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MINISTRY OF HEALTH

ARAB REPUBLIC OF EGYPT

DIARRHEAL DISEASE CONTROL STUDY

Final Report on Phase 1

to

USAID AND WHO (EMRO)

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PART 1

TECHNICAL REPORT

STRENGTHENING RURAL HEALTH SERVICE DELIVERY PROJECT

DIARRHEAL DISEASE CONTROL STUDY

INTRODUCTION

In 1976 the Egyptian Ministry of Health and the United States Agency for International Development entered into an agreement to strengthen the Egyptian Rural Health Services. Following selection of a contractor and arrival of the resident consultants, the Strengthening Rural Health Services Delivery Project (SRHD) was initiated April, 1978 with the underlying goal to improve the health status of Egypt's rural population. The SRHD project is attempting to accomplish this goal by testing and demonstrating various configurations of health services and their delivery systems in ten districts of four separate governorates of Egypt.

During the first phase of the SRHD project, diarrhea and its treatment emerged as an important area of interest. Early analysis of existing health statistics supplemented by SRHD surveys indicated that children under 5 years of age, who represent about 17% of the total population, account for approximately 50% of the total deaths which occur each year in Egypt. Moreover, about 80% of these child deaths result from just two diseases: diarrheal disease and lower respiratory tract infection. Diarrhea is by far the more important, accounting for approximately 60% of all child deaths. Mortality followed by morbidity and disability are used in the SRHD project as indices of health status. Hence, a program aimed at the control of child deaths from diarrhea became the highest priority of the SRHD Project because of the seemingly large and positive impact it, potentially, could have on improving the health status of rural Egyptian children.

Establishing the importance of diarrhea as a serious health problem in Rural Egypt was relatively easy; however making recommendations to the Ministry of Health as to specific services and a service mechanism for effecting the greatest reduction in diarrhea-specific mortality given the constraints imposed upon the existing rural health system was more complex. The first consideration in making program recommedations is to identify an effective, affordable prevention, or in absence of this, treatment for diarrhea. The underlying cause of diarrheal deaths is an infection, but the immediate cause of death is dehydration and electrolyte depletion.

Prevention of diarrhea at this point in time in Egypt is not a realistic way to deal with the high diarrhea-specific death rate because of the multiple sources of infection in the community. Treatment to prevent deaths, however, is straightforward: replacement of lost electrolytes and water. In this context, traditional treatment, until a few years ago consisted mainly of parenteral rehydration. More recently oral rehydration therapy (ORT) has become more popular for several reasons:

- o ORT is more effective than parenteral rehydration in the treatment of established dehydration irrespective of the pathogen causing the diarrhea.

- o ORT is more widely available and can be made available more quickly to a sick child than can parenteral solutions because ORT is not dependent upon the hospital setting.

- o Use of ORT can be taught to paramedical personnel as well as to mothers, also facilitating wider use and earlier treatment of diarrhea.

- o Oral rehydration solutions which are highly effective in preventing death are in and of themselves significantly less expensive than parenteral solutions.

Others have made a thorough review of these advantages and of the effectiveness of ORT. This will not be reviewed here again. We will only summarize by saying that ORT has many striking and unique attributes which make it a highly suitable treatment for diarrhea; and that it is currently the accepted treatment for preventing deaths due to diarrhea and its accompanying dehydration.

With the confidence that the best treatment for averting diarrhea-specific deaths, had been found, WHO has taken the lead in an effort to combat deaths from diarrhea and is promoting ORT in the form of a standard oral rehydrant: "Oralyte". The WHO program attempts to exploit the advantages of ORT by relying upon ready availability of the pre-packaged rehydrant through existing health facilities and by promoting decentralized use of Oralyte: the use of paramedical personnel and even mothers to prepare and administer Oralyte. Administration of the solution is recommended to be initiated at the first sign of diarrheal disease and is continued until the child is well. If the child does not respond, the patient should then be referred for parenteral rehydration. In addition to administration of ORT, WHO is promoting provision of extensive health and nutrition education.

A highly efficacious treatment, however, in the absence of an efficient delivery system can lead to disappointment. Indeed despite obvious advances in medical technology coupled with an ever expanding number of medical facilities, manpower and services, diarrhea-specific mortality, worldwide, has declined only slightly. One explanation for this situation is that the WHO and other country programs using ORT have not had enough time to have an impact on world-wide rates. Yet, even in Egypt where an ORT program was initiated in 1977 in all governorates, preliminary survey data suggest that the impact of the Egyptian ORT program (dependent upon Oralyte) has been less successful than was expected. Indeed, the fact that

deaths from diarrhea have not decreased as dramatically as anticipated is both disappointing and perplexing in the face of the demonstrated high efficacy of ORT in general. Several reasons, all of which pertain to delivery systems, have been identified as contributing to this situation in Egypt, but may also be generalized to other parts of the world:

- Ready availability of pre-packaged oral rehydration salts or solution (ORS) does not truly exist in Egypt due in part to the low utilization rate of health facilities by mothers with sick children. SRHD survey results from a pilot household survey conducted in 1979 indicates that about 10% of children sick with diarrhea during a 2 week period receive no care. Another 30% are treated at home by the mother or a relative through use of the village store or some other non-medical source. Only about 60% of children sick with diarrhea seek care from a health practitioner. Of these less than one fifth go to the government physician.

- Ready availability of ORT is affected because Oralyte distribution is restricted: it is distributed as a prescription drug on advice from a medical facility or pharmacy whose operating hours are limited. Hence, contrary to accepted medical opinion, life-saving fluid and electrolyte replacement does not begin at the earliest possible moment after recognition of the disease.

- General unfamiliarity with ORT or possibly a distrust for pre-packaged ORS.

- Oralyte is simply not being distributed at a level consistant with need based on the calculated level of diarrhea which probably exists in the country. Assuming that 4 episodes of 5 days duration each occur in each child less than 5 years of age each year, then every child suffers from 20 days of diarrhea per year. For rural Egypt which has a population of about 20 million of which 17% are below 5 years of age, there are about 68 million child-days of diarrhea per year. Treatment for just rural Egypt, if done according to current recommendations, would amount to 68 million packets per year. Egypt produced or imported approximately 5 million packets of Oralyte or its equivalent in 1980.

- The logistical system for disseminating the required amount of pre-packaged ORS might eventually be possible, but currently is incapable of this task,

It was in the context of these problems that it was decided that a fresh look had to be taken at how ORT as a medical service is made available to the community before recommendations could be made to the MOH about how to strengthen rural health services and in turn improve rural Egypt's health status. Of additional interest in reducing diarrhea-specific mortality was the efficacy of a plain sugar and salt solution prepared and adminstered in the home by the mother early in the course of the disease. Efficacy of this alternative method of ORT was a particularly important question because of the fact that widespread distribution of Oralyte even in the shadow of an existing nationwide program seems not a realistic, achievable goal in the near future in Egypt. Further, previous experience in India

provided strong empirical evidence that a sugar and salt solution could provide life-saving therapy similar to that achieved by a balanced electrolyte solution like Oralyte.

Out of this background a diarrheal disease control study (DDCS) was initiated with the following objectives:

- To compare the effectiveness of the different methods of ORT.
- To determine the effect of unhindered and ready access to these different types of ORT.
- To determine the utilization and effectiveness of ORT when made available through alternative sources.

METHODS

STUDY DESIGN

In keeping with the aforementioned objectives, a study design was developed and is presented in Table 1. The study design consists of 6 "cells": two control cells and four treatment cells. "Control 1" represented no input beyond current government activity. "Control 2" input was limited to physicians' education and to ensuring a plentiful supply of oral rehydrant freely available to health facilities for use in-facility. Input into the four treatment cells comprised health personnel education, community health education, a plentiful supply of Oralyte made available for in-facility use as in "Control 2", and availability of oral rehydrant to the public through various sources.

More specifically, the inputs which were varied among the treatment and control cells are reflected in the study cell names and are described here:

Cell 1: "Oralyte; Home Distribution". Oralyte was distributed in the course of routine home visiting. Mothers were instructed in its use. On the initial visit the nurse left packages of Oralyte with the mother calculated against the following schedule: 4 packages for the youngest child and one more package for every additional child under 5 years of age. The mother was told to come to the facility to replenish her supply if in the course of the following month she used any or all of the packages. The nurse also replenished the mother's supply of Oralyte during home-visits automatically.

Cell 2: "Oralyte; Commercial Sources". In this study, a stock of Oralyte was provided to all shops and pharmacies, free of charge. Instruction was given to the shopkeeper or pharmacist that Oralyte was to be sold at the nominal price of 3 piasters (4.3 ¢) to mothers, and that if necessary, instructions on the use of Oralyte were to be repeated to the mother. The nurse gave health education identical to that in all other treatment cells, but instructed the mother to purchase Oralyte, when needed, from village shop or pharmacy.

Cell 3: "Sugar and Salt; Home Prepared". Mothers were instructed to prepare ORS by mixing 5-6 level teaspoons of granulated sugar with a half of a level teaspoon of salt in one liter of water. The juice of 1/2 a lemon, if available, should be added for taste. In addition, mothers were instructed to give the child either tomato juice, orange juice, mashed banana or tea depending upon seasonal availability as source for increasing potassium intake. The education given by the nurse to mothers in this study cell demonstrated and stressed a properly used teaspoon: one measuring between three and six grams.

Cell 4: "Sugar and Salt; Pre-packaged, Home Distribution". In this fourth and last treatment cell, a pre-packaged sugar (sucrose) and salt mixture was home delivered by the nurse during home-visiting in a fashion consistant with the Oralyte home distribution cell. Each package contained 3.5 gm salt to provide a concentration of 60 meq. of sodium per liter of water.

Cell 5: "Control 2". In this control cell as in all treatment cells health personnel were made aware of the importance of oral rehydration as a treatment of diarrheal disease; and a plentiful supply of Oralyte was made available to all facilities.

Cell 6: "Control 1". In this control cell there were no inputs of any kind provided; the regular health services routinely provided by the government were allowed to continue.

The aims of this study design were to enable:

- Examination of the home-based, mother administered ORT compared to care-on-demand as provided by the health facility in reducing child mortality.

- Comparison of reduction in child mortality among three groups: one using a combination of ORT prepared from in-home ingredients and administered by the mothers; one using a balanced electrolyte ORT (Oralyte) placed in the hands of the health care providers; and one using Oralyte by both mothers and health care providers.

- Determination of utilization of ORT by mothers for diarrheal disease when made freely available or readily accessible.

