

CASE 7

Preventing Diarrheal Deaths in Egypt

Geographic Area: Egypt

Health Condition: In 1977, diarrheal disease among children, which results in life-threatening dehydration, was identified as the cause of at least half of all infant deaths in Egypt.

Global Importance of Health Condition Today: Diarrheal disease is estimated to cause 2 million deaths in the developing world each year; the vast majority of those are among children younger than 2 years. Currently, 1 out of every 200 children who contract diarrhea will die of its consequences, including particularly dehydration. Almost all of these deaths could be prevented with the timely use of a simple and low-cost treatment for dehydration.

Intervention or Program: The National Control of Diarrheal Disease Project of Egypt was established to promote the use of locally manufactured oral rehydration salts, which reverse the course of dehydration. The program sought to distribute the salts, along with information about the appropriate treatment of children with diarrhea, through public and private channels; the program reached mothers through mass media, including television. Training of all types of health workers also was integral to the program, as many physicians and nurses had to reorient their understanding of the optimal treatment of diarrhea.

Cost and Cost-Effectiveness: The average cost per child treated with oral rehydration therapy was estimated at \$6. The cost per death averted was between \$100 and \$200. The program cost a total of \$43 million, approximately 60 percent of which was financed under a grant from the US Agency for International Development, with the United Nations Children's Fund and the WHO collaborating on technical aspects of the program.

Impact: The program succeeded in increasing the production of oral rehydration salts, increasing mothers' correct use of these salts, and changing feeding behavior. During the peak of the program in the mid-1980s, the program had achieved a fourfold increase in the distribution of oral rehydration salts, compared with the 1979 baseline. Virtually all mothers in the country were aware of oral rehydration salts, and most women could correctly mix the solution. Between 1982 and 1987, infant mortality declined by 36 percent, and child mortality fell by 43 percent. Mortality attributed to diarrhea during this same period fell 82 percent among infants and 62 percent among children. Because of the reduction in diarrheal deaths between 1982 and 1989, 300,000 fewer children died.

Diarrheal disease is one of the leading killers of children, causing nearly 20 percent of all child deaths. This represents one of the world's great failures, because the life-threatening complications can be prevented so easily. Worldwide, dehydration from diarrhea kills between 1.4 million and 2.5 million babies

each year, and the vast majority of these deaths occur in developing countries (Kosek et al. 2003). Children born in developing countries suffer from an average of three episodes a year, and nearly 20 out of every 1,000 die of the disease before they reach the age of 2. In total, diarrhea causes a billion episodes

of illness annually and in high-incidence regions is responsible for more than 30 percent of all hospital admissions of children. Virtually all the deaths from dehydration associated with diarrhea could be prevented with the timely use of a simple treatment that parents can provide at home.

Egypt is among the countries that have succeeded in disseminating knowledge about life-saving treatment of dehydration to both health workers and parents through modern communication methods. The result: dramatic declines in mortality associated with diarrhea—enough to contribute to an overall large improvement in infant and child survival.

How Diarrhea Steals Lives

Diarrhea is an intestinal disorder characterized by abnormally frequent and watery stools. Acute watery diarrhea lasts just a few hours or days and can quickly become deadly. Bacteria (such as *E. coli* and *salmonella*), protozoa, and viruses can all cause diarrhea, and of these, rotavirus is the leading cause in developing countries. Unclean water, eating with dirty hands, and spoiled food are primary sources of transmission. Children are most vulnerable, particularly those from poor families living in unclean surroundings. Thus, the most effective modes of prevention include the improvement of the water supply and sanitation, the promotion of personal and domestic hygiene, and immunization against measles. Vaccines against rotavirus do exist but are not yet in widespread use.

Dehydration is diarrhea's most serious effect. During an episode of diarrhea, the body expels electrolytes (sodium, chloride, potassium, and bicarbonate) and water—all of which are necessary for life. Life-threatening dehydration ensues when the loss of the essential fluids is not replaced quickly and the body begins to "dry up." Symptoms of dehydration include thirst, restlessness, sunken eyes, rapid breathing, heart failure, bloated stomach, convulsions, and fainting. When fluid loss reaches 10 percent, dehydration turns fatal. In cases that are not immediately deadly, dehydration can leave a child more susceptible to infections.

Avoiding death from dehydration requires the swift restoration of lost fluids and electrolytes. Until

the development of oral rehydration therapy (ORT) in the 1960s, the only effective treatment available was through intravenous infusions in a hospital or clinic that "rehydrated" patients. Intravenous therapy is far from a treatment of choice in the developing world, however, because of its high cost, the hardship patients experience in traveling to clinics from remote areas, and shortages of both trained personnel and supplies. Many people instead turn to popular drugs, including antibiotics, which can stop diarrhea but still expose the child to the risk of dehydration. The majority of these drugs demonstrate no proven health benefit and in some cases cause dangerous side effects.

