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# THE MASS MEDIA AND HEALTH PRACTICES EVALUATION:

## A Report on Morbidity and Mortality

A Report to

Stanford University

and

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by

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## EXECUTIVE SUMMARY

This is a report of the findings on diarrheal morbidity and mortality from the evaluation of the Mass Media and Health Practices (MMHP) projects in Honduras and The Gambia. In Honduras, the program was an undertaking of the Ministry of Public Health, with technical assistance from the Academy for Educational Development. It was known in Honduras as the Proyecto de Comunicacion Masiva Aplicada a la Salud Infantil (PROCOMSI). This evaluation covers the period from January 1981 through June 1983. In the Gambia, the project was carried out by the Department of Medical and Health in the Ministry of Health, Labour, and Social Welfare, with the collaboration of the Academy for Educational Development. The project in The Gambia, known as the Mass Media for Infant Health project was active from mid-1981 through mid-1984.

Both interventions and evaluations were funded by the Office of Education and the Office of Health of the Bureau for Science and Technology, United States Agency for International Development (USAID), with additional support from the USAID Missions in Honduras and The Gambia, the Honduran Ministry of Public Health, and the Gambian Department of Medical and Health. The evaluations were performed by the Institute for Communication Research and the Food Research Institute of Stanford University and by Applied Communication Technology.

The purpose of the MMHP projects was to introduce oral rehydration therapy (ORT) and other behaviors related to the treatment and prevention of infant diarrhea in rural areas. The target behaviors included treatment of acute cases, preventive actions that mothers could perform, and related nutritional and breastfeeding activities. In Honduras, the treatment behaviors involved the administration of an oral rehydration solution mixed from packets of salts containing the World Health Organization ORT formula and named "Litrosol." The packets were manufactured in Honduras and distributed and clinic and community levels by the Ministry of Health. In The Gambia, the treatment behaviors included mixing and administering a home-made oral rehydration solution made from water, sugar and salt (WSS).

The project and the evaluation were also designed to test the efficacy of an intervention strategy that tied elements of several different approaches into an integrated campaign. The MMHP interventions used broadcast, print, and interpersonal communication channels to deliver a coordinated set of messages about a fairly narrow set of issues - - responses to infant diarrhea. The knowledge and behavioral objectives and the strategies for behavioral change were developed using intensive planning research and the principles of behavioral analysis. The campaign incorporated elements of social marketing and systematic development of messages using formative evaluation.

The evaluation tracked the process of the intervention's effects, as well as measured the impact of the entire effort. It used a model of the program effects that stipulated that, in order for a final outcome to be achieved, a series of interim steps must be successfully completed. These steps included determining: that the population had access to the channels of communication used by the campaign; that the messages actually reached the population through those channels; that the content of the messages was learned and retained by the audience; that members of the target audience actually changed their behaviors in response to the campaign; and that the health status of children was improved as a result of these changes in behavior. In this report, we focus on behavioral and health status results.

The evaluation design included a number of studies with different methodologies, but relied primarily on large-scale survey data from repeated visits to a panel of mothers of small children. In Honduras a sample of roughly 750 mothers and in The Gambia, a sample of approximately 1000 mothers was selected from 20 communities in each country. These mothers were visited monthly for interviews about various aspects of the campaign. To control for the influence of repeated measurements on the sample mothers' knowledge and behaviors, comparison groups were also measured in additional communities that received all the elements of the campaign but not of the evaluation. The experimental and control sample were structured to yield quasi-equivalent groups of women of child-rearing age that were representative of the full range of differences found in the two countries. Examples of the other study approaches include anthropometric measurement, behavioral observations, community mortality, and health professional interviews.

This report examines the overall question of whether adoption of ORT led to changes in diarrheal morbidity and mortality. Specifically, it summarizes the evaluation findings on change in:

- prevalence of diarrhea;
- characteristics or severity indicators of diarrheal episodes;
- relationship between the characteristics of a bout and use of ORT; and
- trends in child mortality.

Honduras

Prevalence of diarrhea showed no change that could be

attributed to the intervention. This result was expected as the use of ORT does not influence the transmission of diarrhea disease pathogens in the environment. Overall, prevalence of diarrhea was high and showed seasonal fluctuations. Point prevalence among children five years or less in age averaged 14.3 percent in the rainy season and 9.9 percent in the dry season.

Severity indicators in diarrhea cases in the two weeks prior to the interview showed no consistent overall pattern of change across the two years of the intervention. Number of days a child had diarrhea ranged from 4.7 to 5.6, number of stools in the worst day of the bout ranged from 5.6 to 7.3, and the number of times a child vomited ranged from .82 to .94. When mothers were asked to assess the severity of recent cases, from 24.3 to 39.1 of the cases were judged as being severe.

Litrosol use increased dramatically during the course of the intervention. Litrosol was unknown before the intervention as it had been produced as part of this project. Within six months of the start of the intervention, 37 percent of mothers reported having tried Litrosol. This percentage rose to 62 percent of mothers by the end of the intervention. After one year of the intervention, 26 percent of cases in the last two weeks were treated with Litrosol, and after two years, 36 percent of recent cases were treated with Litrosol.

The association between Litrosol use and severity indicators was examined next. Although none of the individual items showed a consistently significant relationship with Litrosol use, there was an overall pattern of use of Litrosol for more serious cases of diarrhea. Multiple regression analyses indicated that episodes occurring in rural areas, which were judged as severe by the mother, and which had a higher number of stools were more likely to be treated with Litrosol. Mucus in the stools and vomiting were marginally significant predictors of Litrosol use. A previous finding that mothers are more likely to give Litrosol to younger children and this finding about severity suggest that mothers adopted Litrosol for treatment of the episodes of diarrhea more likely to threaten health and survival.

Change in mortality was examined using data collected from the official Death Registries kept in the county seats. An analysis of mortality for children less than five using the cause of death reported by the mother showed marked declines in deaths involving diarrhea in any way. In the two years prior to the campaign, death of children under five involved diarrhea in 39.8 percent of the cases. In the two years after the start of the campaign, deaths involving diarrhea fell to 24.4 percent of all mortality, a statistically significant drop. Total mortality dropped, although by a slightly smaller amount. Virtually identical reductions in the percentages of cases involving diarrhea before and after the campaign are found when the

analysis is restricted to children less than two years and to children less than one year, but the drop in total mortality is smaller. The changes are also consistent when analyzed by time relative to the start of the intervention. There may be multiple causes for these reductions in reported diarrheal mortality, but it does appear that there has been a reduction in diarrheal deaths that can be attributed to the oral rehydration intervention.

