understand why mothers using oral rehydration solutions gave more or less volume, we carried out logistic regression analyses for each site with volume given (one glass or less, and half a liter or less) as

Table 5. Proportion of children given extra or special fluids or breast milk, alone or in combination with oral rehydration solutions

Country	Child received extra or special fluids		Child received other fluids and/or breast milk	
	Not given oral rehydration solution	Given oral rehydration solution	Not given oral rehydration solution	Given oral rehydration solution
Ecuador	56.3* (n = 462)	80.7 (n = 135)	76.4* (n = 462)	92.6 (n = 135)
Guatemala	87.6 (n = 4688)	89.6 (n = 289)	94.1 (n = 4740)	93.9 (n = 293)
Central Java	24.2 (n = 190)	35.8 (n = 67)	85.3 (n = 190)	89.6 (n = 67)
West Java	48.0* (n = 281)	67.8 (n = 143)	81.5* (n = 281)	92.3 (n = 143)
Philippines	66.1* (n = 375)	82.1 (n = 84)	77.1* (n = 375)	90.5 (n = 84)
Lesotho	28.1* (146)	40.5 (n = 301)	61.6* (n = 146)	77.7 (n = 301)
Zaire	17.9 (n = 469)	20.8 (n = 255)	61.6 (n = 469)	67.1 (n = 255)

\*Differences between ORS/SSS users and nonusers significant at  $P < 0.05$ .

dependent variables. Two variables were included to control for general access to community services (measured by availability of water in the home or in the compound) and for mother's education. The following variables were examined for their predictive value: sex of the child with diarrhea (boys have been shown to receive preferential health care in some countries [37, 38]), mother's assessment of whether the child was moderately or very sick vs not sick [39], giving of extra or special fluids during the episode (excluding breast milk and oral rehydration solutions), giving of non-liquid treatments (generally antibiotics or anti-diarrheals), mother's potential availability of time (mother's work status and the ratio of older children and adults to children under five in the household), and several variables measuring knowledge. The knowledge measures include mother's knowledge that ORS or SSS replaces fluids [40], mother's ability to recite or demonstrate correct mixing of the solution in use in the country (used as an indicator of her knowledge about the mechanics of ORS or SSS use because no direct measures were available for administration), and mother's concerns about diarrhea in general. In Guatemala, the Philippines, Lesotho, and Zaire mother's concern about

diarrhea was measured by a scale of the possible physical consequences of serious diarrhea. The measure differed in the two Indonesian sites. In West Java, mothers were asked if a young child could die from diarrhea, and in Central Java they were asked if diarrhea was dangerous for a young child.

Within each country, very few of the hypothesized relationships were significant and, among those that were, there was no overall consistent pattern across sites (see Table 6 for results for one glass; those for half a liter are not presented because so few showed a significant association). Mother's assessment that the child was sick, mother's education and work status, potential availability of household help, and use of other treatments were not significantly associated with volume of ORS or SSS given in any country. Mothers in Lesotho who gave extra or special fluids, were more likely to give at least a glass of SSS as well, rather than giving a smaller volume of SSS as expected. Only in West Java, was the sex of the sick child a consideration (boys were more likely than girls to have been given at least one glass of ORS), although there was a nonsignificant trend toward giving a greater volume to boys in several of the other sites.

Table 6. Results of logistic regression analyses with giving at least one glass of solution as the dependent variable (odds ratios and 95% confidence intervals)\*