Oral Rehydration Therapy: "The Most Important Medical Discovery of the 20th Century"

A massive cholera outbreak in refugee camps on the border of India and Bangladesh in the 1970s exposed the limitations of intravenous treatment and paved the way for a radically different approach to treating dehydration. In 1971, the war for independence in what is now Bangladesh prompted 10 million refugees to flee to the border of West Bengal, India. The unsanitary conditions in the overcrowded refugee camps fueled a deadly cholera outbreak characterized by fatality rates approaching 30 percent (Mahalanabis et al. 1973). Health officials from the Indian and West Bengal governments and relief agencies faced a daunting task: Conditions were squalid and chaotic, intravenous fluid was in scarce supply, treatment facilities and transportation were inadequate, and trained personnel were limited (Mahalanabis et al. 1973). Mass treatment with intravenous therapy alone would not halt the impending crisis.

Dr. Dilip Mahalanabis, a cholera expert at the Johns Hopkins Centre for Medical Research and Training in Calcutta and head of a health center at one of the refugee camps, proposed an alternative to the intravenous treatment. He suggested the camp use a new method of oral replacement of fluid, known as oral rehydration therapy (ORT), that had been developed in the 1960s in Bangladesh and Calcutta.

Box 7.1 Oral rehydration therapy

Oral rehydration therapy (ORT) is the oral application of fluids to treat diarrhea and since 1993 has been defined by the WHO as “increased fluids plus continued feeding.” The science is based on research that shows that glucose helps the body quickly replace the electrolytes and fluid expelled by diarrhea. Two strategies have been recommended for increasing fluids.

The first element is use of oral rehydration salts or “recommended home fluids.” Oral rehydration salts are prepared by dissolving in water a ready-made packet with the following formula:

- 2.6 grams sodium chloride (common salt)
- 2.9 grams trisodium citrate dehydrate
- 1.5 grams potassium chloride
- 13.5 grams glucose

Recommended home fluids are homemade solutions of water, glucose (or a carbohydrate substitute), and sodium. Variations include salt-and-sugar solutions, salted rice water, cereal-based solutions, and traditional soups. Each national Center for Diarrheal Disease establishes appropriate mixtures for the local context. The homemade treatment draws on a tradition dating back thousands of years in which spiritual leaders and health practitioners used various fluid combinations to treat diarrhea.

Increased feeding is the second element of the ORT formula. Withholding food is a dangerous practice that can increase a child’s chance of becoming malnourished and can accelerate a life-threatening cycle of malnutrition and severe diarrhea.

The science was as ingenious as it was simple: A solution of water, salt, and sugar was found to be as effective in halting dehydration as intravenous therapy (see box 7.1). Dr. Mahalanabis’ team recognized

the many advantages of oral therapy over the intravenous rehydration: It is immensely cheaper, at just a few cents per dose; safer and easier to administer; and more practical for mass treatment. ORT, however, had still not been tested in an uncontrolled setting, and skeptical health specialists cautioned that only health professionals and doctors should administer the new therapy (Fontaine and Newton 2001).

Mahalanabis’ team moved quickly to introduce the treatment to the 350,000 residents of the camp. Packets of table salt, baking soda, and glucose were prepared in Calcutta at the diminutive cost of one penny per liter of fluid (Mahalanabis 1973). The solution was widely distributed, with instructions about how to dissolve it in water. Despite the shortage of trained health personnel, large numbers of patients were treated, with mothers, friends, and patients themselves administering the solution.

The results were extraordinary: At the height of the outbreak, cholera fatalities in the camp using ORT dropped to less than 4 percent, compared with 20 to 30 percent in camps treated with intravenous therapy (Fontaine and Newton 2001).

The success of ORT in the refugee camps demonstrated that diarrhea could be treated effectively and inexpensively even in the world’s most impoverished and isolated regions. Thus, ORT, heralded by *The Lancet* as “potentially the most important medical discovery of the 20th Century,” gave the world a powerful tool to reduce the estimated 5 million annual deaths from diarrhea recorded in the 1970s. In 1972, one year after Mahalanabis’ results from the refugee camps, the WHO made ORT the world’s standard treatment for diarrhea, setting in motion a revolution that would drastically cut diarrheal deaths in the following decades.