The Gambia

Prevalence of diarrhea showed no change that could be attributed to the intervention. Point prevalence estimates ranged from a low of 0.8 percent to a high of 9.0 percent. As in Honduras, the results show higher rates of diarrhea during the rainy seasons. Incidence of diarrhea also differed markedly from year to year, possibly in relation to drought conditions in the second year of the intervention.

Severity indicators showed slight change over the course of the intervention and marked variation by season. The duration of diarrheal episodes reported in the last two weeks did not appear to decline over the course of the study. Episodes in the rainy season were of longer duration (3.9 to 4.4 days) than those in the dry season (3.1 to 3.9 days).

Mothers' reports of the severity of an episode and weight loss in the child, in addition to the expected variation by season, do show a clear decline over the course of the two years. This decline in reported severity may be attributed to the campaign, to year-to-year variation in diarrhea, or to a combination of the two.

The drought in the second year of the intervention seems to have had a marked effect on diarrheal incidence and characteristics. In this first year signs of bacterial diarrhea (mucus or blood in the stool) were higher in the rainy season and signs of dehydration (less urine and dry eyes) were higher in the dry season. In the second year, bacterial indicators did not drop as expected in the dry season and signs of dehydration were lower overall.

WSS use increased steadily during the course of the intervention. The proportion of cases that were treated with WSS rose from 3.6 percent in the first measurement period to 49.4 percent in the twelfth. Thus, the use of WSS as a home treatment achieved a very high level of adoption within two years. Among the effects of this change were that the percentage of cases being treated at health centers dropped from 80.6 percent to 59.2 percent.

Not only was the proportion of cases treated at home rising because of the adoption of WSS, but the WSS treatment was displacing virtually all other home treatments. If one restricts the analysis to those treatments chosen for cases treated at home, WSS rose from 21.7 percent in the first measurement period to 94.1 percent in the twelfth.

The association between WSS use and severity indicators was not strong, but showed some change over time. In the first months of the intervention, only mucus in the stools was significantly associated with greater WSS use. In the measurements taken in 1983 and 1984, after the Happy Baby Lottery, we see a slightly stronger pattern of the mother linking severity to use of WSS. Severity indicators significantly associated with WSS use were mucus in the stools, number of stools, dry eyes, and mother's perception of severity. Other important predictors were season and geographic district.

Change in mortality among young children was measured by monitoring all child deaths in the 20 sample villages during the course of the study. Unfortunately, it was found that Gambian mothers are unwilling to discuss their children's deaths with outside researchers and the figures collected under-identified child deaths by an estimated factor of four. However, even if it had been possible to collect data on mortality, the rate of dehydrating diarrhea is too low in The Gambia for us to have been able to attribute any changes in mortality patterns to the campaign. Because of these problems, figures on child mortality could not be presented.

Estimates for historical rates of infant mortality were derived from pregnancy history data. The causes of death reported by mothers for their children of all ages had diarrhea in second place at about a quarter of all deaths. The pregnancy history yielded a historical estimate of infant mortality of 153.7 per thousand. This estimate is very high in an absolute sense, but it may be too low because of poor recall or reluctance by mothers to give out the information.

In sum, the evaluation of morbidity and mortality data indicated that:

- as expected, prevalence of diarrhea showed no change attributable to the campaigns;

- no change was seen in severity indicators over time in Honduras, but, in The Gambia, a steady decline was seen in mother's perception of the severity of the bout and of weight lost;

- high rates of usage of ORT were achieved in both countries;

- in Honduras, there was a strong confirmation of the hypothesis that mothers are more likely to use ORT for cases perceived to be severe, while in The Gambia, there was only weak support for this hypothesis;

- in Honduras, mortality involving diarrhea declined sharply, with a corresponding, though smaller, drop in total mortality.

We have evidence of remarkable achievements in the use of ORT in Honduras and The Gambia. No changes in morbidity were observed in Honduras, but notable declines were evident in The Gambia. Mortality was assessed only in Honduras and the results indicate sharp reductions in mortality due to diarrhea.

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# Chapter I
# INTRODUCTION

Infant diarrhea is a leading cause of infant and early childhood mortality in many developing countries. Children die from dehydration - - they lose too much water and electrolytes - - before their bodies can recover from the diarrhea. Fortunately, most mortality associated with dehydration can be avoided if the fluids and electrolytes are replaced while the child fights the cause of the diarrhea. An effective and inexpensive way of replacing the losses - - oral rehydration therapy (ORT) - - is now available for home use. It consists of administering water in which sugar and salts have been mixed in certain proportions. The World Health Organization has established a standard formula (oral rehydration solution, or ORS) that includes glucose, sodium chloride, potassium chloride, and sodium bicarbonate. However the WHO formula, while inexpensive, does cost money to package and distribute. A less complex version containing ordinary sugar and salt can also be mixed in the home, and provides the minimum cost and maximum availability to families. Other elements of oral rehydration therapy include breastfeeding and feeding of nutritious and solid foods during diarrhea.

Oral rehydration therapy (ORT) can be administered easily by mothers at home using packets or homemade solutions and wide coverage of diarrheal disease episodes is feasible as has been demonstrated in Honduras and The Gambia by the Mass Media and Health Practices Projects (see ACT 1985a and 1985b). A logical question to ask is whether the ORT adoption levels achieved have led to changes in morbidity and mortality.

ORT is a treatment for water and electrolyte loss. ORT does not interfere with the transmission of diarrheal disease pathogens in the environment and hence would not be expected to lead to lower diarrheal disease prevalence. If the timely adminis-

tration of ORT promotes appetite recovery and increased food consumption, weight loss would be reduced and nutritional status would be better for children given ORT than for sick children not given ORT. Still, this would not be a reason to expect reduced morbidity rates for most research indicates that nutritional status is unrelated to the future incidence of episodes of diarrhea. That is, variations in nutritional status are unrelated to who gets sick. However, the literature also indicates that once children are sick, nutritional status will be related to the severity of the episodes. For children of poorer nutritional status cases will be longer in duration and more severe. Thus, ORT, by itself, could conceivably lead to reduced indicators of severity.