	Guatemala (n = 255)	Central Java (n = 67)	West Java (n = 144)	Philippines (n = 84)	Lesotho (n = 292)	Zaire (n = 253)
Child is a girl	0.64 (0.31,1.32)	0.84 (0.23,3.05)	0.44 (0.21,0.92)	0.66 (0.24,1.79)	0.72 (0.39,1.32)	1.17 (0.43,3.32)
Other fluids given	1.4 (0.43-4.54)	1.18 (0.29,4.80)	1.36 (0.62,2.99)	0.76 (0.20,2.81)	2.09 (1.08,4.05)	1.83 (0.70,1.74)
Knowledge that ORS replaces fluids	0.84 (0.39-1.80)	0.59 (0.15,2.34)	1.05 (0.38,2.89)	2.62 (0.93,7.41)	1.66 (0.87,5.81)	0.84 (0.41,1.69)
Correct mixing knowledge	1.46 (0.65-3.26)	na	1.75 (0.84,3.65)	na	2.24 (0.87,5.81)	3.15 (1.41,7.04)
Mother's general concern about diarrhea	1.19 (0.84,1.67)	2.68 (0.30,23.72)	1.06 (0.49,2.30)	1.36 (0.73,2.52)	0.85 (0.60,1.20)	0.77 (0.51,1.14)

\*Significant associations are highlighted in bold type. Control variables that were not significantly associated with the dependent variable in any site are not displayed in the table. These include: easy access to water, mother's education, child considered not sick (vs a little sick or very sick), child was given other treatment, mother's work status, and ratio of older children and adults to children under 5 years.

Table 7. Duration of ORS and SSS administration during the last episode of diarrhea

Country	Solution	% given ORS every day of episode or longer (cases lasting 4 days or less)	% given ORS > 1 day & had diarrhea > 1 day	% given ORS who had > 1 day of diarrhea
Ecuador (cases in last 2 weeks only)	ORS or SSS	34.6 (n = 78)	41.0 (n = 117)	87.4 (n = 135)
Guatemala	ORS or SSS	36.9 (n = 103)	62.4 (n = 263)	98.9 (n = 266)
West Java	ORS	na	31.3 (n = 134)	93.7 (n = 143)
Philippines (cases in last month only)	ORS	26.1 (n = 23)	51.6 (n = 31)	95.0 (n = 40)
Lesotho	SSS or ORS	61.4 (n = 145)	91.6 (n = 274)	94.6 (n = 296)
Zaire	SSS or ORS	23.1 (n = 91)	76.8 (n = 237)	98.4 (n = 250)

Of the hypothesized knowledge variables, knowing how to mix ORS or SSS correctly (a possible measure of exposure to detailed information about the solutions) was associated with giving at least one glass of solution only in Zaire. General knowledge that oral rehydration solutions replace fluids was not significantly related to giving at least a glass of solution, nor was concern about the danger of diarrhea.

The lack of significant associations could partly have been a function of the small number of cases for some of the sites (specifically Central Java and the Philippines). However, increasing the sample size by including all last cases of diarrhea, instead of only those occurring within the last 3 months, did not change the results.

#### Duration

The ORT policies in most countries recommend a limit of 2-4 days for giving home treatment, referring mothers to health centers or doctors if diarrhea persists. Table 7 shows the percent of children who received an oral rehydration solution every day of an episode lasting 4 days or less. Only in Lesotho did a majority (61%) of mothers give oral rehydration solutions for the entire duration of an episode lasting four or fewer days. In the other sites, approximately one-quarter to one-third of children were given ORS or SSS every day they had loose stools.

We also looked at a less exact measure—giving of ORS or SSS for more than one day. In all six sites with data on duration of ORS or SSS administration, the vast majority of children had diarrhea for more than one day (see Table 7). Thus, they had a good chance of losing substantial amounts of fluids. However, a substantial proportion of children with more than one day of diarrhea were given ORS or SSS for only one day. Duration of oral rehydration solution administration varied greatly across sites, ranging from a low of 31% of children given ORS for more than one day in West Java to highs of 77% in Zaire and 91% in Lesotho, countries in which SSS was the solution most widely promoted.

