
Evaluation of Oral Rehydration Therapy in Matiguas, Nicaragua

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Synopsis

Use of oral rehydration salts is an effective tool to decrease deaths due to diarrheal dehydration. Following concerted educational efforts to introduce oral rehydration therapy, Nicaragua reported a significant decrease in deaths of young children from diarrhea and dehydration over a 5-year period. Further decline in the mortality rate has not occurred, however, and factors that would affect usage and impact are poorly understood.

A health survey was administered in 155 randomly selected homes in Matiguas, Nicaragua, in July 1990. Caretakers of children were asked about their knowledge, attitudes, and practices in treating diarrhea in children younger than age 5. They were also asked to demonstrate their knowledge of mixing World Health Organization oral rehydration salts packets.

Ninety percent of the respondents said they used oral rehydration therapy. The major reason quoted for not using it was dislike of the taste. Of the three-quarters willing to mix the oral rehydration salts, 62 percent prepared the solution correctly and 38 percent incorrectly.

Knowledge about diarrhea and the role of oral rehydration therapy was high in this population, and those with this knowledge were more likely to use it. Respondents who learned to mix the oral rehydration salts at the health center had more years of education and were more likely to mix the salts correctly.

In this study, there is a positive association between contact with the health center and correct use of the rehydration salts. The relationship of this association with morbidity and mortality needs further research.

THE MAJOR KILLER of children younger than age 5 years in developing countries is diarrheal dehydration; 4 million children die from it each year (1-3). Because oral rehydration therapy (ORT) is effective, easily administered, and inexpensive, it has the potential to reduce this mortality substantially (3-5). Worldwide efforts to promote ORT in various forms have resulted in an initial decrease in mortality from diarrheal illness in countries where it was introduced, but the decline for developing countries has not continued (3,6-9).

Factors associated with the success or failure of ORT projects are complex (see box). During the 1980s, the Government of Nicaragua spent a significant percentage of the national budget on health care (10). ORT education and immunizations were primary focuses of the National Health Promotion Campaign

of Nicaragua started in 1979 (11). ORT education included teaching the preparation of World Health Organization (WHO) oral rehydration salt (ORS) solutions to community health workers and to the public at large via newspaper, radio, and television advertisements (12). Education regarding the identification of diarrhea, its causes, sanitation, nutrition, the importance of continued breastfeeding, and the availability of free ORS packets from WHO at the health center was also stressed. Hoping to simplify ORT education, authorities deliberately did not teach how to make solutions at home. The program had a number of the features associated with successful ORT programs (box).

The childhood mortality rate from all causes in Nicaragua declined from 120 per 1,000 in 1978 to 76 per 1,000 in 1983 but has not declined further (13).

Features Associated with Successful and Unsuccessful Programs Promoting Oral Rehydration Therapy (ORT)

Successful

1. Expert supervision and leadership (8)
2. Education of both literate and illiterate caretakers in ORT use (9,17)
3. Easy access to the ingredients of salts caretakers in ORT use (20,21)
4. Longitudinal support and followup by health care providers (26,27)
5. Recognition of the roles and status of women in the design of programs (28,29)
6. Cooperation between the government, media, pharmacists, health care workers, and caretakers (28,30,31)

Unsuccessful

1. Lack of an infrastructure to sustain programs in communities (8).
2. Difficulty in altering attitudes and behaviors of families (8,32).
3. Inadequate access to referral facilities for children who do not improve with ORT (8).
4. Biases of health care workers and the private sector which favor more technological and more expensive interventions and medicines (8).

Acute diarrheal dehydration moved from the leading reported cause of in-hospital mortality in 1978 to the fifth ranking reported cause of in-hospital mortality in 1983 (12). Public health officials have suspected that incorrect use or mixing of ORS may contribute to the lack of further decline in the childhood mortality rates from diarrheal dehydration. Little is known about how the mothers or other caretakers of children use ORT.

Complications other than dehydration probably account for 10-20 percent of deaths from infectious diarrhea (14-15). While efforts to lower the mortality rate from diarrheal illness further are aimed logically at improvement of the socioeconomic status of communities, with associated improvements in sanitation, water supplies, and nutritional status, it is possible that the therapeutic effects of ORT have not been maximized.

The ability of child caretakers to prepare a solution for oral rehydration correctly is an important prerequisite to a successful program (16). In this study, the capacity of the caretakers to mix a solution for oral rehydration using WHO oral rehydration salts was evaluated. The WHO ORS packet contained 3.5 grams of sodium chloride, 1.5 grams of potassium chloride, 2.5 grams of sodium bicarbonate, and 20 grams of glucose (6). We examined the population of one village in Nicaragua, a country with a decade of public health efforts to encourage the use of ORT as an early home intervention for diarrheal illness. The sole clinic in the village provided the infrastructure for ongoing education and support of ORT.