Though ORT was central to the campaign, other aspects were included that could impact on the level of morbidity. Among these were preventive messages about hygiene, the promotion of breastfeeding, and the discouragement of bottlefeeding. Changes in the prevalence in diarrheal diseases would be expected to the extent that significant behavior change in these areas were achieved.

This report summarizes the evaluation findings with respect to three topics:

(a) Changes in the prevalence and characteristics of diarrheal disease during the course of the study;

(b) Relationship between characteristics of diarrheal diseases and use of ORT; and

(c) Trends in child mortality rates.

The rest of this chapter briefly describes the background and general methodology of the project implementations and evaluations, then describes the specific efforts in each country. The findings for Honduras and The Gambia will be discussed separately and a final section summarizes the main findings.

## A. Background

In 1978, The U.S. Agency for International Development (AID) established the Mass Media and Health Practices Program to implement and evaluate programs to inform mothers about ORT and influence them to adopt the new practices, perform them repeatedly, accurately and effectively, and ultimately to reduce mortality from diarrheal dehydration. The program was structured to run related projects in two countries in order to learn more about the way a methodology for influencing a large number of mothers to change behaviors related to infant diarrhea operates in different cultural and environmental contexts.

Agreements with the governments of Honduras and The Gambia permitted the program to cooperate with both Ministries of Health in introducing the methodology in support of the countries' diarrheal disease programs. The project in Honduras began in January 1980 and that in The Gambia started in May 1981. The original program since has been amended to include several additional sites, but this report deals only with Honduras and The Gambia. The Academy for Educational Development (AED) in Washington, D.C. was competitively selected to work with the Ministry of Public Health in Honduras and the Gambian Department of Medical and Health to design and implement the program. The Institute for Communication Research at Stanford University was awarded the contract to evaluate it. Responsibility for the evaluation was subsequently transferred to the Food Research Institute at Stanford University and its subcontractor, Applied Communication Technology.

The implementation and the evaluation are funded by the Office of Education and the Office of Health, Bureau of Science and Technology, United States Agency for International Development. The USAID Missions in The Gambia and Honduras and the Ministries of Health contributed additional resources for many project-related activities.

## B. General Description of the Implementation Methodology

The Mass Media and Health Practices interventions used an integrated program of radio, print materials, and health worker training to teach or reinforce changes in a variety of skills and beliefs surrounding infant diarrhea. The salient characteristics of the methodology were:

- intensive use of village level research on practices, cultural constraints, and vocabulary for planning;
- adoption of a social marketing perspective;
- intensive use of pretesting and formative evaluation in message and project design;
- use of an integrated campaign format through multiple channels;
- use of behavioral analysis in project design and implementation; and
- concentration on a focused set of objectives.

The primary objective of the program was to use an optimal combination of inexpensive radio communication in combination with more expensive interpersonal and print communication to teach mothers to prevent and treat infant diarrhea. More detailed information on the implementation methods is available in project implementation plans (AED, November 1980 and AED, February 1982).

## C. General Description of the Evaluation Methodology

The evaluation followed a process model which described a sequential series of steps that were expected to take place in order for the campaign to have an effect. These steps were: ac-

cess and exposure to the campaign, knowledge and attitude change, behavior change, and change in health status. In order for changes in health status to take place, we expected that a mother first needed access to the channels used, exposure to the messages, learning of the information in these messages, and then actual change in her health practices.

The primary evaluation study was a longitudinal survey. The evaluation gathered information from a sample of more than 750 women in each country over time measuring access and exposure to the project campaigns, learning and acceptance of campaign content, change in behavior, and change in the actual health of children in the target audience. Background information on demographics, socio-economic status, literacy, and wealth was also collected. In each country, a baseline survey collected pre-intervention data on access, knowledge, and practice. Mothers were then questioned approximately every month using repeated administration of several different instruments measuring learning, behavior during illness, nutrition, and anthropometry. Several other studies were also carried out ( e.g. behavioral observation, ethnographic studies, and mortality studies).

The samples from each country were selected based on a multi-stage design incorporating purposive, stratified, and random sampling at the various stages. In each country, 20 villages were purposively chosen to reflect the full range of characteristics in the rural environment, particularly availability of different levels of health care facilities, general accessibility and ethnic diversity. In Honduras, villages in Health Region I, where the intervention took place, were sampled. In The Gambia, villages from the four rural administrative divisions with good radio access were sampled.

In Honduras, all the households in a village were enumerated, then households were randomly sampled. This resulted in a sample of slightly more than 750 families from which the mother or caretaker was interviewed.

In The Gambia, people live in compounds which often include more than one nuclear family. One objective of the sample was to choose women from as many different compounds as possible. For this reason, the sampling process randomly selected a specified number of compounds, then, after enumerating all the eligible women, randomly selected women from each compound. This resulted in a sample of 1029 women in The Gambia. Approximately 800 women were interviewed in each interview sweep.

Because of repeated interviewing, there was a possibility that mothers' responses would be influenced by the measurement process itself. For this reason, quasi-equivalent control or comparison groups were chosen which were measured only once. In The Gambia a comparison group of 226 mothers was interviewed one year after the start of broadcasts. A second group of 208 different mothers was interviewed near the end of the project. In Honduras, a comparison group of 244 mothers was interviewed at the end of the project. An additional control for the effect of repeated measures was incorporated for the instruments measuring exposure to and recall of the campaign. For these interviews only, the experimental group was randomly divided into two equal groups. The first group was interviewed about exposure and recall in Waves 1 to 4, but the second was only measured after this. This interview wave is called the "post" wave.

## D. Description of the Mass Media and Health Practices Projects in Honduras and The Gambia

The goals of the Mass Media and Health Practices projects in Honduras and The Gambia were to teach mothers and influence them to practice new diarrheal treatment and prevention behavior. The Academy for Educational Development worked with the Ministry of Public Health in Honduras and the Department of Medical and Health in The Gambia to identify appropriate practices and develop a long-term multi-media campaign lasting two years. A

major focus of the campaigns in both countries was the correct use of ORS, correct feeding during diarrhea, and breastfeeding.