- Determination of ill effects from the sugar and salt home-prepared mixture, if any, due to errors in the proportion of ingredients.

- Determination of the effect of providing adequate supplies of ORS to health facilities on child mortality.

Table 1

STUDY CELLS AND INPUTS OF THE DIARRHEAL DISEASE CONTROL STUDY

Study Cell	Input
Control 1	Unchanged (present) MOH system. ORT carried on in facilities since 1977.
Control 2	Oralyte available ad-lib at facility level. Physicians made aware of importance of ORT.
Oralyte home distributed	Oralyte distributed to all house-holds on monthly basis. Health education in homes and at mosques and other public places at regular intervals.
Oralyte through commercial sources	Oralyte available at all village shops and pharmacies at 3 P.T per package. Health education in homes and at mosques and other public places at regular intervals.
Sugar/salt home prepared	S/S rehydration mixture prepared in home by mothers. Health education in homes and at mosques and other public places at regular intervals. Oralyte available ad-lib to nurses and at facilities.
Sugar/salt pre-packaged; home-distrib.	S/S rehydration mixture prepackaged and distributed to all homes on monthly basis. Health education in homes and at mosques and other public places at regular intervals. Oralyte available ad-lib to nurses and at facilities.

The health education component in the study cells was carried out in the community in general, (by both the nurse and the sanitarian), and in the individual homes (mainly by the nurse). Health education stressed five points:

- The importance of diarrhea as the most dangerous disease for pre-school children during the upcoming and every summer.
- Recognition of the signs and symptoms of diarrhea using three liquid stools per day as the criterion of disease. This definition was used, based on the previous experience of one of the investigators in India.
- Early management of diarrheal disease through preparation and administration of ORT by the mother.
- The need to continue breast feeding and regularly used supplemental food intake throughout the entire diarrheal episode. Mothers were instructed, however, to stop commercial supplementary milk, if used, for 24 hours.
- Recognition of the danger signs and symptoms requiring immediate referral to the health facility.

Health education was provided once every four to six weeks to all mothers with children of pre-school age by a health facility nurse through home-visiting. In addition, village men were also exposed to health education by the sanitarian of the local health facility.- Health education of the men of the village was effected through a series of talks given by the sanitarian at the mosque after the prayer meeting. These talks were given on at least three Fridays per month. Handbills, appropriate to the study cell and stressing the main health education points listed above were distributed to saturation at two to three months' intervals.

In-home health education was carried out by nurses during their regular home-visits. In order to accomplish a home visiting program which could reach all households with children less than 5 years of age, each nurse was assigned a sector of the village consisting of no more than 500 families, and a daily home-visit schedule quota of no more than 25 families. Nurses spent an entire day every other day visiting homes in their sectors. Nurses in the same facility took turns home-visiting so that one nurse was always in-facility on any given day.

During home-visits nurses instructed mothers in the preparation of the Oral Rehydration Solution (ORS). The method taught was dependent upon the study cell. In all house holds in study cells on the first home-visit, mothers were asked to provide a vessel which could be used in the future by the mother exclusively for the preparation of ORS. The vessels ranging from plastic containers to earthenware jugs, were calibrated by the nurse to measure one liter of water. The nurse first filled the vessel using a project-provided, standard one liter measure, and then marked the side of the household vessel with a sharp instrument. The etched mark was then colored. On all subsequent visits the nurse requested to see the vessel, and, if necessary, repeated the calibration procedure. Mothers were instructed to prepare ORS using the cleanest water available. Water from a tap was suggested as being the most desirable; water from the canal as least desirable. Mothers were told not to bother boiling water for the first batch of ORS so as to avoid additional delay in starting rehydration of the child. However, for subsequent batches, they were

Villages for the study cells were chosen randomly until the desired population size was achieved from within three districts of the Dakahlia Governorate: Dekernis, Miniet-el-Nasr and Sinbellawen. Two limitations were encountered in the selection of treatment and control villages.

- All villages for the Sugar and Salt Home Prepared study cell were selected from one district: Sinbellawen. This was done because routine home-visiting had been instituted throughout this district five months prior to the onset of the study ensuring detection of excess mortality or treatment problems should those arise.

- Control villages could not be selected from among villages in Sinbellawen, since home-visiting was already in progress, and hence, the routine government system no longer prevailed.

Prior to the implementation of services in villages in treatment and control cells, two types of maps were prepared. The first was drawn to show all major landmarks both man-made and natural in each village. The second type of map was a sector map corresponding to the nurse's home visiting sector of responsibility. In each study cell village, a census was carried out to determine the population base as well as to find households with children of pre-school age or pregnant women likely to deliver during the study period.

DATA COLLECTION

Several data collection processes were established to collect information on both intermediate (process) variables as well as on impact (outcome) variables. These included:

Household Survey. This 10% random sample survey of families was designed to determine diarrheal disease incidence, prevalence, knowledge about and practice of management of diarrheal disease by the mother, population based mortality rates and sources of treatment, if any. The survey was conducted at two sequential points in time: July of 1980 and January of 1981. The survey was done in all treatment villages and in the "Control 2" cell. "Control 1" villages were included only in the second round of this survey.

Ingredient and Utensil Survey. This 1% random sample survey of families was designed to determine the availablity of granulated sugar, of salt, of teaspoons and their range in size, ability of mother to measure correctly one liter of water within ± 10%, and the sources of water used for preparation of beverages. This survey was conducted after three and again nine, nurse home-visits in treatment and "Control-2" cells.

Home Prepared ORS Electrolyte Concentration Analysis. This random 1% sampling of households in all treatment cells was carried out to ascertain the sodium concentration of home prepared/diluted ORS. ORS samples were obtained after three and nine (nurse), home-visits, respectively. Analysis of samples was done by the NAMRU analytical laboratory.

Mortality Survey. In all study villages, the clerk in each facility kept a regular count of the number of pre-school children who had died within the preceeding week. Age, sex, house number and father's name were reported for each death to the district health officer at the end of the week (Saturday). In addition, in treatment villages, nurses through their home-visiting routinely checked for deaths among study cell children. If a death had occurred the nurse urged the parents to register the death with the facility, and had the name of the deceased entered into the weekly mortality report prepared by the clerk: As home-visiting was not done in either control cell, nurses conducted a once-only survey of all households at the end of the study to determine previously unrecorded deaths.

Verbal Autopsy Report. In all study (treatment and control) villages, the mortality survey information (list of weekly deaths discussed above), which was subsequently forwarded to the district health officer, was in turn broken down into 5 lists. The lists were distributed to one of five specially trained physicians (called "flying doctors") for further in-depth investigation. Flying doctors rotated throughout all cells. The flying doctors verified each death and completed a "verbal autopsy" form for each death, the objective of which was to ascertain the cause of death, circumstances surrounding death, treatment information and, if a diarrhea death, specific practices used to treat the patient prior to death. Previously unregistered deaths in control villages that were detected in the final house-to-house survey at the end of the study were similarly verified by the flying doctors and, if found to be true deaths that had occurred during the study period, a Verbal Autopsy form was filled.

Treatment and Referral Record. Physicians in all treatment villages as well as in "Control 2" cell villages were instructed to record, regularly, the number of all preschool child patients seen for diarrheal disease in the course of their routine outpatient as well as after-hours private clinics. The treatment and referral record was designed to obtain information about presenting signs, symptoms, treatment prescribed, and referral. This survey was not done in "Control 1" villages.

STUDY ORGANIZATION

At the local level, the study was administered by a resident MOH official - the project field executive director (PFED). He was assisted by the (three) district health officers (DHO) of the districts in which the study was held. Each DHO in term was assisted by an itinerant supervisory team consisting of a physician, a senior nurse and the chief sanitarian. The PFED, DHO's and members of the supervisory teams were regular members of the governorate or district health staff.

In order to achieve yet another objective, namely to determine if and to what extent the local MOH health service administration could continue the program without "expert" outside help, the study was divided into two phases. Phase one, from May through October, was directed out of the central (SRHD) office, phase two, from November 1980 through January 1981 was managed mainly by the PFED.

Supervisory teams guided by the DHO were responsible for monitoring both frequency and quality of program related activities among the health staff of the study facilties: physicians, nurses and sanitarians. If and when deficiencies were found they were corrected through on-the-spot re-training. In "Control 2" health facilities, supervision covered only weekly reporting of deaths and daily completion of the "Diarrheal treatment and Referral Record" by the physicians. Supervisory visits were scheduled to occur once per facility per month. The DHO was responsible for all activities in his district including ensuring that death reporting forms were in fact submitted to him weekly by the facility physicians, and distribution these forms to the "flying doctors" whose turn, it was to work in his district during the succeeding week. The PFED, in turn assembled routinely collected data for forwarding to the (SRHD) central office. The PFED generally coordinated study activities between the three districts and between districts and center.

The Household survey, Utensil and Ingredient survey, and sampling of diarrhea mixtures for the home prepared ORS electrolyte concentration analysis were carried out under the direction of the regular MOH social scientist from Dakahleia governorate. Interviewers were hired from among (Mansourah) university students as well as chosen from among existing health personnel staff. All interviewers received special training for each type of survey from central (SRHD) staff together with the social scientist.

Carrying out study activities required work beyond that carried out routinely by MOH employees resulting in longer working hours. For this reason it was decided by the MOH to provide on a monthly basis the following monetary incentives provided program activities were carried out according to preset performance criteria:

- Health facility nurses and sanitarians (treatment villages only): L.E. 5.- ($ 7.-) per month.
- Health facility physicians in treatment villages: L.E. 7.- ($ 10.-); in control villages L.E. 5.- ($ 7.-) per month.
- Supervisory team members: physician L.E. 15.- ($21.40), Sanitarian L.E. 12.- ($17.10), nurse L.E. 10.- ($ 14.30) per month.
- D.H.O.'s and PFED L.E. 30.- ($ 42.90) per month.

In addition to these, clerks (3 district, 1 governorate and 1 central) and survey team personnel received special remuneration. Since their work was, however, entirely research-related and would not be encountered in a pure service program their remunerations shall not be detailed here.

STUDY IMPLEMENTATION

The study was launched May 1, 1980 in 29 villages spread over the three districts with a total child population of almost 29.000 children below five years of age. Eleven villages (total population approximately

64.000) were, in Sinbellawen district, ten villages (total population approximately 74.000) were in Dakernis and eight villages (total population approximately 48,000) were in the smallest of the three districts, Miniet-el-Nasr.