Egypt: A Pioneer in ORT

Egypt was one of the pioneers of national-level administration of ORT, and its experience represents a tremendous public health success story. In the 1970s, as the efficacy of ORT was being proved, diarrhea posed a serious public health problem in the North African country: In 1977, diarrhea caused at least half of the large number of infant deaths in Egypt

(the infant mortality rate at the time was 100 per 1,000 live births) (el-Rafie et al. 1990). That year, the Egyptian Ministry of Health introduced packets of “Oralyte,” oral rehydration salts (ORS) packaged for the United Nations Children’s Fund (UNICEF), in its public clinics; soon after, a parastatal company began manufacturing ORS packets called “Rehydran” for sale at pharmacies.

Despite the availability of ORS, progress by the early 1980s was disappointing. Few mothers were aware of the new treatment and even fewer used it. In 1982, only 10 to 20 percent of diarrhea cases used ORS (John Snow, Inc. 1995), and most of the ORS lay untouched in warehouses and clinics (el-Rafie et al. 1990). Instead, the most widespread treatments were ineffective antidiarrheal medicines, and physicians commonly recommended that mothers withhold fluids and food and suspend breastfeeding—dangerous advice that was at odds with the effective use of ORT (el-Rafie et al. 1990).

Health officials recognized that the success of Egypt’s ORT promotion efforts depended almost entirely on the active involvement of mothers and physicians. To test how these important groups could be persuaded to use and promote ORT, community trials were held in 29 rural villages in 1980 through the Strengthening of Rural Health Delivery Project. Nurses taught mothers at their homes how to use ORT, and public physicians were educated about the therapy. ORT use rose dramatically, and as a result, overall child mortality was 38 percent lower than in control villages, and diarrhea-associated mortality during the peak season was 45 percent lower (Gomaa et al. 1988).

Based on the success of the community trials, Egypt undertook a massive promotion of ORT use among the country’s 41 million residents. The National Control of Diarrheal Diseases Project (NCDDP) was established in 1981 with financial and technical support from the US Agency for International Development (USAID). The program involved the entire Ministry of Health as well as other branches of government, the private sector, professional societies, and international organizations including WHO, and UNICEF. In 1984, the program became fully operational and set out to achieve the following goals:

- reduce diarrhea mortality in children under 5 by at least 25 percent;
- increase awareness of ORT to at least 90 percent of mothers;
- increase understanding of ORT use to at least 75 percent of mothers;
- decrease hospital mortality from diarrhea to at least 5 percent; and
- increase the number of severe diarrhea cases treated with ORT in the health system to at least 50 percent.

The NCDDP in Action

To achieve its ambitious objectives, the national program had to change the behavior of mothers and physicians and ensure an adequate supply of ORS. Mothers needed to understand the value and proper use of ORT, and physicians needed to be convinced of its efficacy over competing treatments (intravenous therapy, drugs, and fasting). The program began with a pilot study or “rehearsal” to test the various approaches and gather baseline data; it was then scaled up based on this information. Rather than providing the ORT services directly, the national program worked through the existing health infrastructure to strengthen the capacity of the health service delivery units to produce, promote, and explain ORT. The four main components of the program included product design and branding, production and distribution, training, and promotion and marketing.

Product Design and Branding. Based on market research, the program chose to supply ORS packets in a 200-milliliter size, rather than the standard one-liter pack distributed by UNICEF in most countries. Surveys found that mothers generally lacked an appropriate liter container at home, and many felt that a full liter was too much to give to a child to drink. So 200-milliliter plastic measuring cups were designed with the project logo for distribution through pharmacies and public health centers. Mothers were

also encouraged to use a small soda bottle as a replacement for the measuring container.

Because ORS helps halt dehydration but does not stop diarrhea as popular antidiarrheals do, appropriate branding and product positioning was essential to promote the product competitively. The brand name selected for ORS was “Mahloul Moalgett et Gaff,” meaning “solution for treating dehydration,” and was referred to simply as “the solution.” The brand name used the word “gaff,” Arabic for drought, which was intended to help mothers make the link between the symptoms of dehydration and the oral therapy. The project logo—a seated mother feeding her small child—became the most recognized product label in Egypt.

Production and Distribution. An uninterrupted supply of ORS was vital to the program’s success, and this rested on local production. An extensive tracking system was established to help the project forecast demand and meet its goal of a three-month supply of ORS. A parastatal company, Chemical Industries Development, played a large role in the production of ORS. The company sold the packets at cost to the project, and the solution was then distributed through public-sector stores. NCDDP and UNICEF subsidized both public and private production. With an average of 6 million liter-equivalents of ORS produced each year, local production met demand, and Egypt even began exporting surplus production to the Middle East and Africa.