In both countries the primary target audience was rural mothers, grandmothers, or other caretakers of children under five. Secondary audiences were rural health-care providers. Messages were differentiated by intended audience and by season.

A key part of the implementation methodology was the use of multiple and complementary channels of information. Both campaigns used an integrated system of radio messages, health workers, and print materials to provide women with the same messages through multiple channels.

The overall goals, target audience, and strategy were the same in both countries. The actual campaigns and messages differed. Extensive pre-program research was conducted in each country and an overall campaign strategy and specific messages were developed to fit the context and the needs in Honduras or The Gambia. The rest of this section describes the two projects in turn.

1. Honduras

The activity in Honduras was known as the Proyecto de Comunicacion Masiva Aplicada a la Salud Infantil (PROCOMSI). The PROCOMSI project operated only in Health Region 1 in Honduras. This region was selected after careful study and was determined to be representative of the range of characteristics of the Honduran population. After extensive pre-program research, message design and pretesting, the PROCOMSI campaign began in March 1981 and continued through March 1983. The evaluation activity started in January 1981 and ended in June 1983. In 1982, guided in part by its experience with PROCOMSI, the Ministry of Health began the implementation of a national diarrheal disease program in all regions.

The Honduran government chose to use locally produced

packets of oral rehydration salts following the World Health Organization formula. Each packet contained the recommended amounts of sodium, glucose, potassium, and bicarbonate. The contents were to be mixed in one liter of water, thus the ORS in Honduras was named "Litrosol".

The campaign used radio, health workers, and print materials to teach mothers how to obtain, mix, and administer Litrosol, to seek help if diarrhea gets worse, to breastfeed young children, and to follow recommended practices in food preparation and hygiene. The campaign was carried out in five phases which followed the differences in seasons. The main activities and messages in each phase were as follows:

> PHASE 1 (Dry season, March - June, 1981): radio messages focused on dehydration, the special care of infants, breastfeeding, and hygiene; professional and paraprofessional health workers were trained in ORS and dehydration; posters, flyers, and ORS packets were distributed.
>
> PHASE 2 (Rainy season, July - October, 1981): radio broadcasts introduced Litrosol and gave mixing and administration instructions; health workers passed on their training to other rural health workers; print materials and Litrosol packets were sent to distribution points.
>
> PHASE 3 (Dry season, November, 1981 - April, 1982): radio messages focused on prevention, feeding during diarrhea, and breastfeeding, but also included messages explaining that Litrosol instructions were on the packet; lower levels of packet distribution continued.
>
> PHASE 4 (Rainy season, May - October, 1982): radio broadcasts focused on Litrosol administration and mixing and on the signs of dehydration; training sessions were held for new health professionals, and auxiliary nurses and community health workers were retrained.
>
> PHASE 5 (Dry season, November, 1982 - March, 1983): intensive campaign on breastfeeding, radio course; training of some health professionals; distribution of breastfeeding posters.

In Honduras, use of radio messages was emphasized due to radio's ability to reach many mothers. Radio formats included

short spots and a weekly magazine program ("Voz de Salud"). Approximately 32,500 radio spots were broadcast in Honduras during Phases 1 through 4, those which emphasized treatment of diarrhea and Litrosol.

Professional and paraprofessional health workers based in rural areas were also an important part of the campaign. Litrosol packets were distributed to mothers through rural health workers. When dispensing packets, health workers were instructed to give a short explanation of the Litrosol mixing and administration instructions on the packet.

Training sessions were held for health workers at the beginning of the campaign and after the first year. In April through July 1981, 317 physicians, regional nursing supervisors, nurses, and auxiliary nurses were given direct training in clinical treatment of dehydration, home treatment with ORS, feeding and prevention, and methods for training other health workers. They were also given posters about treatment of dehydration and ORS. From May through September 1981, these health workers trained 960 traditional midwives, primary health care workers, and local mayors or auxiliary mayors (used as distributors of packets in the first year) in ORS, feeding and prevention.

New health professionals (235) were trained from March-October 1982 and 900 auxiliary nurses and community health workers were retrained.

Litrosol packets were distributed to auxiliary nurses, community health workers, and midwives throughout the campaign. During the two years, over 300,000 packets were distributed. Each distribution point was identifiable by a flag with a red heart, one of the symbols of the campaign.

The third channel of the campaign was print materials: a manual and pictorial posters for health workers, calendars with Litrosol mixing and administration procedures, and the packets themselves. A poster with detailed information on diagnosing and treating all levels of dehydration, feeding, and ORT was dist-

ributed to physicians and nurses. A second, smaller poster showing signs of dehydration was widely distributed to community health workers. Special print materials were also developed for use in the AMA-MAS breastfeeding course.

## 2. The Gambia

The project in The Gambia was known as the Mass Media for Infant Health Project. After 6 months of pre-program research, message development and pretesting, the campaign started in May 1982 and continued through April 1984. The evaluation was carried out from February 1982 through July 1984.

The Gambian government chose to adopt an oral rehydration solution made from water, sugar, and salt (WSS) available in the compound or village. Prior to the campaign, the Medical and Health Department had promoted WSS, but it was found that health workers and mothers used many different mixing formulas. One of the first steps was to institute a standardized WSS formula and diarrhea management policy. This was written up in the Health Worker's Manual for the Management of Acute Diarrhoea in The Gambia. This manual covered methods for assessing dehydration status, determining a treatment plan, treating different types of diarrhea, and educating mothers in prevention and treatment of diarrhea. The WSS mixing formula promoted was 1 liter of water (3 Julpearl bottles), 8 Julpearl bottle caps of sugar, and 1 Julpearl bottle cap of salt.

As in Honduras, the campaign used radio, health workers and print materials. The main topics covered were correct mixing of WSS, administration of WSS with breastmilk and solid foods in the rainy season, intensive administration of WSS with breastfeeding during the dry season, taking the child to the health center if signs of dehydration were seen, and cleaning up feces in the compound.

The campaign was carried out in five phases tied to the

different seasons. A short description of the activities in each phase follows:

PHASE 1 (Dry season, May to June, 1982): radio messages covered dehydration, diarrhea and malnutrition, and the "diet for diarrhea" (WSS, breastmilk, solid foods); training sessions were held for rural health workers in WSS mixing and administration; posters and mixing flyers were distributed to health workers.