#### Explanations for short duration

Logistic regression analyses were carried out using the same controls and independent variables, but with the criterion variable "gave ORS or SSS for more than one day if the child had loose stools for more than a day." Again, few of the hypothesized factors were significantly associated with duration of giving oral rehydration solutions in each country (see Table 8). Mother's perception that the child was sick was associated with giving SSS for more than one day in Zaire and showed a similar, but nonsignificant, relationship in Lesotho and no significant association in Ecuador, Guatemala or West Java. The pattern of treatment for the episode (use of other treatments or giving of other fluids) was not consistently related to duration of ORS or SSS administration. Only in West Java was duration of use of ORS significantly (but positively) associated with giving other treatments such as antibiotics or anti-diarrheals. Duration of ORS or SSS administration did not differ between boys and girls in any country.

Overall, knowledge about rehydration and about mixing was not associated with duration of ORS or SSS administration. Only in Guatemala did knowledge of rehydration positively influence giving ORS for a longer period of time. Also in Guatemala, mothers with greater concern about diarrhea (knowing more signs of serious diarrhea) were more likely to have given an oral rehydration solution for more than one day.

Expanding the sample to include all last cases of diarrhea produced almost the same results. The only difference was that, in addition to mothers in Guatemala, those in West Java were more likely to give ORS for more than one day if they had a greater concern about the danger of diarrhea.

#### Study limitations

The data used in this study were collected to evaluate the impact of seven health communication programs. The research and the survey instruments

were designed to allow for some cross-site comparison, but were developed primarily to evaluate the specific components of each individual country's program. All the projects addressed ORT but the content of the messages, the communication channels used, and the intensity of the communication efforts varied. In particular, volume and duration of use, the themes of this study, were minor elements of the communication efforts.

The findings reported here cannot always be generalized to the population of the entire country in question. For most of the sites, to evaluate the impact of the communication activities among specific audiences, the sample was chosen to represent the population of specific geographic areas (i.e. the regencies chosen in the provinces of Central and West Java and the city of Lubumbashi in Zaire) or the population in certain demographic categories (i.e. lower income families in urban areas in the Philippines).

The variation in research contexts also has limited the number of variables that could be compared across sites, particularly those measuring knowledge. As noted previously, in the sites studied, the major focus of the ORT communication programs was to convince mothers to use ORS or SSS for virtually all episodes of diarrhea and to mix the solution correctly. Many of the programs also discussed the need for fluids and the efficacy of ORS or SSS as a fluid. Knowledge and behavior relevant to these issues were measured in most of the sites using questions that were as similar as possible given cultural and linguistic differences. In most of the sites, instructions on administration of the solution were expected to be given by health workers or volunteers or were listed on the ORS packets themselves. Ecuador was the only country in which the mass media messages specified the quantity to give a child. However, even in Ecuador, detailed questions about knowledge related to ORS administration were not asked because of the space limitations in a survey evaluating mul-

tiples topics (immunization and growth monitoring, in addition to use of ORS).

These factors have limited our ability to examine ORS or SSS administration in detail within each country. However, despite the differences in samples and measures, comparison across the six countries shows a similar pattern of giving lower than recommended volumes of the solutions and of giving ORS or SSS for fewer days than recommended in each country, but of giving other fluids and breast milk during diarrhea.

## SUMMARY AND DISCUSSION

### Volume

As has been shown in previous studies of ORT practices, we found that children in six samples from five developing countries generally received volumes of oral rehydration solution far below those recommended by WHO or by the diarrheal disease control program in each country. Although the majority of mothers gave at least a glass (200–250 ml) of solution on the first day they gave the solution, few gave more than that.

Volume of ORS/SSS given varied substantially among sites, with no apparent pattern by continent, by solution used, or by the volume of the recommended solution (1 liter or 200 ml mixtures). Children in Guatemala and Lesotho received the largest volumes of oral rehydration solution. There was no clear indication of why these two sites showed higher volumes than the other sites. Guatemala promoted ORS, whereas Lesotho focused on SSS. Children in Guatemala were the least likely among those studied to have received an oral rehydration solution at all (6%), whereas children in Lesotho were the most likely to have been given an oral rehydration solution (67%). Guatemala had not yet started its mass media ORT program, whereas Lesotho had been involved in a two-year effort to promote ORT through radio and health providers.