In several surveys, caretakers have been asked how they mix the oral rehydration solutions from WHO packets and from home ingredients. In a few surveys, the preparation was supervised or samples of solutions mixed from home ingredients were collected

(17-19). In the health survey conducted by three teachers from Matiguas and Ms. Gibbons, we were among the first to ask the caretakers of young children to describe how to mix the solution and actually to mix it. Additionally, we attempted to replicate previous findings regarding knowledge and attitudes towards ORT. We hypothesized that there would be differences between the caretakers who mixed rehydration solutions correctly and those who did not. Specifically we expected the caretakers who mixed the solutions incorrectly to be poorer, less well educated, with less knowledge about diarrheal illness, and to have more cultural biases against ORT.

Methods

Matiguas is a rural town of 10,000 people located in the mountains of central Nicaragua. At the time of this study, the main source of health care, the Centro de Salud (health center), was a government-operated hospital and clinic, centrally located, with free care and prescriptions. Two private physicians intermittently worked and lived in the town, although neither were in town at the time of the study. The presence and role of lay healers was not studied.

A map of the town was made and a random sample of homes was selected from each block. Only the 873 households with children younger than age 5 years were included in the sampling frame. We chose a sample size of 155 to permit a minimum precision of 8 percent with alpha equal to 0.05 when estimating the proportion of those with a given response.

At each of the 155 randomly chosen households, the person taking care of the children at that time was interviewed. While our definition could have included fathers or male household members, all respondents were female. Family size, and the age and sex of all

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those living in the house were noted. A rough indication of socioeconomic status (SES) was determined using a person-per-room ratio. Those with a higher number of persons per room were considered to have a lower SES.

Data collected included demographic information, frequency of health center use, number of cases of diarrhea of children younger than age 5 during the past 2 months, method of treatment of diarrhea, and reasons for using this treatment. Breast-feeding practices when the child had diarrhea were also noted. Definitions of diarrhea were noted. Diarrhea was defined as bowel movements that had more liquid consistency or were more frequent than usual, or both (5).

Following the preliminary questions, the caretaker was asked to identify a WHO ORS packet. She was asked to state where she had heard of ORT and where she learned to use it. Lastly, she was asked if she did indeed use it and the reasons why or why not. Respondents were asked to describe the proper procedure for mixing the solution and then were asked to demonstrate mixing an ORS solution. The caretaker was given a WHO ORS packet which she then mixed using utensils and measures in the home. A 1-liter cup was then used by the interviewer to measure whether the solution had been correctly mixed or not.

At the end of the interview, respondents were asked to describe any homemade solutions that they knew about or used.

Results

In the 155 households sampled, 132 (85 percent) women agreed to the interview, and 73 percent of those interviewed agreed to mix the ORS salts. The average family had seven members, two of whom were younger than 5 years. The caretakers had a mean age of 36 years (range 17–85), and 4.4 years of

education (range 0–16). Over the preceding 2 months, respondents averaged two visits of family members to the Centro de Salud, and the children younger than 5 experienced on average two cases of diarrhea (range 0–12).

Knowledge. Seventy-two percent of all respondents described diarrhea as a bowel movement that was soft or frequent, or both. All respondents had heard of ORT, and 99 percent correctly identified the packet. Ninety-two percent described the correct procedure for mixing WHO ORS with water. Of the 118 willing to demonstrate mixing the ORS packet, 63 percent correctly measured exactly 1 liter. A breakdown of the respondents mixing ORT with different volumes of water shows

<i>Water used to mix ORS</i>	<i>Number</i>
0.5 liter	8
0.62 liter	1
0.75 liter	19
0.88 liter	8
1 liter	74
1.12 liters	8

Practices. More than 90 percent of respondents said they used the health center and it was there that they learned how to mix and use oral rehydration solutions with WHO ORS. Nearly two-thirds of the caretakers mentioned that they took their child to the Centro de Salud when their child had diarrhea. Although 89 percent said they used WHO ORS, only 75 percent said they had administered it to their children who had diarrhea during the past 2 months. Eighty-eight percent did not have a packet of ORS in the house. Ninety-three percent of those who were breast feeding said they continued to breast feed when their child had diarrhea. Table 1 lists the explanations respondents gave for treating diarrhea. Of those who did not use WHO ORS, the majority said that it was because of the taste.

Respondents with more years of education were more likely to mix WHO ORS correctly (odds ratio 2.7; confidence interval [CI] 1.08, 6.82), as were respondents who learned to prepare ORT at the Centro de Salud (odds ratio 2.1; CI 0.87, 5.16) (table 2).

Socioeconomic status did not correlate with correct or incorrect mixing. Of those who mixed the solution incorrectly, 81 percent added too little water (too concentrated). Those with fewer years of education, larger families, and larger numbers of dependents claimed to use ORT more often, but the difference lacked statistical significance. Those who administered ORS were more likely to mix it correctly

(odds ratio 3.5; CI 1.16, 10.70) (table 2), have an accurate definition of diarrhea (odds ratio 2.91; CI 1.15, 7.39), use it "for rehydration," and treat diarrhea by going to the Centro de Salud (odds ratio 2.21; CI .089, 5.57) (table 3). Those who breast fed were less likely to administer ORT than those who did not.