PHASE 2 (Rainy season, July to October, 1982): radio broadcasts emphasized mixing and administration of WSS, feeding during diarrhea, proper disposal of feces; rural mixing contest ("Happy Baby Lottery") was held; mixing flyers were distributed to mothers.

PHASE 3 (Dry season, November 1982 to March 1983): the radio reinforced WSS mixing instructions, the need for immediate administration of WSS, and feces disposal.

PHASE 4 (Rainy season, July to October 1983): radio messages focused on feeding during and after diarrhea, reminders about breastfeeding and WSS, rural healthworkers were trained in feeding messages and methods for teaching mothers; feeding posters and flyers were distributed.

PHASE 5 (Dry season, February to April 1984): mini-campaign on protection of community wells, personal hygiene, and the educational role of Village Development Committees; health workers were trained; a handwashing flyer was distributed.

Radio was an essential component of the campaign in The Gambia. The radio programs included short spots, mini programs, and longer magazine programs. The programs were broadcast in the two most widely understood languages used in The Gambia, Mandinka and Wolof. Approximately 1800 programs or spots were broadcast during Phases 1 through 4.

Rural health workers were given training three times during the campaign. At the start of the campaign (April to June 1982), a series of five-day training workshops was held for rural health workers. These workshops included all community health nurses and health inspectors, the two groups who were the most mobile and who were already involved in health education. Key curative

personnel (dresser-dispensers and nurse-midwives) from each health center were also included. Shorter workshops were held for leprosy inspectors, Peace Corps volunteers, and community health nurse trainees. A total of 182 health personnel attended these workshops. The workshops focused on diarrheal management, teaching rural health workers to: assess a child's hydration status and treat different levels of dehydration, mix WSS correctly and teach mothers and other health workers about WSS and the Diet for Diarrhea. Each trainee was given a set of printed materials: a poster detailing treatments, a Diet for Diarrhea poster, and a copy of the health worker's manual.

A second objective, after teaching health workers directly, was to prepare health inspectors and community health nurses to train village volunteers to be local sources of support and information. After the workshops, the inspectors and nurses returned to their posting areas, identified a volunteer in each of ten villages, and trained these volunteers in the mixing and administration of WSS. The volunteers were given a red flag to fly above their compound and were known as "Red Flag Volunteers". The radio told mothers to see a Red Flag Volunteer if they couldn't remember the WSS formula. A total of 840 volunteers were trained.

A second series of training sessions was held in July and August 1983 for 95 rural health staff. These sessions focused on the 1983 feeding campaign, but also reviewed the WSS campaigns and problems seen by the health workers. A third training session, about well protection, was held for community health nurses in March 1984.

The main campaign activity during Phase 2 (July to October 1982) was to publicize and teach WSS to as many mothers as possible. To this end, a rural mixing contest (the "Happy Baby Lottery") was held during September and October. An important component of the contest was a pictorial flyer detailing mixing proportions and instructions. These flyers were distributed to rural health centers throughout the country during the month of

August. From there they were then distributed to rural dispensaries, sub-dispensaries, and Red Flag Volunteers.

The lottery was designed to motivate mothers to obtain the flyer and listen to the radio spots. The flyer was an entry ticket to participate in the lottery. For four weeks, 18 villages were randomly selected each week to be lottery villages (a total of 72 villages participated). In each village, twenty of the mothers with flyers were randomly chosen and asked to demonstrate their WSS mixing knowledge. Each mother who correctly mixed WSS was given a prize, a one-liter cup. If she could also answer administration questions, she received a bar of soap. All mothers with correct knowledge were then eligible for the Grand Prize Drawing during which fifteen mothers were selected to receive a radio-cassette player.

Distribution of the flyers and participation in the lottery were widespread. Approximately 150,000 mixing flyers were distributed. The lottery was widely attended: 6,580 women came to the village contests with a flyer in hand, 1440 won the chance to mix WSS for the judge, and 1097 won a prize for mixing. Participants and spectators totaled 10,728.

In the second year of the campaign, two other topics received wide coverage: feeding during and after diarrhea and a mini-campaign on sanitation. The feeding messages stress giving solid and protein-rich foods to children after diarrhea and adding milk or sugar to the gruels commonly given during diarrhea. The mini-campaign on sanitation focused on handwashing and well protection. New print materials were designed for each of these phases and workshops were held for rural health workers.

# Chapter II

## Morbidity and Mortality in Honduras

### A. Morbidity Change

#### 1. Changes in the prevalence of diarrheal diseases.

The information available about diarrheal disease and Litrosol use comes from five morbidity rounds or waves as shown at the top of Table 1. The very last round also included the "Municipio" (county) of Moroceli which had not been previously visited by our field workers but which was exposed to the media intervention.

Field workers visited homes and asked mothers a series of questions about the occurrence of diarrheal diseases in their children and about the treatment which they followed. Mothers were asked whether young children had diarrhea in the last weeks and when that was the case, whether the children were sick on the day of the interview and two weeks before the interview (the beginning of the recall period). In this manner, it is possible to establish whether the duration of an episode is contained during the two week recall period or whether it is truncated at either end. Finally, mothers reporting healthy children during the last two weeks were asked about episodes of diarrhea in their children during the previous six months.

It was originally intended that all mothers in the study cohort were to have been interviewed at each wave so as to monitor changes that might occur in the prevalence of diarrhea during the course of the study. However, due to an oversight, the field workers frequently did not turn in a questionnaire when children were healthy during waves four and five. We therefore do not know the true denominator and can not assess whether there were changes in the prevalence of morbidity symptoms during waves four and five. For the first three waves, we do have an unbiased