This report summarizes findings up to and including October 31, 1981. Study results from the second phase of the program, from the""household" and "diarrhea treatment and referral" surveys as well as detailed results from the "verbal autopsy" surveys have not as yet been analyzed and will be reported separately at a later date.

RESULTS

Results shall be presented under three main headings:

1) those pertaining to intermediate outcome or "process" results,

2) those reflecting the impact of the program on child mortality, or "outcome" results and,

3) data regarding the cost benefit analysis.

With respect to all three groups it must be repeated that we have, as yet not been able to analyze our Household Survey, Diarrheal Treatment and Referral Survey data, or our verbal autopsy forms for other than causes of death. Lastly, the cost information presented here may change, after details on differential health facility utilization by consumers in the six study cells become available from the "household" and "diarrheal treatment and referral surveys.

PROCESS

In Tables 2 through 5 results from the Ingredient and Utensil survey are presented. As expected, granulated sugar and salt were readily available in virtually all households during the first and the repeat surveys. Use of the correct size of teaspoon in the "Sugar/Salt Home Prepared" cell rose from 74% to 96% ($P < .005$) and the ability to measure one liter of water within ± 10% rose from 85% to 97% ($P < .005$) in all treatment cells as shown also in Figures I and II, respectively.

In Table 5, sources of water used to prepare beverages (tea and/or ORS) are shown as determined during the initial and repeat surveys. Overall, the proportion of mothers using canal water was highest in the "Sugar/Salt Home Prepared" cell less in the "Oralyte Home Distributed" cell and non-existant in the other three study cells.

Although there was a numeric decline in the proportion of mothers using the canal in the two cells where canal water was being used from 10% to 6% this shift is statistically not significant. Neither did any of the other changes in the source of water between the initial and final surveys reach or approach statistical significance.

Table 2

AVAILABILITY OF GRANULATED SUGAR AND SALT ON INITIAL (I) AND REPEAT (II) SURVEYS

Study Cell	Survey No.	Granulated Sugar				Salt				Total No. of households surveyed
		Yes		No		Yes		No		
		No.	%	No.	%	No.	%	No.	%	
Control (2)	I	66	97.1	2	2.9	68	100	0	0	68
	II	68	100.0	0	0	68	100	0	0	68
Oralyte: home distribution	I	59	100	0	0	59	100	0	0	59
	II	74	100	0	0	73	99	1	1	74
Oralyte: through commercial services	I	27	100	0	0	27	100	0	0	27
	II	32	100	0	0	32	100	0	0	32
S/S: home prepared	I	75	97.4	2	2.6	77	100	0	0	77
	II	67	97.1	2	2.9	69	100	-	-	69
S/S: prepackaged; home-distr.	I	26	100	0	0	26	100	0	0	26
	II	28	100	-	-	28	100	-	-	28
ALL	I	253	98.4	4	1.6	257	100	0	0	257
	II	269	99.3	2	0.7	270	99.6	1	0.4	272

Table 3

DISTRIBUTION OF SIZES OF "TEA SPOONS" PRESENTED

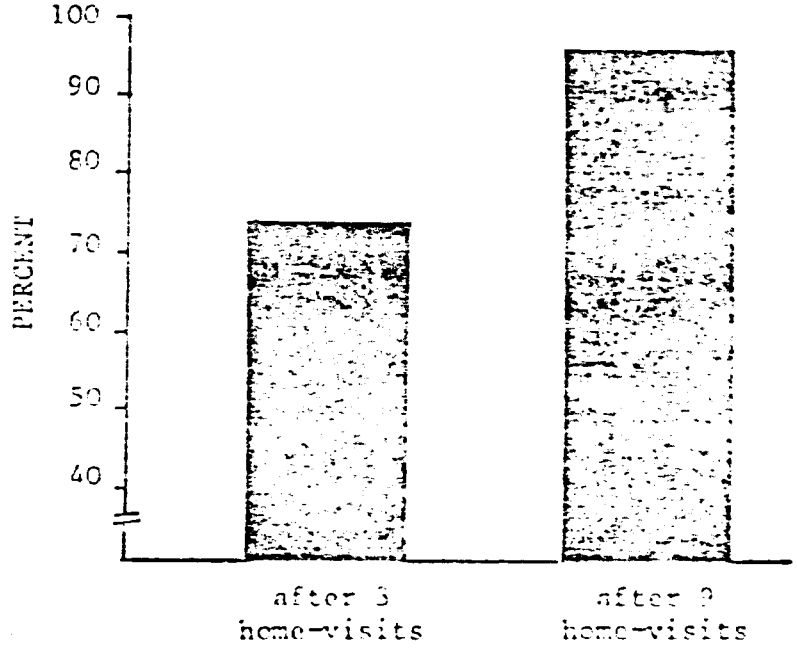
ON REQUEST IN INITIAL (I) SURVEY IN ALL AND IN REPEAT (II) SURVEY IN THE

"SUGAR AND SALT HOME PREPARED" CELL

STUDY CELL	Survey No.	SIZE 1 Mean=1.9 gr.		2 Mean=2.9 g.		3 Mean=4.7 gr.		4 Mean=6.2 gr.		5 Mean=9.8 gr.		NO SPOON AVAIL.		ALL
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
Control (2)	I	0	0	0	0	56	82.3	7	10.3	2	2.9	3	4.4	68
Oralyte: home-distributed	I	0	0	5	8.5	46	78.0	7	11.9	1	3.4	0		59
Oralyte: through Commercial sources	I	0	0	0	0	22	81.5	5	18.5	0	0	0	0	27
S/S: home-prepared	I	10	13.0	21	27.3	18	23.4	18	23.4	9	11.7	1	1.3	77
	II	3	4.3	18	26.1	47	68.1	1	1.4	0	0	0	0	69
S/S: prepackaged; home-distr.	I	0	0	0	0	18	69.2	7	26.9	1	3.9	0	0	26

Figure I

USE OF CORRECT (3-6 gm) TEASPOON SIZE
AFTER THREE AND NINE HOME VISITS



$P_{\Delta} < .005$

ABILITY TO MEASURE CORRECTLY ONE LITER OF WATER ON

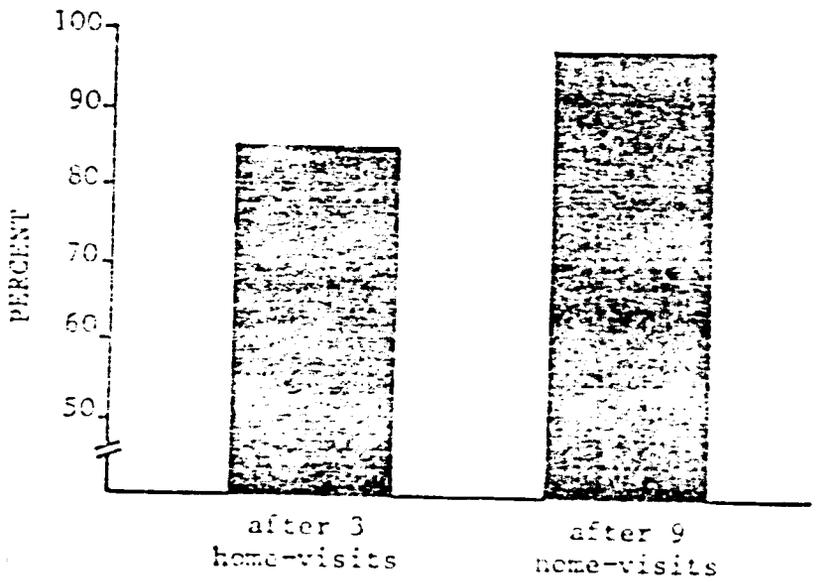
INITIAL (I) AND REPEAT (II) SURVEYS

Study Cell	Survey No.	ABLE		UNABLE		ALL
		No.	%	No.	%	Number
Control (2)	I	1	1.5	67	98.5	68
	II	1	1.5	67	98.5	68
Oralyte; home distributed	I	53	89.8	6	10.2	59
	II	72	97.3	2	2.7	74
Oralyte; through commercial sources	I	27	100	0	0	27
	II	31	96.9	1	3.1	32
S/S; home prepared	I	55	71.4	22	28.6	77
	II	60	87.0	3	13.0	69
S/S; prepackaged; home-distr.	I	25	96.2	1	3.8	26
	II	28	100	-	-	28
ALL *	I	160	84.7	29	15.3	189
	II	191	97.0	6	3.0	197

* excluding control

Figure II

ABILITY TO MEASURE CORRECTLY
ONE LITER OF WATER
AFTER THREE AND NINE HOME VISITS



$P_{\Delta} < .005$

Table 5

SOURCES OF WATER FOR HUMAN CONSUMPTION ON INITIAL (I)

AND REPEAT (II) SURVEYS

Study Cell	Survey No.	Tap in Home		Public Tap		Pumps		Canal		Total No. of Interviews
		No.	%	No.	%	No.	%	No.	%	
Control (2)	I	42	58.8	29	41.1	0	0	0	0	71
	II	45	64.1	23	35.8	0	0	0	0	68
Oralyte: home distributed	I	20	33.9	22	37.3	9	15.3	8	13.6	59
	II	35	47.3	22	29.7	10	13.5	7	9.5	74
Oralyte: through commercial sources	I	14	51.8	13	48.2	0	0	0	0	27
	II	15	46.9	17	53.1	0	0	0	0	32
O/S: home prepared	I	7	9.1	22	28.6	30	40.0	18	23.4	77
	II	3	4.8	30	47.6	20	31.7	10	15.9	63
O/S: Prepackaged: home mixing	I	14	53.9	12	46.2	0	0	0	0	26
	II	13	46.4	15	53.6	0	0	0	0	28
All Cells	I	95	37.0	97	37.7	39	15.2	26	10.1	257
	II	111	41.8	107	40.4	30	11.3	17	6.4	265

In Table 6 the sodium concentrations of randomly collected, home-prepared O R S in initial and repeat surveys are shown. In the initial survey, mean sodium concentrations tended to be considerably higher than expected suggesting that mothers, in general, tended to use too little water. On repeat survey, the mean and mode of the sodium concentration in all treatment cells closely approximated expected concentrations as shown in Figure III.