Discussion

The educational efforts had effectively taught caretakers of children in this study the definition of diarrhea and how to mix a rehydration solution from WHO ORS packets. Most (two out of three) mixed it correctly. Those who learned to mix the solutions at the clinic were more likely to mix them correctly than those who learned elsewhere. Those who treated diarrhea by taking their child to the clinic were more likely to administer the oral solutions to their child than those who did not use the clinic.

These findings suggest a role of the public health system in teaching and supporting the use of ORT. Conversely, women positively disposed to ORT and to the beliefs of the public health system might be more likely to use the system and be motivated to use their prescriptions correctly. While this study suggests the former, it does not eliminate the possibility of the bias inherent in the second explanation.

Other studies, however, have shown that ORT education and access to ORS are the main factors associated with successful ORT programs (17,20-22).

Some studies have suggested that concentrated solutions are more dangerous than diluted ones (20,23). Further work is needed to clarify the relative risks of more diluted versus more concentrated mixtures. In this study, 36 of the 44 who mixed it incorrectly mixed more concentrated solutions. Public health education efforts have addressed the issue of dispensing standard containers to measure one liter (7). One author suggests the WHO ORS packet be adjusted to correspond with a common, locally known container (24). Perhaps the use of a local 1-liter container (or worldwide 1-liter packet) would increase the likelihood of correct mixing.

Exposure, knowledge, and actual use of ORT in this population is high. Factors associated with incorrect mixture, such as lower education level and ORT instruction from other than the Centro de Salud are important findings. Groups with these characteristics could be targeted with increased education, not only in Nicaragua but throughout the developing world. Less frequent use of the ORS packet was associated with inaccurate definitions of diarrhea, treating diarrhea by other methods than taking their

Table 1. Reasons given for treating diarrhea compared with reasons for using World Health Organization oral rehydration salts (ORS)

Reasons	Percent
For treating diarrhea:	
Help stop the diarrhea	30
The health center knows best	25
For rehydration	10
For using World Health Organization ORS:	
For rehydration	35
To get help to stop diarrhea.....	18
It refreshes the stomach.....	10
Because the center says so.....	5

Table 2. Characteristics of respondents mixing ORS

Characteristic	Correct mix (percent)	Incorrect mix (percent)
Education (N = 118):		
0-1 years	45	55
2-6 years	67	33
7 or more years.....	73	27
Site of learning (N = 118):		
Clinic	68	32
Other	50	50
Use of ORT in prior 2 months (N = 97):		
Use of ORT.....	86	14
Did not use ORT.....	64	36

Table 3. Relationship of clinic attendance to use of Oral Rehydration Therapy among 132 respondents

Use of clinic	Claim to use ORT (percent)	Did not use ORT (percent)
Went to clinic.....	82	68
Did not go to clinic	18	32

child to the Centro de Salud, and not knowing ORS is used for rehydration. Steps toward increasing the frequency of ORT administration might include efforts to increase knowledge about diarrhea, dehydration, and the role of ORS as a rehydrating agent.

An intriguing finding was the association between fewer years of education, a larger family size, and lower socioeconomic status with claims to use ORT. This might be an artifact of the political and social structure of Nicaragua at the time. Perhaps the wealthier, smaller families were more likely to seek care from private physicians. The attitudes of these private physicians towards the WHO ORT program are unknown. On the other hand, SES had no effect on knowledge about the preparation of the packets or

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correct mixing.

In this survey, caretakers were asked what they did for children with diarrhea before being asked information about ORT; the order of questions hopefully reduced claims to use ORT as a response to please the interviewer.

Bias may also have been introduced by the presence of a North American during the interviewing. This effect would be small, since she was present only for one-third of the interviews, and all the questions were asked by members from the community. Because the interviewers were from the community, possible interpersonal biases may have affected the results. Although the focus of the survey was aimed at assessing the knowledge, attitude, and practices of primary caretakers, the methodology could have been strengthened by interviewing the community health providers and lay healers to assess their knowledge, attitudes, and practices regarding ORT.

Additionally, it is unknown whether the results from this study in one village are representative of the country as a whole. It may indeed be most representative of the rural areas, with fewer sources of alternate health care and only one health center. Lastly, our data on the number of diarrheal episodes may be inaccurate due to recall bias. Findings reported by Martorell and coworkers in 1975 suggest that mothers underreport days of illness by about 22 percent when longer than 2 weeks has passed since the illness (25).

In summary, this study suggests that caretakers of children in areas where ORT has been promoted have an accurate definition of diarrhea and know how to mix an ORS packet. Second, administration of WHO ORS was positively associated with correct definitions of diarrhea, knowledge of the rehydration purposes of ORT, and use of the Centro de Salud when a child had diarrhea. Further efforts to promote correct use of oral rehydration solutions might be directed at identifying a local 1-liter container and focusing ORT educational efforts on less educated

families. Additionally, facilitating access and promoting use of public health clinics that advocate ORT may accomplish the most to maximize any further impact ORT might have on decreasing childhood mortality from diarrheal illness.

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