Table 8. Logistic regression results for duration of ORS or SSS administration (odds ratios and 95% confidence intervals)<sup>a</sup>

	Ecuador (n = 115)	Guatemala (n = 231)	West Java (n = 134)	Lesotho (n = 253)	Zaire (n = 235)
Child not sick	na	0.74 (0.38,1.44)	1.19 (0.38,3.77)	0.47 (0.16,1.38)	0.36 (0.17,0.80)
Child given non-fluid treatment	0.68 (0.31,1.53)	1.2 (0.63,2.27)	3.90 (1.45,10.48)	0.79 (0.30,2.05)	1.62 (0.68,3.86)
Ratio of family size to number of children under five	1.06 (0.92,1.23)	0.98 (0.84,1.15)	0.76 (0.57,0.97)	0.97 (0.80,1.17)	0.92 (0.82,1.02)
Knowledge that ORS replaces fluids	1.62 (0.68,3.86)	2.0 (1.06,3.78)	0.58 (0.19,1.80)	1.72 (0.61,4.83)	1.29 (0.65,2.58)
Correct mixing knowledge	0.74 (0.31,1.77)	1.03 (0.54,1.94)	1.19 (0.51,2.78)	0.65 (0.20,2.10)	1.17 (0.60,2.29)
Mother's general concern about diarrhea	0.87 (0.50,1.53)	1.57 (1.18,2.07)	2.43 (0.97,6.11)	1.44 (0.80,2.58)	0.97 (0.64,1.49)

<sup>a</sup>Significant associations (at  $P < 0.05$ ) are highlighted in bold type. Control variables with no significant association in any site were eliminated from the table. These include: easy access to water, mother's education, sex of child, age of child, child was given other fluids, and mother's work status. Analyses could not be performed for the Philippines because duration of giving ORS was available only for the 31 diarrhea cases given ORS within the last month.

Mothers in these samples generally did give more than a few spoonfuls of solution in a day. However, in the Philippines and West Java, a quarter of the children received under half a glass of solution in a day, and a quarter of Central Javanese children received under three-quarters of a glass. In the Indonesian sites, this could partly be explained by the promotion of a packet to be mixed in a 200 ml glass instead of in a liter container. Mothers in West Java in particular seemed to limit themselves to giving at most one glass on the first day. The smaller packet of salts mixed in a drinking glass may indicate to mothers that a child with diarrhea only needs one glass of the solution particularly if, as was found in West Java, health workers and volunteers only give out one or two packets at a time. However, this does not explain the equally low volumes given to children in the Philippines, where one-liter packets were provided.

#### *Duration*

The mothers studied generally did not give oral rehydration solutions to children with diarrhea for as long as recommended—every day of the episode, to replace fluids and prevent dehydration due to continued loose stools. Considering only cases lasting up to four days (by which time mothers should be seeking outside help), only in Lesotho did a majority (61%) of children receive the solution every day they had diarrhea. In the other sites, daily administration ranged from 26 to 37% of cases given oral rehydration solutions at all.

However, in four out of the six sites, at least half of the children with diarrhea for more than one day were given oral rehydration solution for more than a day. The exceptions were children in West Java and Ecuador. A possible explanation for the shorter duration in West Java is that mothers waited until diarrhea had "continued," as recommended. Following the recommendations would preclude giving ORS every day of the episode or perhaps even more than one day. However, in Ecuador, the mass media messages told mothers to give ORS from the start of the episode. It may be that the majority of mothers in our samples watched their child for one or two days before deciding their child needed oral rehydration fluids or until their child became thirsty and asked for more to drink.