Table 1: Cases of diarrheal disease by wave in Honduras

| Variable | Wave 1 6,7,10 /81 | Wave 2 2,3/82 | Wave 3 5,6/82 | Wave 4 1/83* | Wave 5 (5,6/83) All sites | Wave 5 (5,6/83) Study only | Wave 5 (5,6/83) Control group |
|---|---|---|---|---|---|---|---|
| Percent and number of cases of diarrhea in the last two weeks | 36.1 (382/1059) | 21.5 (210/977) | 34.5 (252/731) | 45.2 (122/270) | 29.8 (117/393) | 35.6 (98/275) | 16.1 (19/118) |
| For cases[1/] in the last two weeks, percent and number with diarrhea on the day of interview | 40.9 (156/381) | 46.4 (97/209) | 40.1 (101/252) | 38.5 (47/122) | 29.9 (35/117) | 32.7 (32/98) | 15.8 (3/19) |
| For cases[2/] in the last 2 wks, percent and number with diarrhea 14 days before the interview: | 20.8 (79/380) | 19.0 (40/210) | 24.2 (61/252) | 15.6 (19/122) | 17.9 (21/117) | 18.4 (18/98) | 15.8 (3/19) |
| Percent and no. of cases of diarrhea on day of interview: | 14.7 (196/1059) | 9.9 (97/977) | 13.8 (101/731) | 17.4 (47/270) | 8.9 (35/393) | 11.6 (32/275) | 2.5 (3/118) |
| Percent and number of cases of diarrhea in last six months: | 55.8 (591/1059) | 45.4 (444/977) | 62.0 (453/731) | 98.9 (267/270) | 89.8 (353/393) | 97.5 (268/275) | 72.0 (85/118) |

*Wave 4 also administered 12/82

1/ Asked of cases with diarrhea in last two weeks
2/ Asked of cases without diarrhea in the last two weeks

MORB:DIA1WKQ,DIARNWQ,DIARBFQ,DITOTAL

denominator and hence it is appropriate to ask whether there were any changes over this period in the prevalence of diarrhea and related symptoms. These data are shown in Table 1 and are also shown in Figure 1. It appears that the values for wave 2 are lower than for those of either wave 1 or 3. This can easily be explained as a seasonal effect for waves 1 and 3 were collected during the rainy season, a time when diarrheal diseases are generally more frequent, and wave 2 during the dry season, a time of less frequent diarrhea. On the basis of the available information, we conclude that the mass media intervention does not appear to have reduced the prevalence of diarrheal diseases.

## 2. Trends in severity indicators

Data about the characteristics of episodes of diarrhea for each of the waves are given in Tables 2 and 3. Information about the presence of fever, mucus or blood in the stools, occurrence and frequency of vomiting, number of bowel movements, duration of the episode and maternal impressions of the child's appetite and the severity of the episode were collected by recall only for cases of diarrhea reported for the two week interview period. Information about specific signs of dehydration (mouth, eyes, urine, fontanelle) was recorded by the interviewer by direct observation only for children who were ill with diarrhea on the day of the interview.

There does not appear to be a consistent overall pattern of change across waves even when considering waves 1, 3, and 5 separately since these were collected during the rainy season (see Tables 2 and 3).

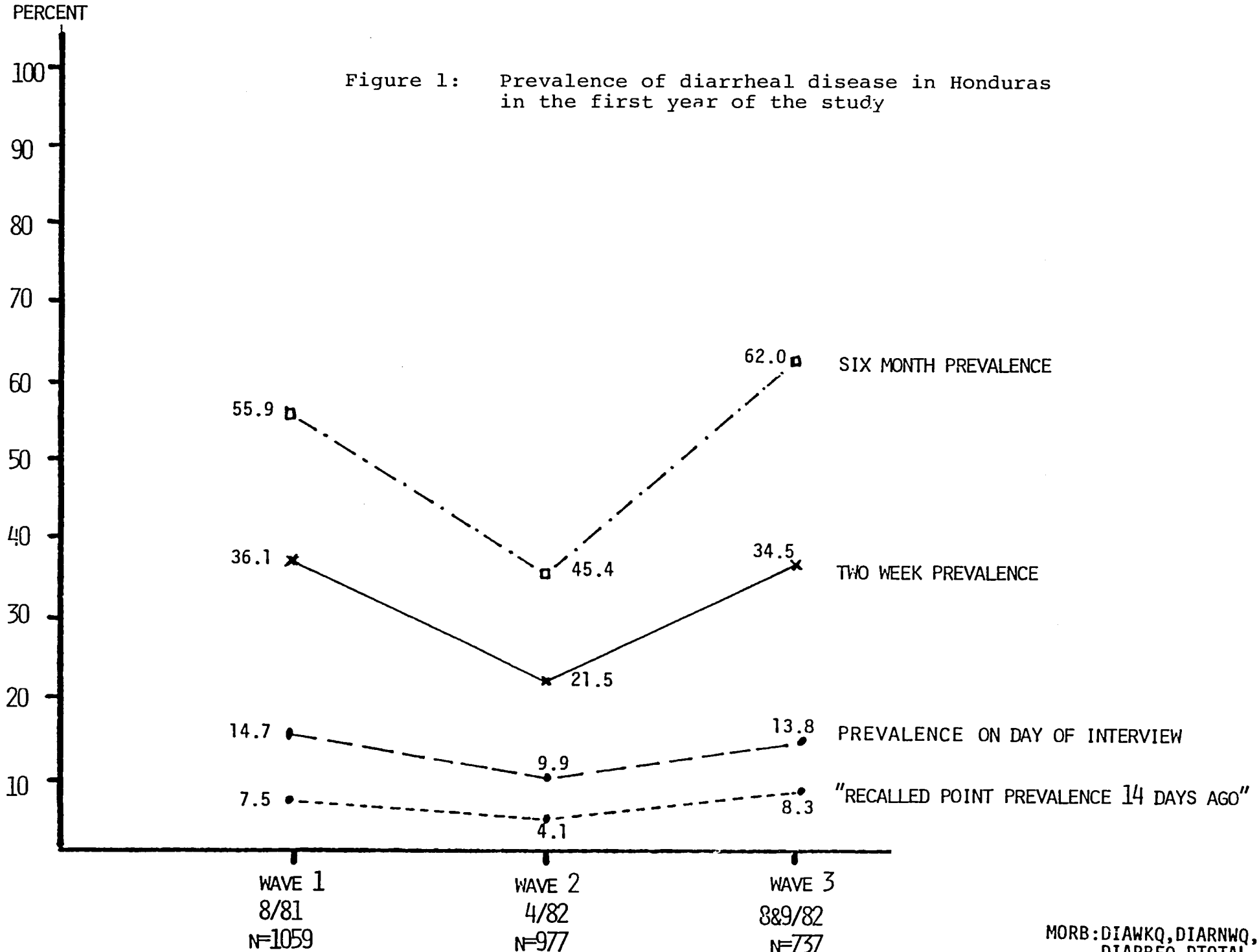



Figure 1: Prevalence of diarrheal disease in Honduras in the first year of the study