Distribution was accomplished through both public and private channels. The public sector received the ORS packets through a network of five main distribution centers and 37 sub-branches. In rural areas, where the death rates from diarrhea were twice that in urban centers, long distances between homes and health centers inhibited distribution. To reach the more remote rural areas, 3,000 “depot-holders” were recruited to hold ORS packets at their homes and distribute them to villagers for either a small price (about two cents) or for free. Depot-holders included community leaders, traditional birth attendants, or health workers who were trained in the use of ORS.

Private-sector distribution posed a significant challenge: There, ORS had to compete with the

more profitable antidiarrheal drugs. To create financial incentives for pharmacies to promote ORS, the NCDDP provided pharmacies with free measuring cups that the pharmacy could sell with ORS packets, thus raising profit margins to a more competitive 30 percent.

Training. The program set out to train health workers to accurately diagnose diarrhea and dehydration and to teach mothers how to use ORT. The program distributed audiovisual and print materials, held seminars, and conducted six-day training courses covering practical and theoretical aspects of diarrhea and ORT, emphasizing that ORT should be the primary tool to manage cases of diarrhea; that the use of antidiarrheal drugs should be limited; and that breast feeding and good hygiene can help prevent diarrhea.

By 1990, 47 rehydration training centers had been established at university and central hospitals, teaching hospitals, urban clinics, and various other health centers. Between 1984 and 1990, nearly 14,000 practicing nurses and 10,000 physicians underwent the training course (John Snow, Inc. 1995). The program also persuaded medical and nursing schools to include rehydration and ORT in their curricula to train future generations of health professionals.

Promotion and Marketing. The most pivotal component of the program was the social marketing and mass media campaign. The primary audience for the outreach was mothers of children under 3; health professionals, pharmacists, and media reporters also were targeted (Hirschhorn 1985). In 1984, the first national media campaign was launched, emphasizing several basic messages about the dangers of diarrhea, its causes, and the means to reduce its impact.

The program’s launch coincided with an important new phenomenon in Egypt: television. The share of households with a television had skyrocketed to 90 percent by 1984, from just 38 percent in 1980. Television became the primary media outlet of the campaign and provided a powerful vehicle to spread the program’s core messages and to reach even rural, illiterate households that would have been inaccessible through print media. The television spots were de-

Box 7.2 Reaching Bangladeshi children with ORT

As in Egypt, diarrhea and dehydration have posed a formidable health problem in Bangladesh. The setting in Bangladesh, however, was markedly different from that in Egypt when both countries introduced oral rehydration therapy (ORT) in the early 1980s. Meeting the needs of Bangladesh's population of more than 100 million, nearly 10 times the size of Egypt, would have required a massive production effort of tens of millions of packets of oral rehydration salts each year. Considering that more than 90 percent of Bangladesh's population lived in rural areas with poor transportation, distribution of salts also posed a serious challenge. And unlike Egypt, where the vast majority of households had a television, very few in Bangladesh even had access to a radio. Hence, a nationwide media campaign mirroring Egypt's successful television campaign was impractical.

Beginning in 1980, the Bangladesh Rural Advancement Committee, a large nongovernmental organization, began a program to promote ORT in rural Bangladesh. The program, the largest nationwide ORT program ever undertaken, trained tens of thousands of oral rehydration workers, or female health workers aged between 20 and 50, who went door-to-door training mothers about dehydration and ORT. The health workers visited each household in the program area and taught at least one woman in the household the "10 points to remember," including: what diarrhea and dehydration is and looks like, how to rehydrate through ORT, how to make the solution at home and when to use it, when to call the doctor, and when to continue feeding. The oral rehydration workers demonstrated how to make a homemade oral solution called *lobon-gur* through the "pinch and scoop method" by mixing a three-finger pinch of salt, a fistful of sugar, and a liter of water. (Today, packaged oral rehydration salts are widely available in most of the country, including the rural areas.)

The program employed an innovative performance-based salary system that provided incentives for oral rehydration workers to accurately and thoroughly teach mothers the 10 points. Approximately one month following the workers' visits, a monitor would randomly select and visit 10 percent of the households. The monitor would ask the mother questions about the 10 points and test her ability to make the mixture properly. The health worker would be paid based on how much the mothers within the program area had learned.

Because men in Bangladesh are the key decision makers, the program also reached out to men. Male workers at bazaars, mosques, and schools helped influence the attitudes of men toward ORT. Village healers were also recruited to spread the message about ORT, and a small radio and television education campaign was launched (Chowdhury et al. 1997).