Daily administration of ORS in all sites promoting ORS packets may be constrained by mothers not being given enough packets to allow them to give ORS every day of the episode. This could be confirmed only in West Java, where mothers reportedly received one or two small packets in one health visit. However, the evaluation of the program in Ecuador documented problems with easy access to ORS packets which may have contributed to the shorter duration of giving ORS in this site [41]. Mothers in Lesotho and Zaire, were the most likely to have given oral rehydration solutions for more

than a day. This may be the result of ease of access; in both sites solutions using locally available sugar and salt were promoted.

#### *Predictors of volumes given and duration of ORS/SSS administration*

In regression analyses for each country we examined a number of factors that could explain some of the similarities and differences seen in the broader, cross-site analyses. These included general measures of knowledge about rehydration and diarrhea, time availability, use of other treatments, and mother's view of the condition of the child.

Overall, very few of the hypothesized predictors of ORS/SSS administration were significantly related to volume given or to duration, within any one country or across the sites. However, because of the limited precision of many of the measures used, we do not conclude that knowledge or beliefs about ORT and other factors in the mother's life could not have an impact on administration of oral rehydration solutions as recommended.

For this study, we had only indirect measures of mother's time, being limited to data on whether the mother worked outside the home and a crude measure of potential availability of help for child care. We expect the time required to seriously constrain giving an adequate volume and giving an oral rehydration solution a spoonful at a time over several days. In light of the efforts in developing rice-based solutions that are also time-consuming, mother's time needs to be examined in greater detail and with more accurate measures before it can be ruled out as a limiting factor.

Gender of the sick child was a significant predictor of administration only in West Java and only for volume in one day, not duration. The question of whether mothers give more ORS or SSS to boys than to girls needs to be addressed in more detail in the future. There was some evidence, although not statistically significant, that boys in other sites were also more likely to have been received a greater volume of ORS or SSS.

Contrary to our expectation, giving the child another treatment, such as anti-diarrheals or antibiotics, did not explain lower volume or shorter duration of oral rehydration solutions. However, the lack of association may be partly a function of the measure used; we looked only at whether any other treatment was given and were unable to enumerate how many other treatments were used. These data also could not show the interaction between use of anti-diarrheals or antibiotics and use of oral rehydration solutions (at all or in the volume and for the length of time recommended). Are oral rehydration solutions or fluids used along with other treatments or are they used sequentially, with ORS or SSS being replaced by pills or syrups when the diarrhea does not stop?

The question of greatest interest in this study was about the association between knowledge and administration and about the potential role of communication in ORT administration. For this study, three variables measuring knowledge or beliefs could be compared across the sites: knowing that ORS or SSS replaces fluids, knowing correct mixing of ORS or SSS, and a measure of general concern about diarrhea. On the whole, these three knowledge variables were not significantly associated with volume or duration of ORT administration.

ORT programs have emphasized the importance of teaching mothers that ORT works not by stopping diarrhea but by replacing fluids. However, research examining the relationship between knowing the function of oral rehydration solutions and use of the solutions has shown conflicting results [4, 15–17]. Other analyses of these data have shown that mothers who knew that ORS or SSS replaces fluids were more likely to have used an oral rehydration solution at all during their child's diarrhea [17]. However, the analyses here indicate that this general knowledge did not have an impact on the volume of solution that the mother gave her child (either a glass or half a liter) or on duration. Program implementors and researchers need to go beyond addressing simple knowledge of the function of ORS or SSS and look more carefully at how mothers think about diarrhea. Although mothers may know the function of oral rehydration solutions, they may have very different views as to how much solution is actually required to serve this function or how long the solution should be given. Mothers who give other fluids may conclude (perhaps correctly) that the child is receiving enough fluids from these sources and that greater quantities of ORS or SSS are not necessary. In addition, knowing about rehydration may interact with the symptoms of the episode (e.g. number or liquidity of stools) or with the child's level of thirst.