In Table 7 the consumption of pre-packaged oral rehydration salts (Oralyte and pre-packaged Sugar/Salt) by source and study cell is shown. Total use ranged from 1/25 of a package per child per six months in the "Control 1" cell to almost 5½ packages per child in the "Sugar and Salt; Pre-packaged; Home distribution" cell as shown in Figure IV. The majority of pre-packaged ORS used came through home distribution, 94% in the "Oralyte; Home Distribution" cell, 95% in the "Sugar and Salt Pre-packaged; Home Distribution" cell. The next highest utilization occurred in the "Oralyte Commercial sources" cell with 1.3 packages per child per six months, of which 81% was purchased by mothers. In health facilities Oralyte use ranged from the previously mentioned 1/25 of a package per child in the "Control 1" cell to almost half a package per child per six months in the "Sugar and Salt; Home Prepared" cell with the other cells taking intermediate positions.

OUTCOME

Table 8 shows the total and diarrhea-specific death rates for children one month to five years of age in the six study cells. Deaths below one month of age were not included in the analysis as there is strong evidence to support that deaths below that age are under-reported.

The differences in total mortality and diarrhea specific mortality between "Control 1", "Control 2" and the "Oralyte; Commercial Sources" cell are statistically not significant. Similarly, the differences in total child mortality and diarrhea-specific mortality between the "Oralyte Home Distribution", "Sugar and Salt; Home Prepared" and "Sugar and Salt Pre-packaged; Home Distribution" cells are statistically not significant. The differences in mortality between these two groups are around 40% in total mortality and 50% in diarrhea specific mortality and are statistically, highly significant ($P < .005$). Differences in child mortality between each of the three study cells where ORS was made either at home (from sugar and salt) or where ORS was delivered in high quantities to the home and each of the other three cells, "Control 1", "Control 2" and "Oralyte Commercial Sources" are similarly statistically highly significant ($P < .005$). Figure V shows the percentage reduction in total child mortality and diarrhea-specific mortality between 1 month and 5 years of age in all treatment cells as compared to the mortality mean of the two control cells.

In Table 9 the mortality trend is shown over the four years preceding the study. From an initial level of around 22 per 1000 children per six months (May through October) in 1976/77, mortality dropped significantly ($P < .005$) to a mean of 17.5/1000 in 1978/79 and to a mean of 10.5 ($P < .005$) by 1980 in the three treatment cells (excluding the "Oralyte; Commercial Sources" cell). This drop in total child mortality is shown graphically

in Figure VI. Interestingly the MOH introduced nation-wide measles vaccination as well as an oral rehydration program in September 1977 similarly seemed to have brought about a 20% decline in child mortality from the 1976/77 levels.

COST BENEFIT ANALYSIS

Table 10 summarizes the cost for the delivery of the service components of the program up to and beyond routine expenses incurred in the "Control 1" cell. Of the total cost 51% was due to salary supplements, 34% to the cost of pre-packaged ORS, 8% to increased transport needs (mainly for supervision), 1% for health education posters and less than half a percent for training. By dividing the costs of the program up to and beyond that encountered in the "Control-1" cell by the total number of children affected by the program, a cost per child was obtained. This cost canged from L.E. 0.16 ($ 0.23) in "Control-2" villages to L.E. 0.61 ($ 0.87) in the "Sugar/Salt; Prepackaged; home-distribution" villages. In the "Sugar/Salt; home prepared" villages it was L.E. 0.30 ($ 0.43). Lastly, by multiplying the number of the study population in each cell other than "Control-1" by the diarrhea-specific mortality rate in the "Control-1" cell and subtracting the total number of diarrhea-specific deaths observed during the study period in these cells from the product, the number of "averted deaths" was determined to come to 134.

The total cost of the program divided by this number then provides a mean cost per death averted in the study. Extending this calculation to all individual study cells, the cost-effectiveness of each mode of program delivery was established as shown in Figure VII. The cost per death averted ranged from L.E. 36.5 ($ 52) in the Sugar/Salt; home prepared" cell to L.E. 483.5 ($ 691) in the "Control-2" cell. In the "Oralyte; home distributed" cell it was L.E. 73.- ($ 104).

PROBLEMS

Rumours. Several rumours arose early on in the study. All arose in areas where prepackaged electrolytes - Oralyte or prepackaged Sugar/Salt were used. In several villages rumours circulated to the effect that the content of the packages killed children. One of the origins of this rumour was traced to a pharmacist (who probably worried about a decline in sale of antibiotics and intestinal anticeptics during the summer diarrhea season). The District Health Officer (DHO) as well as the physician supervisor from the district discouraged further spread of the rumour by talking to the pharmacist concerned, to the persons known to have spread the rumour as well as to the villagers in general, after the Friday prayer meeting at the mosque. Another was traced to a family whose child had been suffering from severe diarrhea, was treated with oral therapy and had died. The supervisory team explained to the family and to the village community that even with "good treatment" there are occasionally failures and that probably the treatment had come too late. In another group of villages where Oralyte was distributed on a house-to-house basis a rumour spread to the effect that Oralyte permanently

sterilized children. As previously, source and focus of the rumour were identified by the supervisory team and were found to be limited to one village. The supervisory personnel as well as the nursing staff in that village defused the rumour by giving dissolved Oralyte to their own children in front of village persons at a meeting specially arranged for the village community.

Secondary treatment sources. Physicians were advised to directly refer cases of moderate to severe dehydration to the pediatric departments of either district and/or governorate hospital, hence a visit to each of the "rehydration centers" in the pediatric wing of the governorate (referral hospital as well as in one of the district hospitals was made. The district rehydration center was found to be non-operative. The center in the governorate hospital was deficient both with respect to quality of care and available equipment.

Rapid scruting of verbal autopsy forms suggests that even though the majority of fatal cases were seen by private physicians, only in the minority were fluids part of the prescribed treatment. In the majority of cases, treatment consisted of one or more antibiotics, intestinal antiseptics and tonics with little, if any, follow-up. Mothers not infrequently consulted two and more private practitioners for the same illness episode.

Lastly, since in an earlier sample survey we had found that 17% of mothers went directly to the pharmacist for medical care if their child had diarrhea a survey was carried out in nine pharmacies, three of which were in the governorate capital (Mansoura) and six in the diarrhea study area. The objective was to determine the treatment pharmacists commonly advise (and sell) for uncomplicated childhood diarrhea. A medical anthropologist and visitor to the project posed as mother whose 8 month old baby allegedly was suffering from diarrhea since one day.

Drugs advised (and sold) were: Chloramphenicol, Pentrax (Ampicillin), Nimarol, Enteroquin and Enteroquin with Streptocillin. Not one pharmacist advised Oralyte or Rehydran*. Only when specifically asked for, was oral rehydration salt sold. All pharmacist indicated that O.R.T. was only for severe diarrhea when there was dehydration. The dose recommended ranged from 1 teaspoon of the diluted mixture every ten minutes to 1 teaspoon every 15 minutes. Two pharmacists from within the "Oralyte; commercial sources" cell claimed, contrary to our records, not to have any Oralyte left and further added that it had a bad reputation among villagers because it reportedly killed children. One of them stated that when he used to sell it, he dissolved 3 packages in ½ liter of water for those mothers who asked for it. One pharmacy in one of the study districts sold one liter of 5% Glucose solution to the interviewer as rehydration mixture.

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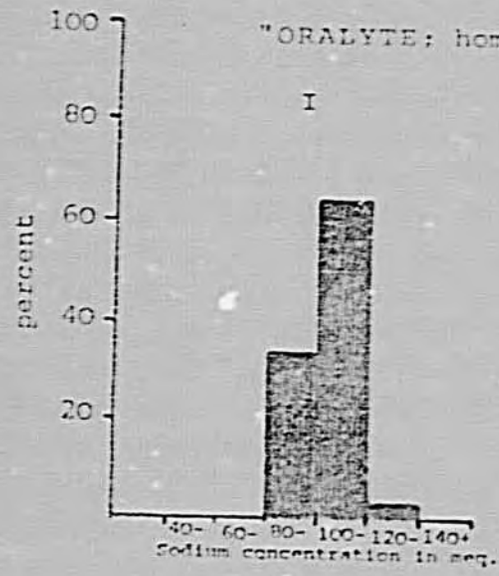
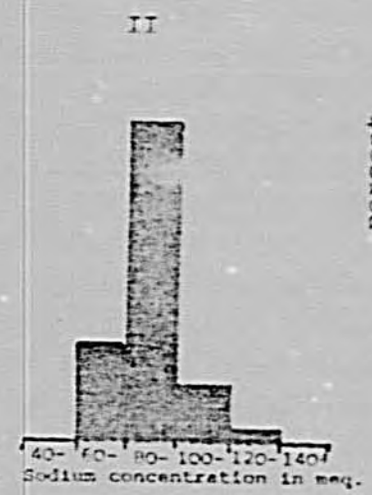
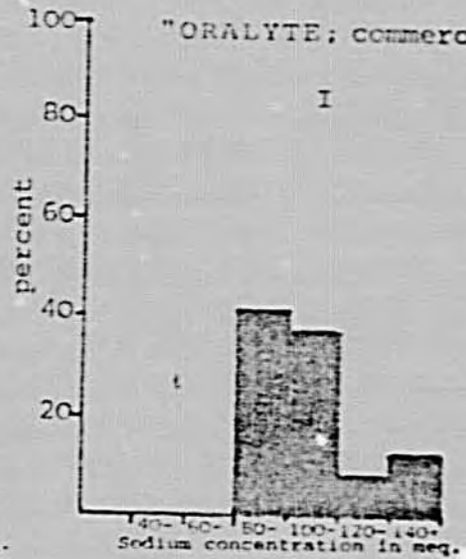
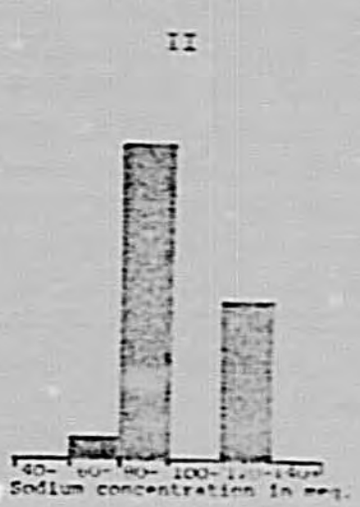
* Rehydration salt prepared by a commercial drug company in Egypt of identical composition as Oralyte but packaged for dilution in 200 cc.

