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DIARRHEAL DISEASE CONTROL: WHERE WE HAVE BEEN AND WHERE WE ARE GOING

Martita Marx, Dr. P.H.
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THE PROBLEM

Diarrhea has afflicted people from the dawn of time. In its most virulent form, epidemic cholera, diarrheal disease has devastated populations, disrupted history and eluded attempts to check it. In its more common endemic form, diarrhea is also deadly and disruptive to families. It is only in the last hundred years that preventive measures in the world's industrialized nations have made diarrhea a rare affliction in those settings. In populations of the world lacking clean water, sanitation and proper food handling precautions, diarrhea rages unchecked.

Diarrhea is still one of the world's leading causes of death in infants and children under five years of age. It is also one of the most frequent causes of childhood morbidity and a major contributor to childhood malnutrition. The World Health Organization (WHO) estimates that each year there are over a billion episodes of acute diarrhea in children, and over four million deaths from this cause alone. In developing countries the situation is particularly grim. Here, diarrhea-related deaths account for one-third of deaths of children under five.[1]

Diarrheal deaths can either occur quickly by dehydration, gradually by wasting associated with persistent diarrhea, or through medical complications, especially in the case of dysentery. Sixty to seventy percent of all diarrheal deaths are caused by dehydration. Dysentery accounts for about 10-15 percent of diarrheal episodes but about 25 percent of diarrheal mortality. Approximately 5-20 percent of diarrheal episodes last longer than two weeks, but 30-50 percent of diarrheal deaths are

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[1] WHO/CDD TAG, 4th Programme Report 1983-1984, p.4.

attributed to persistent diarrhea. Mortality can also be caused by complications related to diarrheal episodes, the most common of which is malnutrition.

A MAJOR TECHNOLOGICAL BREAKTHROUGH

The discovery that the water and electrolyte losses associated with diarrhea can be replaced with solutions administered by mouth has revolutionized the treatment of acute watery diarrhea. Diarrheal deaths caused by dehydration can be prevented if mothers have access to and use a low-cost, easily administered oral rehydration therapy (ORT). Thus the potential of ORT as a "magic bullet" against the devastating effects of acute watery diarrhea evoked a great deal of enthusiasm at the time of its introduction.

The implementation of the ORT technology in diarrheal disease control programs can be compared to implementing the "green revolution" in agricultural programs. New revolutionary technologies (improved seed and fertilizer) were developed under experimental situations and brought great hope of increasing agricultural output. The success of these technologies, however, was limited by difficulties encountered in applying them in the field. What has the story been with this "green revolution" of health care? We have a technology, which under "laboratory" circumstances, works. What has been its success in the "real" world?

Oral solutions, no doubt, have been administered during diarrheal episodes throughout history. However, the idea that oral rehydration therapy is the core of appropriate medical management of diarrheal disease was introduced only a decade ago. The long history of the development of the currently recommended formula for oral rehydration salts (ORS) and its worldwide acceptance is, no doubt, filled with details of medical politics. These will not be presented here. Nevertheless, it is useful to highlight some of the major landmarks in its introduction to the field of public health.

Before the 1970s, the accepted method of rehydration was intravencus therapy. In fact, it was not until the early 1960s that the optimal formula for intravenous therapy was defined. The first formula for oral rehydration based on physiologic requirements was developed in the United States in the middle 1940s.[1] In the early 1960s a few research-minded physicians

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[1]Mathuram Santosham, Kenneth H. Brown, and R. Bradley Sack, "Oral Rehydration Therapy and Dietary Therapy for Acute Childhood Diarrhea," Pediatrics in Review 8 (March 1987): 273-278.

experimented with different oral rehydration formulas.

The first large-scale field trial of oral rehydration salts was conducted in mid-1971 when intravenous supplies were exhausted during a cholera outbreak among refugees from the East-West Pakistan civil war. The results of this field trial among nearly 4,000 persons were so dramatic that they proved the value of ORS beyond doubt. Only 3.6 percent of the 3,700 cholera victims treated with ORS died compared with 25 percent who died before ORS solutions were used. These results and the careful clinical studies led the World Health Organization in the early 1980s to recommend the use of this solution for all diarrheal episodes regardless of the etiology.