MORB:DIAWKQ,DIARNWQ,
DIARBFQ,DTOTAL

Table 2 : Changes in the Prevalence of Indicators of Severity and Dehydration

| Variable | Description | (rainy) Wave 1 | (dry) Wave 2 | (rainy) Wave 3 | (dry) Wave 4 | (rainy) Wave 5 | Control |
|---|---|---|---|---|---|---|---|
| FEVER1Q+ | Fever during the episode | 29.2 (111/380) | 29.5 (62/210) | 46.4 (115/248) | 35.2 (43/122) | 31.6 (31/98) | 31.6 (6/19) |
| MUCUS1Q+ | Mucous in the stools | 52.1 (198/380) | 65.7 (138/210) | 64.1 (159/248) | 61.5 (75/122) | 60.2 (59/98) | 42.1 (8/19) |
| BLOOD1Q+ | Blood in stools | 14.5 (55/380) | 18.2 (38/209) | 20.6 (51/248) | 15.6 (19/122) | 22.4 (22/98) | 21.1 (4/19) |
| PBARFS+ | Vomiting during the episode | 26.2 (100/382) | 22.9 (48/210) | 20.1 (51/252) | 26.2 (32/122) | 24.5 (24/98) | 26.3 (5/19) |
| MTH1Q++ | Dry mouth | 12.2 (19/156) | 5.2 (5/97) | 4.0 (4/101) | 2.1 (1/47) | 9.4 (3/32) | 0 (0/100) |
| FONT1Q++ | Fallen fontanelle | 2.6 (4/156) | 0 (0/97) | 1.0 (1/101) | 2.1 (1/47) | 3.1 (1/32) | 0 (0/100) |
| EYES1Q++ | Sunken eyes | 16.7 (26/156) | 2.1 (2/97) | 5.0 (5/101) | 10.6 (5/47) | 6.3 (2/32) | 0 (0/100) |
| DRYEY1Q++ | Dry eyes | 13.0 (20/54) | 2.1 (2/97) | 8.9 (9/101) | 4.3 (2/47) | 3.1 (1/32) | 0 (0/100) |
| URINE1Q++ | Dark colored urine | 15.0 (23/153) | 8.2 (8/97) | 9.0 (9/100) | 10.6 (5/47) | 31.3 (10/32) | 0 (0/100) |
| HNGR1Q+ | Hunger according to mother: | | | | | | |
| | No change | 36.5 | 44.8 | 37.0 | 48.4 | 39.6 | 47.1 |
| | Somewhat different | 31.2 (375) | 27.6 (210) | 27.2 (246) | 30.3 (122) | 42.7 (96) | 52.9 (17) |
| | Very apathetic | 32.3 | 27.6 | 35.8 | 21.3 | 17.7 | 0 |
| EPSD1Q+ | Mother's view of episode: | | | | | | |
| | Light | 38.8 | 33.3 | 28.5 | 46.8 | 29.9 | 62.5 |
| | Moderate | 31.7 (363) | 27.0 (204) | 32.3 (235) | 28.8 (111) | 32.2 (87) | 12.5 (16) |
| | Severe | 29.5 | 39.7 | 39.1 | 24.3 | 37.9 | 25.0 |
| SEVERE1Q+++ | Severe case according to mother | 34.3 (72/210) | 50.6 (119/235) | 50.7 (103/203) | 35.2 (51/145) | 58.2 (99/170) | 48.4 (31/64) |

+ Data collected if child had diarrhea in the previous two weeks. ++Data collected if child had diarrhea on the day of the interview. +++Data collected if child had six months but not in the previous two weeks.

Table 3: Changes in the Duration, Number of Bowel Movements and Frequency of Vomiting during Episodes in the Previous Two Weeks.

| | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 | Control |
|---|---|---|---|---|---|---|
| DAYSDIQ Days with diarrhea in the past two weeks: | | | | | | |
| Mean: | 5.12 | 5.20 | 5.56 | 4.85 | 4.71 | 5.53 |
| s.d.: | 3.71 | 3.95 | 2.89 | 3.63 | 3.05 | 4.13 |
| n: | 374 | 194 | 245 | 122 | 96 | 19 |
| DUMPS1Q Number of stools on worst day: | | | | | | |
| Mean: | 5.87 | 5.67 | 5.83 | 5.76 | 7.32 | 6.84 |
| s.d.: | 3.00 | 4.16 | 3.05 | 3.14 | 4.28 | 2.50 |
| n: | 377 | 207 | 245 | 122 | 96 | 19 |
| BARFS1Q Number of times vomited on worst day: | | | | | | |
| Mean: | 0.91 | 0.82 | 0.85 | 0.87 | 0.94 | 2.00 |
| s.d.: | 2.14 | 1.83 | 2.18 | 2.00 | 2.00 | 4.31 |
| n: | 377 | 207 | 247 | 122 | 96 | 19 |

MORB

## B. Litrosol Use and Severity Indicators

### 1. Trends in Litrosol use

The pattern of Litrosol use by wave is shown in Table 4 for episodes of diarrhea occurring in the last two weeks, cases in the last six months but not in last two weeks, and for any episode in the last six months. These same data are presented in Figure 2. The findings are clear. Around August 1981, less than ten percent of the cases of diarrhea were being treated with Litrosol. The use of Litrosol climbed dramatically in wave 2, remained at similar levels in wave 3, declined somewhat in wave 4 and rose again in wave 5. Statistics for the control communities were only slightly lower than for the study sites for wave 5. As shown in Figure 2, Litrosol use is lower for cases in the last two weeks than for cases occurring from that point to six months before. We believe this occurs because mothers are more likely to remember the last serious episode of diarrhea and because the probability of Litrosol use rises with the severity of the episode (see below).

### 2. Associations between Litrosol use and severity indicators

Data on a number of indicators of the severity of episodes of diarrhea and about signs of dehydration were collected with the view of ascertaining whether the use of Litrosol would vary as a function of these characteristics. The hypothesis formulated was that mothers would be more likely to use Litrosol when they perceived the episode of diarrhea was more serious than usual or when it involved signs of dehydration.