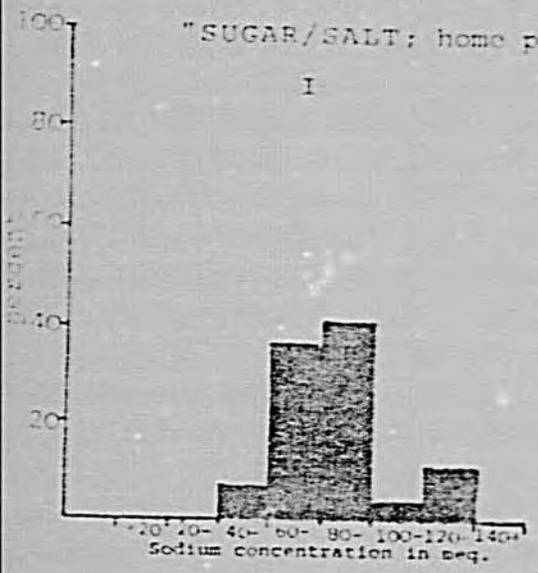
SODIUM CONCENTRATION IN HOME PREPARED/DILUTED ELECTROLYTE SOLUTIONS
ON INITIAL (I) AND REPEAT (II) SURVEYS

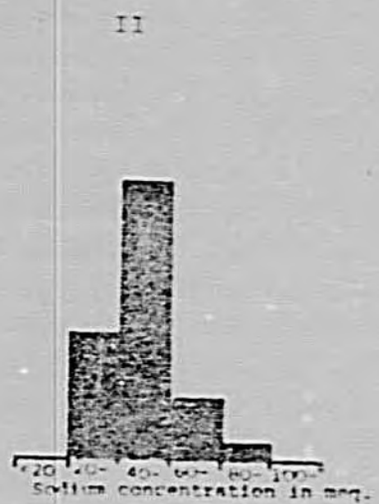












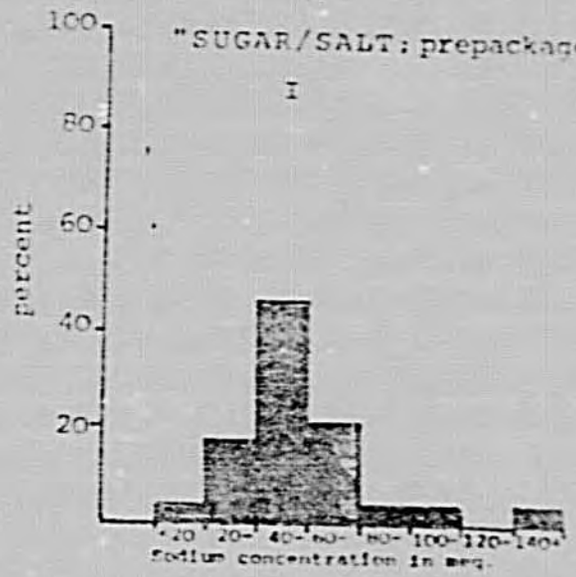


Table 6

SODIUM CONCENTRATION OF RANDOMLY COLLECTED SAMPLES OF REHYDRATION MIXTURE ON INITIAL (I) AND REPEAT (II) SURVEYS

Study Cell	No. of Samples		Expected sodium conc.	Obtained Na concentration (mmols)						Percent of samples with > 120 mmole	
				mean		S.D.		range			
	I	II		I	II	I	II	I	II	I	II
"Oralyte" home distribution	74	74	90	103	90	8.2	11.4	81-125	63-124	1	1
"Oralyte" through commercial sources	24	22	90	112	101	22.7	15.0	96-173	78-123	21	23
Sugar/Salt mixt; home-prepared	76	69	40	59	48	34.7	16.0	13-250	21-106	4	0
Sugar/Salt mixt. prepackaged; home-distr.	27	28	60	79	64	19.8	10.4	52-121	18-73	4	0

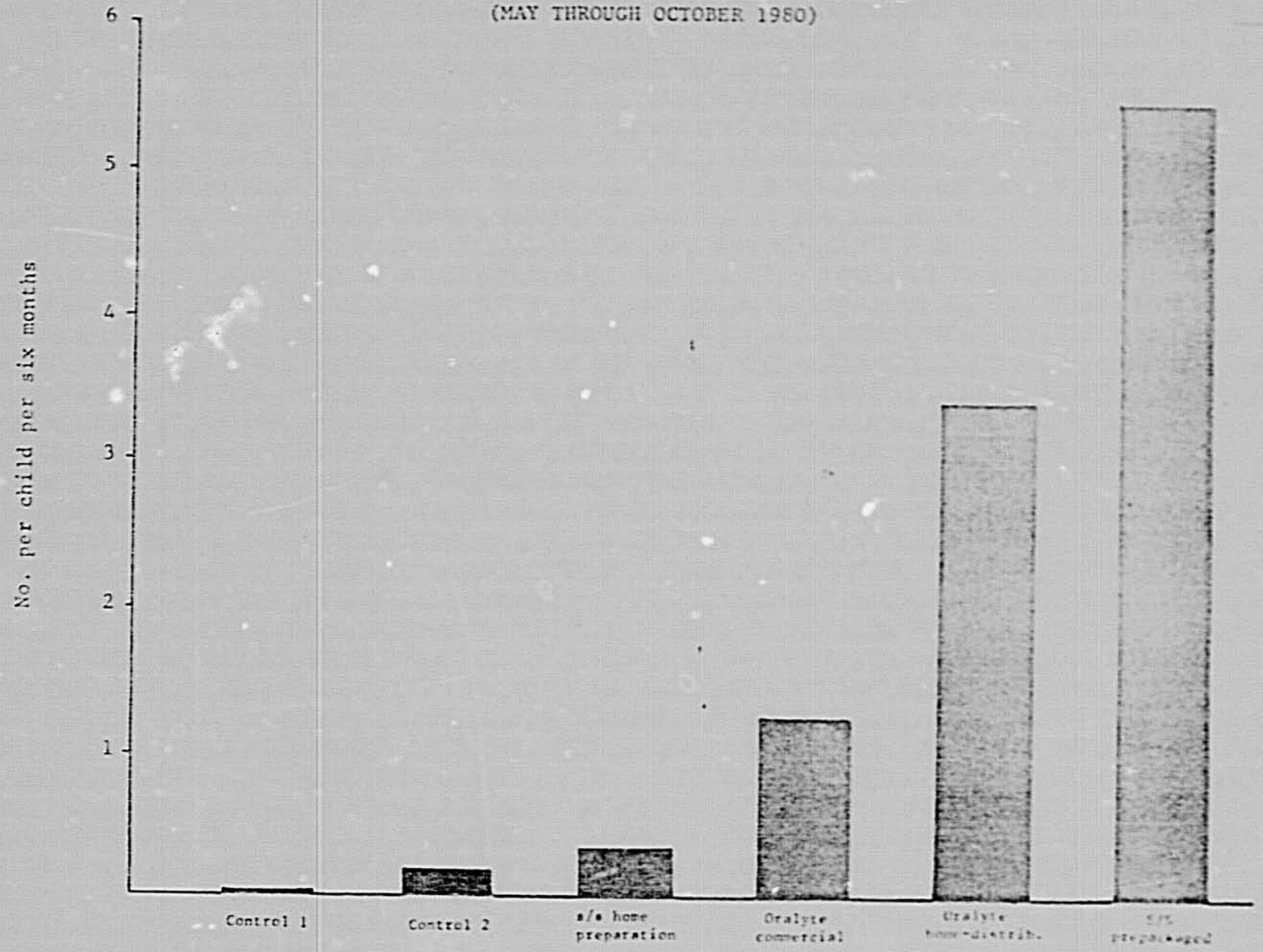
I : Samples taken after 3 home visits
II: Samples taken after 9 home visits

CONSUMPTION OF PREPACKAGED REHYDRATION MIXTURES BY
SOURCE AND STUDY CELL
(May through October 1980)

Study Cell	Distributed to homes		Commercial Procurement		Used in health facilities		Used by all sources	
	Number	Rate*	Number	Rate*	Number	Rate*	Number	Rate*
Control I pop.: 4400	–	–	–	–	182	0.04	182	0.04
Control 2 pop.: 6018	–	–	–	–	1,093	0.18	1,093	0.18
Oralyte home distributed pop.: 6875	21,799	3.17	–	–	1,541	0.22	23,340	3.39
Oralyte through commercial sources pop.: 2073	–	–	2,106	1.02	512	0.25	2,618	1.26
S/S home prepared pop.: 7023	–	–	–	–	2,571	0.36	2,571	0.36
S/S prepackaged; home-distr. pop.: 2461	12,833	5.21	–	–	631	0.26	13,464	5.47

* per child per six months

CONSUMPTION OF PREPACKAGED REHYDRATION MIXTURE
PER CHILD PER SIX MONTHS BY STUDY CELL
(MAY THROUGH OCTOBER 1980)

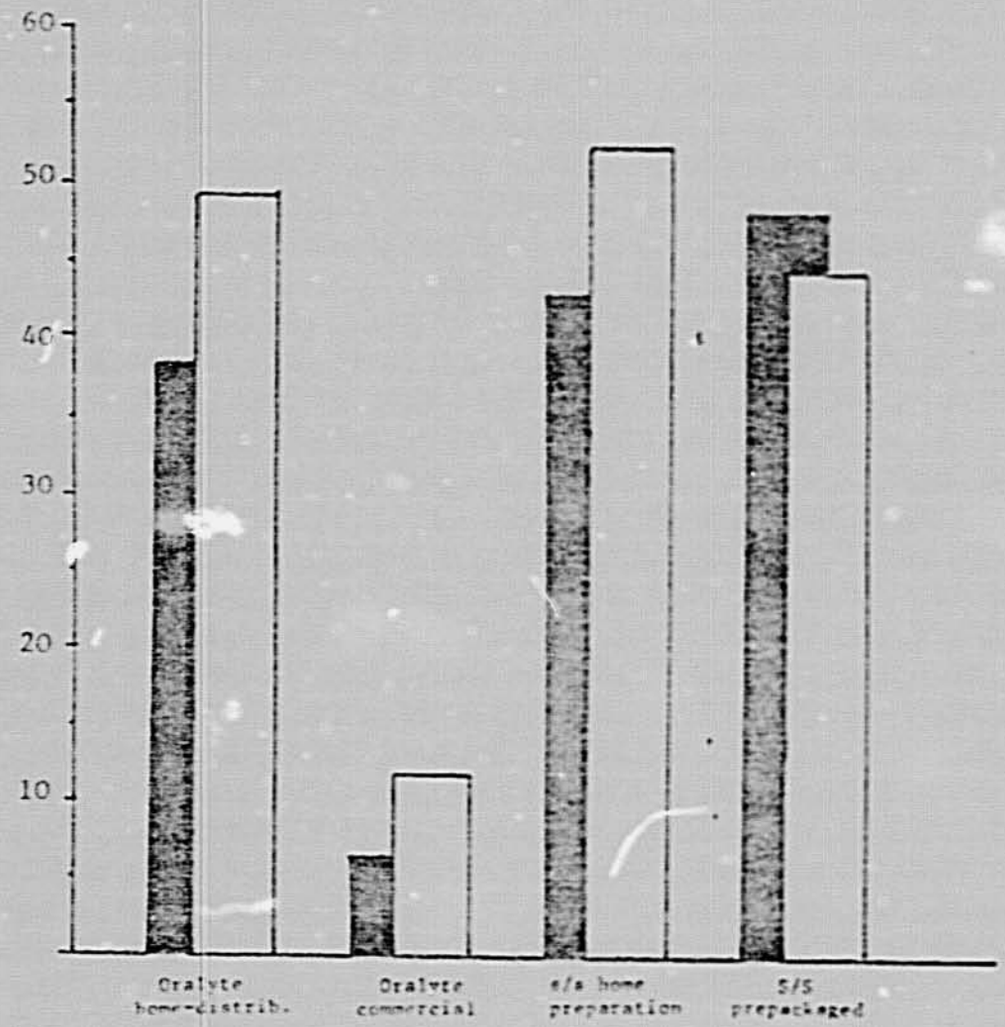


CHILD DEATHS BETWEEN ONE MONTH AND FIVE YEARS OF AGE
BY STUDY CELL (MAY THROUGH OCOTBER 1980)