The proof of the value of oral rehydration therapy coincided with a number of other developments in public health. Experience with trying to develop and sustain comprehensive primary health services during the 1960s and 1970s had demonstrated the futility of trying to meet all primary health care needs with a void of resources. As a result, public health leaders and the donor community began to focus on "selective" interventions that were both feasible in developing country settings, and had the potential of yielding a significant impact on mortality.

Reorienting health care priorities in this way met with both internal and external constraints. However, this preference for "selective" interventions in combination with "new" technological developments such as the "ORT discovery" and advances in the storage and distribution of vaccines, eventually led to the worldwide World Health Organization (WHO) CDD and EPI efforts, to the Agency for International Development (A.I.D.) "twin engines" approach, the United Nations Children's Fund's (UNICEF) GOBI strategy and to the "Child Survival" initiative.

As we consider the present status and the future of diarrheal disease control (CDD) efforts it is useful to reflect on progress within diarrheal disease control in the context of the broader health care picture.

PROGRESS IN DIARRHEAL DISEASE CONTROL

The dramatic demonstration of the value of oral rehydration therapy revolutionized the clinical management of diarrhea and prompted the World Health Organization to establish a Diarrheal Disease Control Programme in 1980. The Agency for International Development, UNICEF and many other donor organizations joined to support the development and implementation of these efforts in 1983. By 1987, ninety-six countries had operational national diarrheal disease control programs.

Although the technological breakthrough in oral rehydration therapy stimulated international interest in diarrheal disease control, the public health emphasis has been on "appropriate case management." This includes not only effective use of ORT, but the promotion of continued feeding during diarrhea, patient (or mother) education about home management and prevention, and appropriate referral of severe or complicated cases. Recognizing that the objective of reducing diarrheal disease morbidity and mortality cannot be addressed through case management alone, diarrheal disease control programs have also expanded their activities to include targeted prevention activities.

The results of the worldwide effort and focus on diarrheal disease have been impressive, particularly considering the short span of time that worldwide support of ORT and the case management approach have been available. Programs have undertaken numerous and varied program activities to accomplish their goals. The impact can be seen on a number of dimensions such as knowledge of correct case management by mothers and health workers, the use of ORT by mothers and health workers, and most importantly on the diarrhea mortality and morbidity picture. Examining these elements should give us an appreciation of the impact of this technology.

Program Activities

Nearly one decade ago neither Ministries of Health nor the World Health Organization had a diarrheal disease control program. Other donor support was virtually negligible. Since then, developing nations of the world have expended much effort on addressing the problem of diarrhea. Donor organizations have poured their resources into combating this disease. These efforts addressed a real need within the framework of something which was "doable." It is impossible to calculate all of the resources or efforts devoted to this cause. From WHO figures, however, it is possible to see the tip of this iceberg. Table 1 briefly summarizes selected program activities completed in the short time period since countries began to focus on the problem of diarrheal disease.

TABLE 1

COMPLETED CDD PROGRAM ACTIVITIES 1980-1987

	1983	1987/88
CDD programs with initial plans	72	110
Operational CDD programs	52[1]	96
Supply of ORS (1 l equiv)	110m	350m
LDCs with local production of ORS	38[1]	58
Annual local production of ORS (1 l equiv)	60m	270m
"Access" to ORT*	24%	58%
CDD training courses held		
program managers	0	13
supervisory skills	0	140
clinical management	0	139

*Access=percentage of the population having reasonable access to a trained provider of ORS.

SOURCE: Unless otherwise indicated, figures are from WHO/CDD Programme Interim Programme Report, 1988.
2. CDD/WHO Interim Program Report 1983.