Mothers also may give lower than recommended volumes of ORS or SSS because they do not know how much to give. Because administration was not a major focus of the communication messages in these programs, mothers interviewed in the surveys were not asked what volumes of ORS or SSS they thought a child should have or how long they should give the solution; thus we cannot be sure that mothers had the correct information. Past research suggests that mothers who are given careful administration instructions are more likely to give a greater volume [9–11] but also that many still do not give the recommended volume of ORS [12–14]. This study is limited to concluding that giving mothers accurate ORS or SSS *mixing* instructions generally will not influence *administration* of the solutions. More information is needed on whether mothers actually know the correct volume of ORS or SSS to give, know when to start giving it, and know how long to continue. However, we also need to know why mothers do not give greater volumes in a day or do not give solutions for

more than one day even if they have correct information. Does the child refuse to drink substantial volumes, or does the mother think the child cannot drink that much? Does the mother still not understand the instructions? Are other factors that are unrelated to knowledge, such as availability of time or access to ORS packets, limiting mothers' correct administration?

Detailed studies of mothers' behavior during their children's diarrhea have suggested that they continually assess the severity of the episode, the need for specific treatments, and the mechanics of treatment (such as how much and how long to give fluids), reacting differently to episodes they consider to be more serious [9, 15]. In our samples, mothers generally did not differentiate in their ORS or SSS administration according to their view of whether the child was sick or not. Children who were considered "not sick" were no less likely to be given at least a glass of solution or to be given at least half a liter (where this could be measured). Other studies have found a link between mothers' view of the severity of the diarrheal episode and use of an oral rehydration solution at all [8, 20, 21]. The current study suggests that, once a mother chooses to give ORS or SSS to the child, she does not give a larger volume of solution or give it for a longer period of time if she considers the child to be ill. This is another area needing more detailed research. Mothers may use finer distinctions than "not sick" vs "moderately or seriously sick" or may wait for certain symptoms in deciding how they will administer oral rehydration solutions.

#### *Appropriate use of oral rehydration solutions and fluids during diarrhea*

A major limitation of this study is that we were not able to assess whether the child in question was dehydrated or in danger of becoming so. Oral rehydration solutions are not necessary if the child is not dehydrated, and the vast majority of episodes will not result in dehydration [19, 26]. However, most studies, including this one, evaluate mothers' administration of oral rehydration solutions for all episodes of diarrhea, without separating out those with dehydration or those with symptoms indicating a severe case. In mild episodes, mothers may correctly assess that the child does not need ORS or SSS yet, or the child may refuse to drink the solution because he or she is not dehydrated.

In the countries studied here, ORS or SSS was recommended for virtually all episodes of diarrhea (with the exception of West Java, which officially recommended ORS if "diarrhea continues"). However, the majority of mothers did not give an oral rehydration solution to their child during the last episode of diarrhea and, of those who did, most did not administer the solutions in the quantities or for the time recommended. Only in Lesotho, where sugar-salt-solution was the dominant oral rehydration solution, did a substantial proportion of mothers

use ORT at all, matched with a high median volume used and sustained use for the entire episode.

On the other hand, the great majority of children, whether or not they received ORS or SSS, did receive other fluids (including breast milk) during diarrheal episodes. Without estimates of the volumes of other liquids given, or of the severity of dehydration in each specific case, we cannot be sure whether administration of other fluids or continued breastfeeding made up for the shortfall in ORS or SSS. However, it is likely that many children who drank less than the recommended volume of oral rehydration solution did not suffer from this; indeed they might not have accepted the recommended volume of ORS or SSS if it had been offered. Since only up to 10% of episodes of diarrhea risk dehydration, it is likely that few children would be sufficiently thirsty as the result of fluid loss to find large quantities of salty-tasting water appealing.