Study Cell	All Deaths		Diarrhea-specific Deaths	
	Number	Rate*	Number	Rate*
Control 1 (4400 children)	76	17.3	68	15.5
Control 2 (6018 children)	113	18.8	91	15.1
Oralyte home-distrib. (6875 children)	77	11.2	53	7.7
Oralyte commercial sources (2073 children)	35	16.9	28	13.5
S/S home prep. (7023 children)	72	10.3	51	7.3
S/S prep, home distrib. (2461 children)	23	9.3	21	8.5

* per 1000 Children per six months

PERCENT REDUCTION IN CHILD DEATHS
BETWEEN ONE MONTH AND FIVE YEARS OF AGE BY STUDY CELL
USING THE TWO CONTROL CELLS AS REFERENCE
(MAY THROUGH OCTOBER 1980)



= All deaths 1 month to < 5 years

= Diarrhea-specific deaths 1 month to<5 years

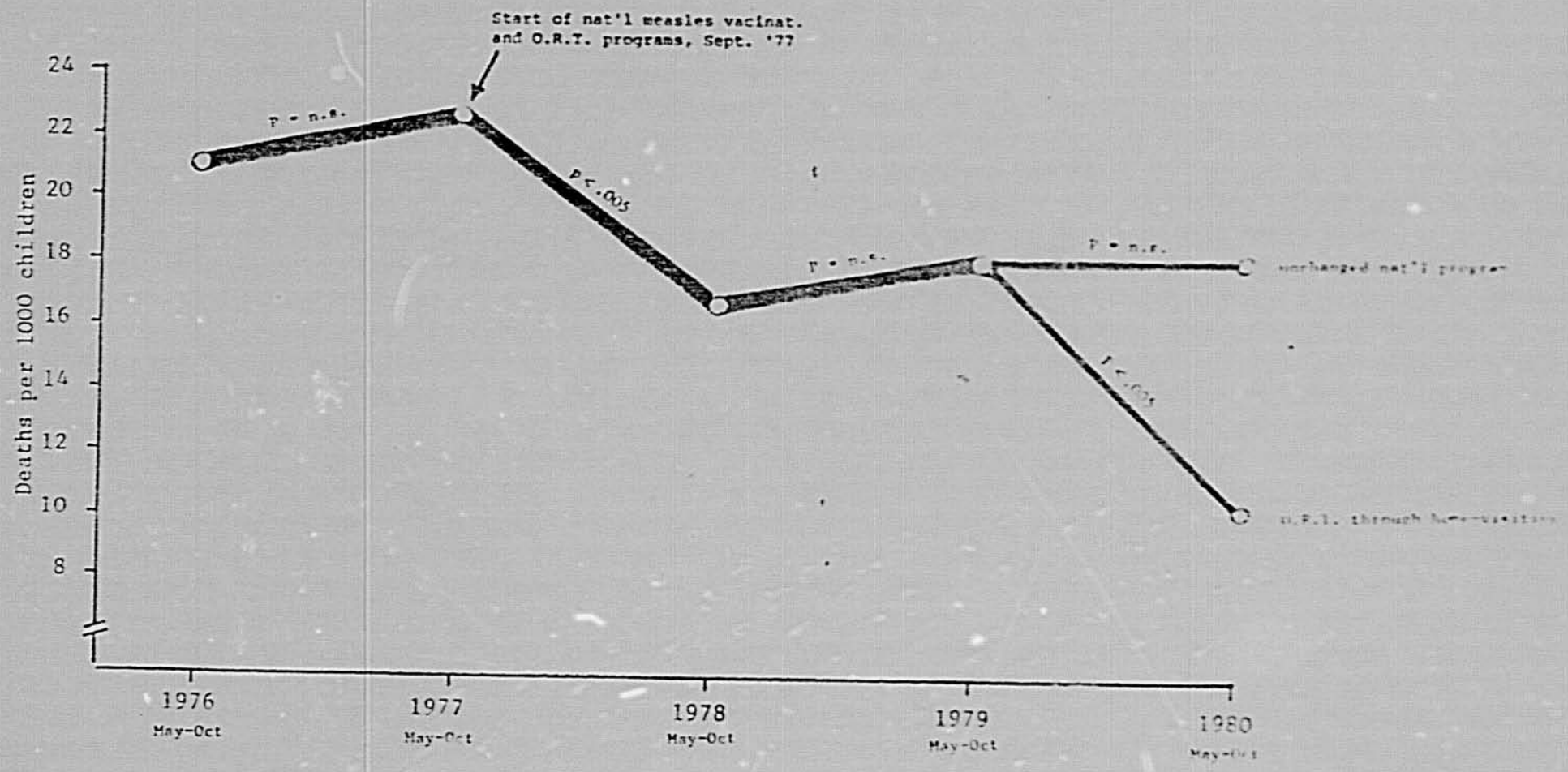
CHILD DEATHS BETWEEN ONE MONTH AND FIVE YEARS OF AGE
DURING MAY THROUGH OCTOBER 1976-1980

Year	No. of Deaths	No. of Children	Rate*
1976	483	22,857	21.1
1977	532	23,368	22.8
1978	421	25,034	16.8
1979	525	28,949	18.2
1980**	172	16,359	10.5

* Per 1000 children per six months
** Excluding Control 1, 2 and Oralyte-commercial cells

Figure VI

CHILD MORTALITY BETWEEN ONE MONTH AND FIVE YEARS OF AGE
BY MODE OF O.R.T. PROGRAM DELIVERY
(MAY THROUGH OCTOBER 1976 THROUGH 1980)