Mothers' and Health Workers' Knowledge and Attitudes

In order to maximize the impact of ORT, it was soon recognized that programs must affect household behavior. This recognition led to a change from the traditional one-on-one doctor-patient approach to an approach which encompassed broad-based face-to-face as well as mass media communication efforts to change household practices. This was a revolutionary concept in medicine.

As a result, studies have shown a dramatic increase in mothers' knowledge about ORT. For example, studies have shown that in Honduras 90 percent of mothers knew about Litrosol, the ORS solution. In the Gambia between 68 and 89 percent of mothers were familiar with the sugar-salt solution (SSS). In Ecuador, knowledge, attitudes, practice (KAP) surveys showed that over 90 percent of mothers recognized "suero oral." In Pakistan, survey results showed that 87 percent of mothers knew about ORS.

Programs also recognized that health worker knowledge and practices would also have to change and, therefore, have focused much effort on training all levels of health workers. The 1988 WHO CDD Programme Report notes that about 80 percent of health workers in the Gambia, 75 percent in Mali, 70 percent in Senegal

and 50 percent in the Philippines demonstrated correct knowledge of case management when interviewed. While these figures look encouraging, a need to improve health worker knowledge about the correct assessment and treatment of diarrhea has also been evident from these survey results and from observation of health workers.

Mothers' and Health Workers' Use of ORT

The appropriate use of oral rehydration therapy for diarrheal disease episodes both by mothers and in the clinical setting has been the immediate behavioral target of CDD programs. As noted, appropriate diarrheal disease control also includes appropriate prevention activities, referral, teaching, feeding and use of antibiotics where indicated for cholera and dysentery. How have countries fared on these dimensions?

Mothers. In general, the results appear quite encouraging. Important increases in the use of ORT for episodes of diarrhea in children have been noted worldwide. The following table shows the change that has occurred from 1983 to 1987 according to WHO estimates for use rates for ORS.

TABLE 2

ESTIMATED USE RATES FOR ORS
IN CHILDREN AGED 0-4 YEARS
1983 AND 1987
BY REGION AND GLOBALLY
(IN PERCENTAGES)

	1983	1987
Africa	1	12
America(excludes USA/Canada)	2	24
Eastern Mediterranean	6	27
Southeast Asia	9	18
Western Pacific (excludes China)	9	15
Global	5	19

SOURCE: WHO CDD Programme, "Interim Programme Report, 1988," (Geneva: World Health Organization, 1989): 18-19.

WHO estimates for ORT use rates (oral rehydration salts packets--"ORS", sugar salt solution, or recommended home fluids) are even higher. The most recent global estimates (1987) are 30 percent. WHO reports 63 countries with ORT use rates of over 20 percent, up from 26 countries in 1985.[1] However, 28 countries still have ORT use rates under 10 percent. It is encouraging to note that the higher WHO ORT use figures appear to be in those countries where real efforts have been made to focus on the diarrheal disease problem.

While these general indicators present a generally positive picture, recent qualitative studies in a number of countries show the data need to be interpreted with some caution and that much remains to be done. Mothers may be using ORT but not necessarily effectively. Some studies have shown significant mixing errors of the ORS or SSS solution, others have revealed that mothers administer only teaspoonfuls of the solution, and still others show that mothers do not start administering fluids early enough and/or are not active enough in encouraging feeding during diarrhea. Significant questions remain about satisfaction with ORS and whether once a mother has tried ORT, she will use it again for future episodes of diarrhea.

Health workers. No such comparative figures exist to document practice patterns for health professionals. The few more reliable studies and field observations assessing case management practices in health facilities reveal that there is a long way to go to change clinical practice patterns. While some physicians and other health workers correctly assess and treat diarrheal disease and dehydration, many continue to prescribe intravenous therapy, antidiarrheal drugs, and antibiotics inappropriately. Health personnel often fail to communicate effectively with the mother. Appropriate referrals for nutritional intervention or for measles vaccination rarely occur. Follow-up and record-keeping systems are weak at best and diarrheal prevention activities have been difficult to integrate into the curative setting of most CDD programs.