The recommendation made in most of these sites—that all cases be given ORS/SSS—reflects a legitimate biomedical concern with doing no harm; it seems better to over-recommend treatment than to risk non-use of ORS/SSS when it is needed. However, that recommendation may be unrealistic given the needs and behavior of children during diarrheal episodes. Indeed, the pattern of treatment observed may correspond more closely to more recent WHO guidelines for ORT promotion programs, which stress the use of home-available fluids for milder diarrhea and expect ORS to be reserved for more serious cases that have been treated in clinics [6].

In the future, researchers need to focus more on overall fluid intake during diarrhea and on home-available fluid and ORS/SSS use in the context of the child's need for these fluids. Although this study suggests that mothers continued fluids or gave extra fluids during diarrhea, in a number of sites this reflected continued breastfeeding rather than offering other liquids to the child (see Table 5). In Central Java, Lesotho, and Zaire, giving of extra or special fluids was particularly low. In addition, in 4 out of the 7 sites, children who were not given oral rehydration solutions were also less likely to have been given more or special fluids (excluding breast milk).

Those developing ORT policies and programs must consider that most mothers in these seven sites did not administer oral rehydration solutions as recommended. Thus far, we have not been able to describe the basis for such decision, although this study suggests that simply providing information to mothers about the function of rehydration solutions, about the danger of diarrhea and dehydration, and perhaps even about how to mix and administer the solutions will not be sufficient to increase volume and duration of ORS or SSS administration. Policy makers, and program planners and implementors need to know more about the decision process mothers go through when treating their children's diarrhea and about the factors that influence their decisions in

choosing and using oral rehydration solutions or other fluids.

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32. The term used to ask about diarrhea in each country was identified through preliminary research. We attempted to use the broadest term possible (for example, in Indonesia we used the phrase "stools that are more watery and frequent than usual") to try to include mild episodes along with those considered more serious.
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36. In each country volumes were computed based on the drinking vessels available in the country. In Central Java and West Java, in cases where children were not given full glasses of solution, the volume assigned was the midpoint (e.g. less than  $\frac{1}{2}$  glass was coded as  $\frac{1}{2}$  glass or 67 ml). No computations had to be made for the Philippines data as the interviewers had coded the volume in ml. In Zaire, a spoonful was coded as 2 ml and a glass, cup or baby bottle was coded as 250 ml. In Lesotho, a spoonful was coded as 2 ml, a cup, enamel mug, or feeding bottle was coded as 250 ml, and beer cans and dishes were coded as 300 ml. In Guatemala, a teaspoon was coded as 2 ml, a tablespoon as 6 ml, and bottles and "pachas" as 250 ml. For mothers who gave ORS in cups or glasses, or who said they gave a liter, a more direct method of estimation was possible. Mothers were asked what vessel they used most frequently for drinking and what they would use to measure a liter. Each of these items was filled with water and the volume measured. Mothers who gave cups or glasses of ORS were assigned the ml value of the container they provided as a drinking vessel. Those who reported giving one or more liters of solution were assigned a score based on the volume of the container they used to measure a liter (from 750 to 1250 ml). Measures of volume given to the child were not available for Ecuador.
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39. In the surveys, the mothers were asked about the different symptoms of the episode of diarrhea (e.g., approximate number of stools per day, vomiting, blood or mucus in the stools) and were also asked to assess the severity of the episode. The latter was measured by asking the mothers, "In your opinion, what was the condition of the child? Was he/she not sick at all, a little sick, moderately sick, or very sick?" using local terms identified during pretesting. The variable used grouped all children considered by their mother to be sick at all in the "sick" category and children considered "as usual" or "healthy" in the "not sick" category.
40. All mothers who were aware of ORS or SSS were asked what the solution was for or what it did to help children with diarrhea. Mothers who gave answers about replacement of water or fluids were coded as knowing something about the function of oral rehydration solutions. Those who gave responses having no relation to adding or replacing fluids (such as stopping or curing diarrhea, preventing vomiting, curing other illnesses), and those who responded "don't know" to the questions were coded as not knowing the function of the solutions.
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