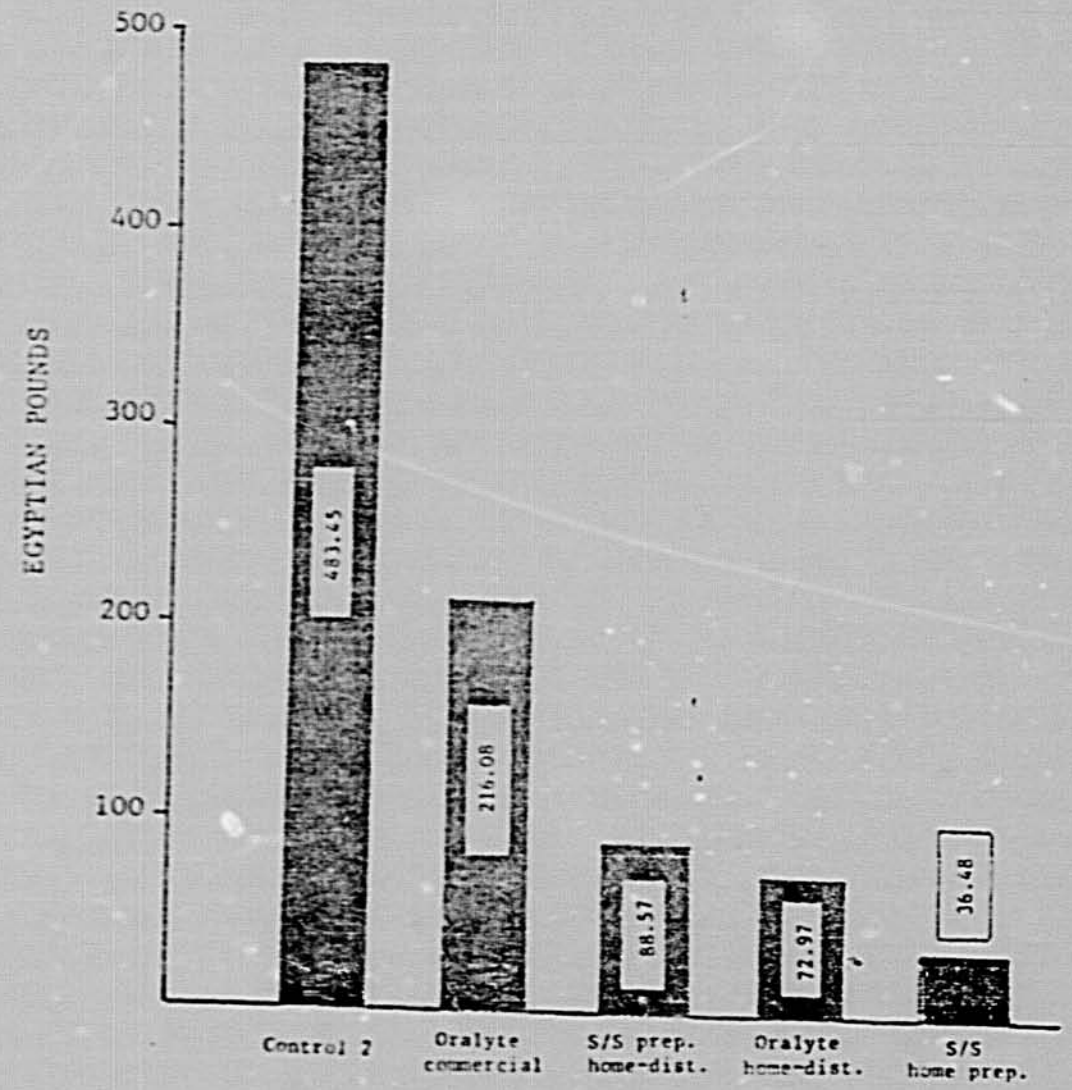
COST EFFECTIVENESS OF VARIOUS MEANS OF O.R.T. PROGRAM DELIVERY

COST ITEMS*	STUDY CELL					ALL
	CONTROL II	Oralyte Home distr.	Oralyte Commercial	S/S home-prepared	S/S prep. home dist.	
REHYDRATION SALTS						
Oralyte @ 10 pt/package S/S prep. @ 6 pt/package	84.40	2,305.56	253.23	228.05	822.90	3,694.14
SALARY SUPPLEMENTS						
Nurses, Sanitarians	----	630.-	240.-	720.-	720.-	
Facility Physicians	210.-	288.-	144.-	384.-	144.-	
Supervisory Teams (3)	174.60	181.70	55.-	189.70	65.-	
Periph. Study Admin.	299.-	311.-	94.-	325.-	111.2	
	683.60	1410.70	533.-	1618.70	560.20	4,836.20
TRANSPORT	197.-	205.-	61.50	213.60	73.10	750.20
TRAINING						
Equipment and food	1.89	15.28	5.47	16.63	6.24	45.51
POSTERS	----	36.97	11.11	38.60	13.22	99.90
Total	966.89	3,973.51	864.31	2,115.58	1505,66	9,425.95
No. of Children covered by program	6018	6875	2073	7023	2461	24,513
Cost per child covered (L.E.)	0.16	0.57	0.42	0.30	0.61	0.38
No. of Deaths averted	2	53	4	58	17	134
Cost per Death averted (L.E.)	483.45	72.97	216.08	36.48	88.57	70.34

* Cost up and beyond that encountered in the Control I cell.

Figure VII

COST PER DEATH AVERTED IN EGYPTIAN POUNDS BY STUDY CELL
USING CONTROL 1 AS REFERENCE
(MAY THROUGH OCTOBER 1980)



DISCUSSION

The DDCS was carried out as practical applied research exercise in order to provide information useful for strengthening rural health services in Egypt. The study took great care to develop a practical investigation which could lead to information useful for realistic, nationwide replication of any positive results. In this regard, the SRHD Project was obliged to investigate the early use of a home prepared sugar and salt ORT, since for the forseeable future the ability to distribute Oralyte at the level consistant with need might not exist in Egypt. The kind of information needed by the MOH required the investigators to:

- Ascertain the efficacy and safety of alternative configurations of treatment and their cost.

- Ascertain the effect of different configuration of service delivery on such factors as mortality, utilization, referral and cost.

In this study different variations of ORT and alternative service delivery patterns have been examined. Unambiguous answers have been provided to many of the questions which provided the impetus for undertaking this study. This investigation has demonstrated that several configurations of ORT can be effective in reducing child deaths from diarrhea Indeed depending on the specific service configuration and the delivery system, ORT can be the basis of an inexpensive program for combatting diarrhea-specific deaths, and easily integrated with the existing health services. At high levels of diarrheal disease prevalence and high mortality from diarrheal disease, ORT in the form of a simple sugar and salt solution in the hands of mothers and backed by a balanced electrolyte solution in the hands of the health care provider is a viable and cost-effective way of reducing child mortality. It must be underscored, however, that diarrhea-specific deaths constitute a substantial portion of child deaths both in absolute and percentage terms in Egypt; hence, the rather dramatic reduction in total child mortality seen in this study. Total child mortality might not drop so precipitously in other countries where the distribution of the causes of child deaths is less skewed. It is worthwhile to mention here, also that for about the same cost ten years ago, the Narangwal Study carried out in India, was able to avert a child-death (non-specific) with an integrated health service package which concentrated on MCH services.

Of great importance to the Egyptian MOH, ORT can be effective, programatically, when carried out as a part of the existing MOH infrastructure. This study was run entirely by MOH personnel in the field supplemented only by the SRHD central staff. A major concern before undertaking this study was the eventual reproducibility of the results should this be warranted. Four areas have been identified as crucial to the success of any ORT program which might be instituted in Egypt.

- The existing health care delivery system needs to be modified to the extent that home-visiting must become a routine part of the health services to assure availability and use of services.

- Unfamiliarity with ORT by health workers necessitates training of workers in the use of ORT.

- Supervision of health staff in Egypt currently proceeds at an unsatisfactory level, and is substantively not as useful as would be expected of such a vast supervisory network. Both the quantity and quality of supervision need to be put into the supervisory network.

- Staff in the DDCS do a significant amount of extra work to implement a diarrheal disease control program. Incentives must be paid to make the program a success. Incentives have been made at a level in this study which can be realistically reproduced nation-wide by the MOH.

One of the most exciting aspects of this investigation has been the demonstration that mothers can be taught, and that they can become proficient in early management of diarrheal disease using ORT. However, it needs to be underscored that a health education effort needs to be repeated and continuous. This would suggest a potential for greater participation by the mother in the care of her child as guided by government health services. Indeed, community participation at the most meaningful level has been demonstrated and can be built upon. Almost all mothers were proficient at the end of nine visits by the nurse in using an acceptable teaspoon (volume) correctly measuring a liter of water, and in producing a safe and useful ORT solution.

It was somewhat surprising that the pharmacist/shopkeeper provided such disappointing performance as a source of ORT. Relative to the other study cells where pre-packaged oral rehydrant was distributed, a small amount of Oralyte was purchased by the community amounting to only one packet per child per six months. Moreover, among those mothers in the "Oralyte Commercial Sources" cell and only in this cell, there was an unacceptably high proportion of mothers who prepared an unsafe ORS. Reasons for this poor performance are probably rooted more in project design and with the pharmacist/shopkeepers than with the mothers. The project simply did not provide a strong training program for pharmacists/shopkeepers. A spot check of the pharmacists/shopkeepers during the DDCS revealed that none of these persons could give correct instruction on the use of pre-packaged oral rehydrant. However, lack of education was not the only factor contributing to the poor performance in this study cell. Shopkeepers and pharmacists conceded that the profitability of pre-packaged oral rehydrant was insufficient. It seems highly unlikely that without intensive education of pharmacists/shopkeepers as well as motivation, commercial outlets are an effective way of delivering oral rehydrants. At best, however, it seems improbable that this distribution alternative can be as cost-effective as sugar and salt home preparation. In addition, a commercial outlet is open for only a limited number of hours a day: a problem shared by the health facility and one reason for seeking alternatives to the health facility as a distribution source complementary to the health facility. It is certain that the household survey, as yet not analyzed, will contribute further meaningful information on this subject.

Also with regard to consumption of pre-packaged rehydration mixture an interesting pattern emerged in the different study cells. The use by all sources of Oralyte in the "Oralyte; home distribution" cell was about half of the rate of that from all sources of oral rehydrants used in the "Sugar/Salt; pre-packaged, home distribution" villages. As the in-facility use for both cells was not statistically different, the cause of the difference lay in the rate of use of Oralyte or pre-packaged sugar/salt in the home. Reasons for this difference are not clear. Perhaps because pre-packaged sugar/salt ORS is not a balanced electrolyte ORT, the diarrheal disease continued somewhat longer and more of the solution was needed to have the same physiologic effect as a lesser quantity of Oralyte.

The study also rather clearly showed that the concentration of the principal electrolyte - sodium - need not be within the narrow range commonly assumed. In our study the range of sodium concentrations was deliberately chosen to be between 40 and 90 yet mortality effects in the cells with these different sodium concentrations were virtually identical. This last finding would tend to qualify the program effected in the"Sugar/Salt; home prepared" villages, where home supplies were used in conjunction with Oralyte as one "Appropriate Technology" intervention.

PART II

FINANCIAL REPORT

COSTING

Up-to-date expenditure including cost for Oralyte imported from the U.S. has amounted to L.E. 8,485.15 and US$ 22,255.28. This represents less than one fifth of the total Pound funds and less than two thirds of the Dollar funds available for the study. A sizeable portion of Dollar funds spent (46%) went into shipping and handling of Oralyte from abroad.

EXPENDITURES (April 21, 1980 through October 31, 1980)

Category	SOURCE OF FUNDS					
	USAID			WHO		
	Funded	Spent	Balance	Funded	Spent	Balance
A) Personnel 1- Local 2- Expatriate - salary - per diem	L.E. 14,110.- US$ 24.100.-*	L.E. 3,482.45 US$ 800.- L.E. 413.60				
B) 1- Equipment 2- Oral Reh. Salts	L.E. 47,000.-	L.E. 3,755.850 US$ 16,474,87**	L.E. 33,144.15	US$ 10,000	US$ 4,98041***	US$ 5,019.59
C) In Country Transportation (Incl. Per diem)	L.E. 500.-	L.E. 244.-	L.E. 256.-			
D) Training and Conferences	L.E. 700.-	L.E. 589.25	L.E. 110.75			
Subtotal Contingency	L.E. 62,310.- L.E. 6,290.-	L.E. 8,485.15				
TOTAL	L.E. 68,600.- US$ 24,100.-	L.E. 8,485.15 US$ 17,274.87	L.E. 60,114.85 US$ 6,825.13	US$ 10,000	US$ 4,98041	US$ 5,019.59

* *Intended for expatriate consultant*

** *This amount includes cost of 100,000 packages of Oralyte ($ 7000.-) and their transport and handling charges ($ 9,474.87).*

*** *US$ 2143.- (L.E.1500.-) for local production of 25,000 prepackaged Sugar-Salt mixtures; US$ 2097.- for 29,9600.- packets of Oralyte, and US$ 740.41 (SFr 1,258.70) for their shipping and handling.*

PART III

ADDITIONAL PERSONNEL ACTIVE IN THE STUDY

List of additional Personnel active in the Study (listed alphabetically)

I) CENTRAL (SRHD) OFFICE

Dr. C. Ajello (expatriate consultant) - data collection, household survey preparation, data analysis, acting technical advisor.

Mr. B. B. Attallah (adm. assistant) - data collection, data analysis

Miss Amna Bastawi (training assistant) - preparation of survey forms.

Mr. Hassan A. Hassan (statistical assistant) - preparation of household survey forms, monitoring of all survey activities, data analysis.

Dr. C. McCord (expatriate, voluntary consultant) - preparation of study proposal.