Obviously, correct knowledge about the assessment and treatment of diarrhea is necessary but not sufficient to promote appropriate case management. Actual practice has lagged behind knowledge. A significant "KAP-gap" exists in most countries. Programs have not yet reached the goal of appropriate management of diarrhea.

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[1] "WHO/CDD Interim Programme Report, 1988," (Geneva, World Health Organization, 1989): 51-54, and "WHO/CDD Interim Programme Report, 1986," (Geneva: World Health Organization, 1987): 37-40.

Mortality/Morbidity

The raison d'etre for ORT is to reduce the mortality caused by dehydration associated with diarrhea. As noted, clinical trials have proven that ORT reduces mortality. While measurement problems make it difficult to prove that ORT reduces mortality at the community level, population-based studies in a number of countries with vigorous CDD efforts (such as Egypt and Honduras) suggest that diarrhea-related deaths have dropped dramatically following the initiation of CDD efforts.

The impact of using ORT in the community has been most evident from health facility statistics. The effective use of ORT has altered the number and types of cases presenting to health facilities, particularly hospitals. The incidence and severity of dehydration resulting from diarrhea and the diarrhea case-fatality rate have dropped dramatically in nations as diverse as Peru, Malawi, Ecuador and Bangladesh. Hospitals in these and other countries report that diarrhea wards have closed and that there are fewer cases of dehydration coming to health facilities.

In Peru, the diarrheal wards at the Cayetano hospital have closed. Malawi also closed diarrhea wards in hospitals where outpatient therapy with ORT was aggressively pursued. Physicians in Ecuador reported drops in admissions of diarrhea patients to hospitals and drops in admissions of children with dehydration. In one area of Bangladesh, a 30 percent drop in clinic attendance was noted after an intensive effort to promote the home use of ORT.

In a number of countries with successful ORT programs, as deaths due to dehydration from acute watery diarrhea have decreased, the reported proportion of diarrhea deaths due to dysentery and persistent diarrhea has increased. Studies in selected areas of Peru, Nepal, Bangladesh and India show that deaths from persistent diarrhea may account for as much as 50 percent of diarrhea-associated deaths. Egypt and certain areas of Pakistan also report this changing pattern of reported diarrheal disease mortality. Although this may be a partial indication of the success of the ORT intervention, it presents new and more difficult challenges to CDD programs.

ORT is critical to the appropriate case management of children with all types of diarrhea, because in all types of diarrhea there is a loss of fluids and electrolytes in the stool. ORT, however, does not affect the severity or duration of any type of diarrhea. In the case of dysentery and persistent diarrhea, ORT is essential to treatment but is not sufficient for optimal treatment. Nutritional interventions and antibiotics for susceptible organisms are critical. But since these complexes

are not yet clearly understood in terms of etiology, risk factors, prevention or treatment, most CDD programs are not yet effectively addressing them. While antibiotic use is discouraged with acute watery diarrhea, antibiotic use becomes important in the treatment of these cases. Likewise, it becomes critical to focus on nutritional interventions. Many diarrheal disease control programs are not yet properly equipped in training or orientation to deal with these changing patterns of morbidity.

DIRECTIONS FOR THE FUTURE

Diarrheal disease control efforts were launched worldwide approximately ten years ago, with ORT forming the core of CDD efforts. The decision to focus on a targeted intervention, such as case management of diarrhea, was stimulated by the technological breakthrough with ORS, and encouraged by the failure to demonstrate a morbidity or mortality impact resulting from hospital and health center construction and comprehensive primary health care interventions. The past decade of promoting ORT use worldwide has been filled with enthusiasm and much activity. And, as is evident, much has been accomplished in a relatively short period of time.

It is clear that focusing on the use of ORT for dehydration has brought about reductions in death and dehydration in numerous areas of the world. Yet, in much of the developing world, acute watery diarrhea continues to lead to dehydration and death much as it did before this past decade. Progress with ORT has been slower than anticipated. Many mothers and health workers now know about ORT, but in many areas of the world a significant "KAP-gap" exists.