Between 1980 and 1990, 13 million mothers were taught to make oral rehydration mixtures in their homes. An evaluation of more than 7,000 households found that between 25 and 52 percent of cases of "severe diarrhea" used the *lobon-gur* mixture (Chowdhury, Vaughan, and Abed 1988). Today, the usage rate of ORT in Bangladesh is 80 percent, one of the highest in the world. ORT is now part of the Bangladeshi culture: Studies show mothers are transmitting ORT knowledge to the next generation (Chowdhury et al. 1997).

signed to have a wide appeal and were particularly targeted at poorer audiences. The language was simple, employing expressions commonly used by mothers, with a theme of maternal love. The recruitment of a well-liked, motherly soap opera star as spokesperson bolstered the campaign's popularity. More than 63 television spots were aired between 1984 and 1990, and billboards, magazine ads, and posters in

pharmacies and health centers also were used to spread the core messages. (Far different approaches are required to reach mothers in countries where the penetration of mass media is lower; see box 7.2.)

The media campaign was extraordinarily successful. Following the first national campaign in 1984, more than 90 percent of the mothers knew of ORS, and ORS use rose quickly to 60 percent.

Impact: Success and Limitations

By 1991, when the 10-year program ended, virtually all of the goals had been reached. During the peak of the program in 1985 and 1986, the distribution of ORS was four times the level at the start of the program. By 1986, nearly 99 percent of mothers were aware of ORS, use of the solution was widespread, and most women could correctly mix the solution. The number of children with diarrhea attending a public clinic rose from 630,000 in 1983 to 1.4 million in 1985 (el-Rafie et al. 1990).

Through its success in disseminating both the ORS and the knowledge about how to use it, the program contributed to a reduction in infant and childhood mortality. According to civil registration data, infant mortality dropped by 36 percent and child mortality by 43 percent between 1982 and 1987. Diarrhea mortality during this same period fell 82 percent among infants and 62 percent among children (el-Rafie et al. 1990). Data from national household surveys and local area investigations suggest that the figures are actually an underestimate and that the reduction was even more impressive. By some estimates, the program helped reduce child diarrheal deaths by 300,000 between 1982 and 1989 (John Snow, Inc. 1995).

Despite this success, some elements of the program were disappointing. The private sector has been slower at converting to ORT than have the public facilities; because private physicians see nearly three-quarters of all cases, this gap will need to be addressed. And the market for antidiarrheals remains large—a continued trend that poses a threat to ORT use and to children's lives.

A Cost-Effective Intervention

The program achieved success with an extremely cost-effective intervention. The average cost per child treated in Egypt with ORT was estimated at less than \$6 (Martines, Phillips, and Feacham 1993), and the program calculated that the cost per death averted was roughly between \$100 and \$200. Overall, the program cost was \$43 million: \$26 million in grants from USAID and \$17 million in cash and in kind from the government of Egypt. UNICEF do-

minated \$827,000 worth of raw materials for ORS production, and WHO contributed training programs and materials worth about \$452,000 (John Snow, Inc. 1995).

Elements of Success

Two elements of success are worth highlighting: first, the use of scientific investigation, including the research that supported various parts of the program, and the evaluation efforts; and second, the program's flexibility.

Market and anthropological research about consumer preferences and cultural practices played a central role in shaping the communications efforts and the product design and branding. Epidemiological and clinical research, conducted in nearly all Egyptian universities through NCDDP-supported projects, had the dual purpose of increasing knowledge and information about risk factors and proper ORS composition, and keeping the medical community engaged and interested in ORT.

An evaluation component was incorporated into the program's design from the outset. Ongoing evaluation efforts tracked the progress of the interventions, their effects (such as ORS use and attitudes), and the impact on mortality. Evaluation tools included mortality studies, knowledge and practice surveys of mothers, cost-effectiveness studies, national household surveys, and monthly and quarterly reports of diarrheal control activities. The project also benefited from independent, external evaluations, with data used continuously as input into decision making.

The diarrhea control program deliberately applied a flexible approach based on trial and error and data analysis. Interventions were frequently tested first in pilots or rehearsals, with the expectation that mistakes would be made and valuable lessons learned. The work plan was reexamined monthly, and the program elements were frequently adapted. For example, ORS packaging was altered after consumer preferences were expressed, and the media campaign changed the star of the TV ads from a male comedian to a TV actress after audiences disliked the earlier spokesperson's comedic approach.

Thirty years after its resounding success in the Bangladeshi refugee camps, ORT continues to be the

most cost-effective means of treating dehydration. An increase in the use of ORT across the globe has helped slash diarrhea mortality rates in children worldwide by at least half. It is estimated that ORT saves the lives of 1 million children each year (Chowdhury et al. 1997).

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