Dr. A. Nagaty (executive project director) - development of study proposal, training of program staff.

Dr. M. El-Nomroussy (consultant) - preparation of study proposal, data analysis.

Mr. Faiez T. Sourial (accountant) - financial administration of study.

Miss Mona Kamel Youssef (secretary) - typing of forms and reports.

II) PERIPHERAL (GOVERNORATE AND DISTRICT) PERSONNEL

1) Consultants

Dr. M. Bassussi, professor of pediatrics, Mansurah University
Dr. A. Mohssen, Undersecretary of State, Dakahlia governorate.

2) Acting (local) Study Directors

Dr. M. Mousfi (facility physician)
Dr. Saber Saber El Sayes (facility physician)
Dr. M. Sabry Osman (facility physician)

3) Supervisory Teams:

Sinbellawen:
Dr. Mahmoud El Sayed Mahmoud Ebeed, Physican
Mr. Soliman El Saied Soliman, Sanitarian
Mrs. Nargess Farag Youssef, Nurse

Dekernis:
Dr. Osman Ali Osman, Physician
Mr. Mohamed Mohamed Abdalla, Sanitarian
Mrs. Magda Abasa, Nurse

Miniet El Nasr:
Dr. Mohamed Sabry Osman, Physician
Mr. Atef Mohamed Abdel Aziz, Sanitarian
Mrs. Afaf Mohamed Abdel Rahman El Mohandes, Nurse

4) "Flying Doctors":

Dr. Mohamed Gad Mohamed Ibrahim	(facility physician, Kafr Alam)
Dr. Mostafa Abdel Moneim El Sabruti	(facility physician, Mit Assem)
Dr. Saber Saber El Sayes	(facility physician, Ashmoun Roman)
Dr. Sabet Khattas Assaad	(facility physician, Abou Dawood)
Dr. Sami Abdel Khafar Ali	(facility physician, Mit Adlan)

5) Survey Team:

Mrs. Ekram Abou El Maged	(social scientist, team leader)
Ms. Hewaida Taha Shoeieb	(interviewer)
Ms. Ragaa Mohamed Abdou	(interviewer)

6) Facility Physicians

Sinbellawen

Dr. Sabet Khattas Assaad	(Abou Daoud)
Dr. Mahmoud Hamed Saker	(Bar Hamtush)
Dr. Mahmoud Hamed Mouafi	(Kafr Ghannam)
Dr. Mohamed Mohamed Ibrahim	(Teranis)
Dr. Mahmoud El Sayed Mahmoud	(Barkein)
Dr. Ahmed Saad El Bayoumy	(Mit Gharita)
Dr. Mahmoud Hamed Saker	(Kafr El Ananaa)
Dr. Ali Mansour Ali	(Abu Seer)
Dr. Rabaa Abdel Megid Abdel Kalik	(Tuch Al Aklam)
Dr. Ahmed Abdel Hamid S. Ahmed	(El Zaheira)
Dr. Eid El Hakkim El Saied Mohamed	(Mukatsa)

Dekernis

Dr. Osman Ali Osman	(Beni Ebid)
Dr. Sami Abdel Khafar Ali	(Mit Adlan)
Dr. El Sayed Abdel Aziz	(Nigir)
Dr. Morcos Abdel Missieh	(Mit Dafer)
Dr. Hamed Abdel Wahab	(Dimuh)
Dr. Saber Saber El Sayes	(Ashmoun Roman)
Dr. Ahmed Abdel Latif Habib	(Mit Sued)
Dr. El Sayed Ahmed Ali	(Mit Taarif)
Dr. Mohamed Mohamed El Dawoody	(Kalyobeya)

Miniet El Nasr

Dr. Mohamed Gad Mohamed Ibrahim	(Kafr Alam)
Dr. Mostapha A.M. El Sabruti	(Kafr Abu Zikri)
Dr. Mohamed Gad M. Ibrahim	(Brembal Gedida)
Dr. Nabaweya Gomaa Shaaban	(Mit Kholi Mo'men)
Dr. Mostapha A.M. El Sabruti	(Mit Hadid)
Dr. Fatma Mohamed Marei	(Riad)

7) Facility Nurses

Sinbellawen

Ms. Afaf Mohamed Khalil	(Mukataa)
Ms. Nadia Hassan Ibrahim	(Mukataa)
Ms. Nadia Abdel Azim Ibrahim	(Abu Seer)
Ms. Fatma Mohamed Abdel Fatah	(Abu Seer)
Ms. Khayreya Ali Khalil	(Abu Seer)

Ms. Fatma Mohamed Afifi	(Mit Gharita)
Ms. Aza Abdel Hamid Shaaban	(Mit Gharita)
Ms. Nadia Abdel Azim Mohamed	(Mit Gharita)
Ms. Soad Abdel Ghafar Mahmoud	(Mit Gharita)
Ms. Amina Sadek El Sherbini	(Tuch el Aklam)
Ms. Laila Mansour Hamama	(Tuch Al Aklam)
Ms. Ayda Mohamed Amin	(Abou Daoud)
Ms. Fatma Ismail Abdel Al	(Abu Daoud)
Ms. El Sayeda Ali Rashad	(Barkein)
Ms. Laila Malak Ismail	(Barkein)
Ms. Noussa Malak Youssef	(Kafr El Ananaa)
Ms. Om Hashem Abdel Hafez	(Kafr El Ananaa)
Ms. Tafadi Mohamed Ali	(Kafr El Ananaa)
Ms. Laila Saad Bassal	(Kafr Ghanam)
Ms. Nawal Mohamed el Charib	(Kafr Ghanam)
Ms. Magda Fathi Ismail	(Teranis)
Ms. Hanaa El Sebai Mohamed	(Teranis)
Ms. Wafdeya Mahmoud Selim	(El Zaheira)
Ms. Laila Ahmed Gomaa	(El Zaheira)
Ms. Soad Abdel Ghafar Mahmoud	(El Zaheira)

Dekernis

Ms. Laila Mahmoud El Sayed	(Beni Ebid)
Ms. Amina Mohamed Ibrahim	(Beni Ebid)
Ms. Zeinab Sadek Abdallah	(Beni Ebid)
Ms. Asmahan Fahmi Osman	(Beni Ebid)
Ms. Kamelya Mohamed Hassan	(Beni Ebid)
Ms. Fatma Ahmed Abdel Fattah	(Beni Ebid)
Ms. Badia Abdel Hamid Hegazi	(Beni Ebid)
Ms. Nawzat Abdel Salam Mohamed	(Mit Adlan)
Ms. Sahar Hassan Hussein	(Mit Adlan)
Ms. Hoda El Sayed Ibrahim	(Mit Adlan)
Ms. Hanem Ali	(Nigir)
Ms. Khadiga Kamel Mohamed	(Mit Dafer)
Ms. Bouthayna Abdel Razek Hassan	(Dimuh)
Ms. Manal Ragab Badr El Din	(Ashmoun Roman)
Ms. Rabha Shabban Mohamed	(Mit Sued)
Ms. Rawya Mohamed El Sayed	(Mit Taarif)
Ms. Rosyat Ramadan El Moursy	(Kalyobeya)

Miniet el Nasr

Ms. Sabra Mohamed Hussein El Imam	(Kafr Alam)
Ms. Faten Abdel Wehab	(Kafr Alam)
Ms. Salwa Ali Amer	(Kafr Alam)
Ms. Fatma Ramadan el Sayed	(Kafr Alam)
Ms. Salwa Saad Salem	(Kafr Alam)
Ms. Samya Saqued Abdel Hadi	(Brembal)
Ms. Laila Ahmed El Ketani	(Brembal)
Ms. Azhar Maati	(Brembal)
Ms. Ganaa Mohamed Ali Daoud	(Brembal)
Ms. Rabha Abdel Ghafar Eguez	(Brembal)
Ms. Khalila Abdou Habib Ayoub	(Brembal)
Ms. Zeinab Lotfi Kamel	(Brembal)

Ms. Fawzeya Mahmoud Mosharaf	(Mit Assem)
Ms. Hanem El Sayed Mostafa	(Mit Assem)
Ms. Bashira Abdel Moneim	(Mit Kholi Mo'men)
Ms. Fatma Mohamed El Sayed	(Mit Kholi Mo'men)
Ms. Fatma Mohamed El Werdani	(Mit Kholi Mo'men)
Ms. Hamida Mohamed Kamal	(Mit Kholi Mo'men)

8) Facility Sanitarians

Sinbellawen

Ismat Ragab Gafar	(Abou-Daoud)
Mohamed Abdel Rahman Khalil	(Bar Hamtush)
Fahim Boulous	(Kafr Ghannam)
Moussaad Mohamed Hegazy	(Teranis)
Ahmed Mohamed Mouman	(Barkein)
Ibrahim Youssry El Atef	(Mit Gharita)
Mohamed Abdel Rahman Khalil	(Kafr El Ananaa)
Atef Michael Fahmy	(Abu Seer)
Ali Ismail Ali	(Tuch Al Aklam)
Salah Mohamed El Essawy	(El Zaheira)
Soliman El Sayed Soiman	(Mukatan)

Dekernis

El Sayed Abdel Moneim Abdel Kadei	(Beni Ebid)
Kassem Ali Hussein	(Mit Adlan)
Badawi Abdel Moneim Mohamed Omar	(Nigir)
Mohamed Sami Ali	(Mit Dafar)
El Sayed El Hassanein Ibrahim	(Dimuh)
Ahmed Mahmoud Hegazy	(Ashmoun Roman)
Ali Abdel Khafar Mohamed	(Mit Sued)
Mahmoud Abdel Bary El Zayat	(Mit Taarif)
Mohmoud Abdel Bary El Zayat	(Kalyobeya)

Miniet El Nasr

Adel Awaad El Mitawli	(Kafr Alam)
Ibrahim Ahmed Abdel Latif	(Kafr Abu Zikri)
Ahmed Mohamed Ebid	(Brembal Gedida)
Awaad El Mitwali Awad	(Mit Kholi Mo'men)
Mohamed Hassan El Wassif	(Mit Hadid)
Ahmed Mohamed Agoez	(Riad)

9) District and Governorate Clerks

Salah Mohamed El Awadi	(Sinbellawen)
Mohamed Abdel Hadi Shabi	(Dekernis)
Gamal Mahmoud El Saied	(Miniet El Nasr)

10) Other Staff

Mr. Wagih Ibrahim El Shourbagy	(Governorate General Assistant)
Mrs. Kamilia Hassan Mitwally	(Typist)