While the rhetoric of many diarrheal disease control efforts has included prevention of diarrhea, in fact many programs are not dealing effectively with preventive activities. In areas that have successfully introduced ORT, problems of persistent diarrhea, dysentery and malnutrition are becoming more and more evident. At the same time, Ministries of Health in most developing countries are facing the problems of addressing other priority health issues in the face of severe economic constraints.

Looking back on this "history" two questions emerge:

a. What have we learned that can benefit the future of CDD activities as well as new and future disease control programs (e.g. ARI, AIDS, etc.)?

b. Where should we go from here?

Lessons Learned

What have we learned from our efforts? Briefly:

Changing Mothers' Practices

- Even with the development of a new "magic bullet," program implementation is a slow process, especially if it requires behavior change on the part of either health providers or recipients. With a few exceptions, the behaviors of mothers and of health workers with respect to diarrhea management have not changed as fast or as dramatically as hoped. Clearly, providing knowledge alone does not necessarily motivate behavior change. We need to give more attention to complex issues of the many determinants of ORT use, and the difficulty of affecting behavior change in different cultural settings.

- New technologies and new ideas are never introduced into a vacuum. Existing belief systems, competing "services" such as those provided by traditional medicine, by pharmacies or by Western medicine will all influence the acceptance of any new technology, as they have influenced the acceptance of ORT.

- Communication efforts must be sustained and responsive to mothers in order to be effective in promoting health behaviors. Creating awareness of a new product does not guarantee that it will be used effectively over time.

- Mothers not only must effectively deal with dehydration at the household level, they must also address more complex concerns related to appropriate feeding, breast-feeding, weaning, and preventive actions. If it has been difficult to communicate relatively simple concepts of dehydration and ORS, it is even more difficult to communicate these more complex concepts to mothers.

- The "product," ORS, does not meet all of the mother's needs or expectations--it does not "stop" the diarrhea. This demonstrates the point that initial enthusiasm for a new product will not necessarily assure its sustained use. Consumer expectations and the degree to which the product meets those expectations will influence continued use. Likewise, exclusive focus on a "product" by either providers or mothers limits the overall impact of effort in diarrheal disease control.

Extending the Reach of Services

- The public sector of health care often reaches only a small proportion of the target population. Even if programs are successful in implementing new interventions through the public sector, they will not reach the numbers of mothers necessary to influence morbidity and mortality rates.

- Health care efforts are not successful if they address just the "supply" side or just the "demand" side of meeting a specific set of health needs. Focusing only on supply or having the system in place will not automatically cause mothers to "demand" health services. And causing mothers to "demand" services which do not exist only leads to frustration and failure. Yet, achieving a balance between supply and demand has been difficult to operationalize in the real world, where we cannot wait for services to be "perfect" before educating mothers about how to prevent and treat diarrhea.

Changing Health Worker Practices

- Quality training for physicians and other health workers is necessary, but not sufficient for encouraging appropriate case management. If training is to be assimilated and applied to the work situation, it must include practical "hands on" experience, and must be followed by supervision and reinforcement. Health workers, like mothers, have pre-existing attitudes and beliefs about diarrhea. These should be identified and addressed when designing training materials and strategies for improving health worker performance.

- It is more effective to teach correct concepts of case management in the pre-service training of health workers than it is to try to alter the established practices of experienced health workers. Nevertheless, it is difficult and time consuming to implement curriculum changes effectively.

Addressing Complex Issues

- As the limitations of a new technology are recognized (for example, only a certain portion of diarrheal mortality reduction can be achieved with ORT alone), issues which are more complex to address assume more importance. In CDD, as programs more successfully address acute watery diarrhea, they must begin dealing

with mortality caused by persistent diarrhea and dysentery. This requires linkages with other programs to address problems of malnutrition, a decline in exclusive breastfeeding, and lack of access to clean water and to sanitation services. Also, in CDD, as with other interventions, management and information systems, the availability of sustained resources, distribution and logistic systems, sustained supervision and follow-up which often are obscured at the beginning of any "new" effort, suddenly become the factors which impede or facilitate progress.

- At this point in the evolution of diarrheal disease control programs, pressures within the donor community and observations from the field are leading public health officials to question the wisdom of continuing the "selective," "magic-bullet" oriented approach to disease control. When public health efforts focused on developing health centers and providing broad services to all age groups of the poor and the rural, it became evident that the impact was not great because resources were spread too thinly. Concentrating on interventions of known effectiveness, ergo GOBI or ORT/EPI, became the response. It has now become apparent that strictly vertical or focused health programs also have limitations. This realization is leading many health leaders to question the advisability of selective programs and their clarion call is "integration."

- Ministries of Health and the donor community are susceptible to waning interest in light of the difficulties posed by addressing these more complex issues. Sustained interest is difficult to maintain and often funding changes to support the "new" and the "exciting". Funding for more complex issues decreases or ends.

Where Should We Go From Here?

The future of CDD programs holds a number of exciting challenges that are relevant not only to the control of diarrhea but to all disease control endeavors. Many country diarrheal disease control programs are now maturing into "middle age." They have been fairly successful at doing the "easy," i.e. in creating awareness of ORT, in developing training materials, educational materials and in establishing a core of health professionals who are proficient in and committed to appropriate case management. Now it is time to focus on the more difficult aspects of achieving sustained behavior change in health workers and mothers. The challenging tasks ahead include:

Changing Mothers' Practices

- Programs need to address the "KAP-gap" by searching for ways to promote early and effective use of ORT by mothers at the household level.

- Research on finding either a "better" ORS or more effective ways of communicating the concept of rehydration to mothers needs to be strengthened to make the "product" better meet mothers' expectations.

Extending the Reach of Services

- Programs need to experiment with and develop ways of reaching mothers and children who are not accessible through the public health sector by:

  - using innovative mechanisms for ORS packet distribution such as pharmacists, shopkeepers or traditional healers;

  - reaching and changing the practice of private sector physicians and other practitioners; and

  - studying the role of fathers in health care decisions regarding children.

Changing Health Worker Practices

- Programs need to take as a priority the development of effective mechanisms of supervision and reinforcement of health workers to guarantee that knowledge about appropriate case management results in appropriate and sustained practices.

- Programs need to assess whether their training strategies are having the desired impact; if they are not, they need to develop and test new approaches to training which are more effective.

- Programs need to assign priority to incorporating needed changes into pre-service curricula.

Addressing Complex Issues

- Programs need to address with urgency improving the management, logistics, and information systems that support CDD programs.

- Programs need to address operationally how nutritional and prevention components of CDD and how persistent diarrhea and dysentery will be addressed both directly

within their programs as well as integrating certain aspects with other national programs. Programs should explore the feasibility of risk assessment and the follow-up of high-risk patients in order to reduce the high mortality in this group of children.

- Donors and Ministries of Health should avoid programmatic jumps and fads in funding. Donor support should not be limited to start-up of activities but should sustain support when more complex implementation issues are being faced.

- The public health field should find ways of effectively addressing priority health issues while integrating services and activities where this makes sense from both program and economic perspectives. Experience has shown that vertical and integrated approaches each have positive contributions to make to address the health care issues developing nations face. Each also has disadvantages. Programs need to find the appropriate mix and timing for these approaches.

Interest and momentum are often motivated by a new technology, e.g. ORS. When the limitations of the technology are realized and the problems become those of behavior change and management, interest often wanes. This can be seen in the past in the example of malaria interventions and DDT. It is now beginning to happen with interventions such as ORT and EPI. The challenge now, is to keep the momentum (and the funding) going as the challenges are more complicated and less glamorous. The tendency is to look to new technologies for solutions and stimulus (super-ORS, food-based ORT). It would be a mistake to delude ourselves by thinking technology can solve management and motivation issues. The tedious tasks of management, supervision, training and logistics are the keys to accomplishing our original goals.

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