A detailed look at the relationship between Litrosol use and each of the symptoms of severity and the signs of dehydration was presented in the two-year Honduras report separately for each wave. None of the items showed a consistently significant

Table 4 : Percent of episodes of diarrhea treated with Litrosol

| | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 | Control |
|---|---|---|---|---|---|---|
| Used Litrosol for episodes within last two weeks (LITSOLQ) | 9.2% (35/381) | 26.2 (55/210) | 33.3 (84/252) | 18.0 (22/122) | 35.7 (35/98) | 26.3 (5/19) |
| Used Litrosol for episodes in last 6 months but not in last two weeks (PLITSQ) | 7.6 (16/210) | 45.3 (106/234) | 45.3 (92/203) | 39.3 (57/145) | 49.4 (84/170) | 40.9 (27/66) |
| Used Litrosol for any episode in last 6 months (TREATD) | 8.6 (51/591) | 36.0 (160/444) | 38.6 (175/453) | 29.6 (79/267) | 44.4 (119/268) | 37.6 (32/85) |

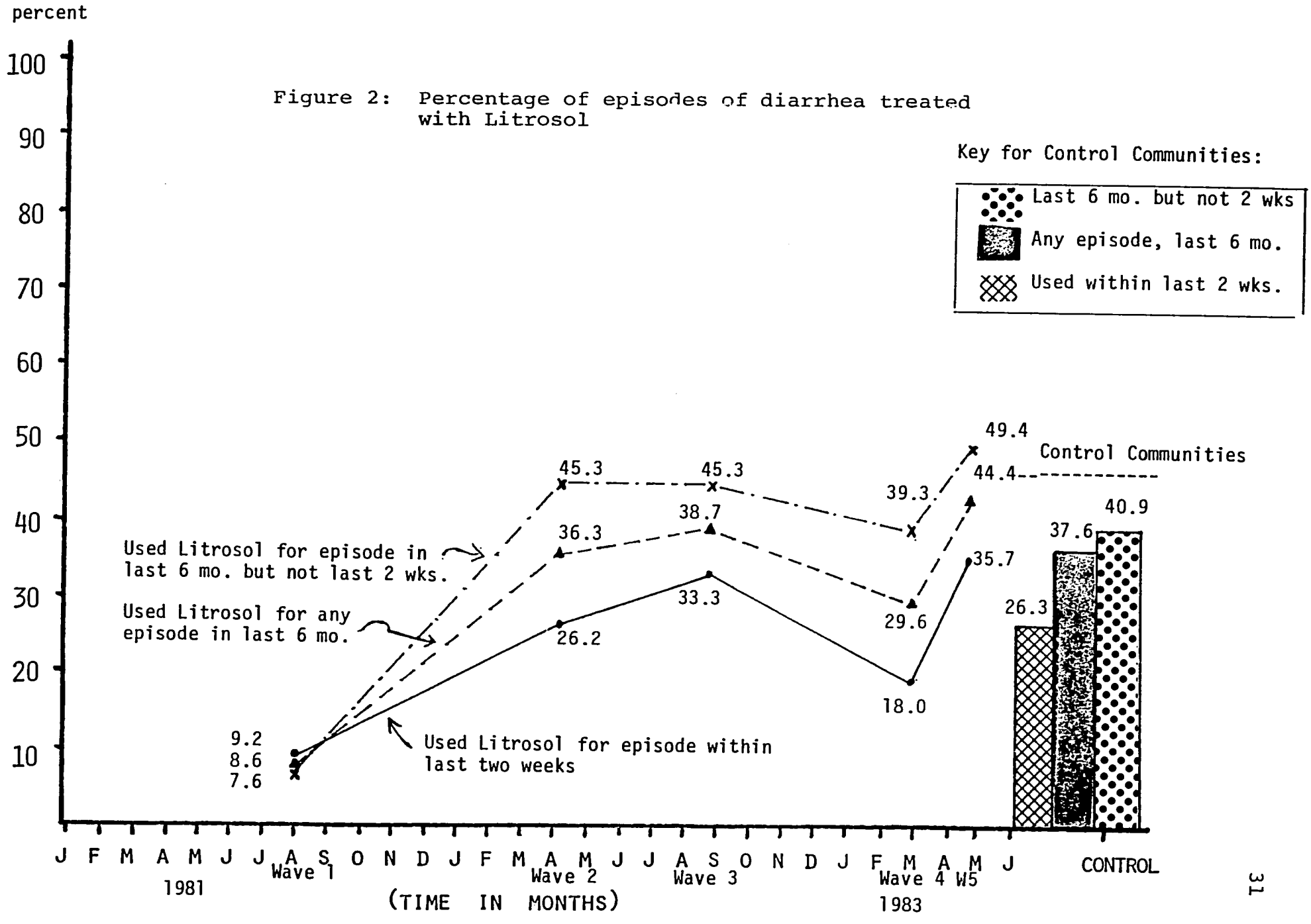



Figure 2: Percentage of episodes of diarrhea treated with Litrosol

relationship with Litrosol use but an overall pattern supporting the hypothesis proposed was clearly evident. This was particularly the case for variables such as the number of stools and the mother's impression about the severity of the episode.

We then examined the relationship between the characteristics of the episode and Litrosol use by multivariate regression analyses run separately for each wave and presented these in the two-year report.

The separate regressions for each wave were somewhat difficult to interpret because of small sample sizes. To overcome this, we have pooled cases across waves and repeated the analyses for children ill in the last two weeks and on the day of the interview. Wave 1 was omitted, since as a baseline measure, few women were using Litrosol at that time. Thus, the analyses were based on cases of diarrhea occurring during waves two through five. Dummy variables for the wave numbers were added to the equations, which were otherwise the same as those presented in the two-year report (Table 5).

In addition to looking at each variable separately, we have treated related variables as a block to test the hypothesis that they help explain the variance in Litrosol use. The control variables about location - municipios and urban - constituted one block. Another control block was for the measurement wave; these can also be taken as a measure of the effect of time. A block consisting of the severity indicators helps answer whether severity, as a whole, helps explain Litrosol use. Also, the mother's perception of the case may be seen as a unique block.

OLS regressions of symptoms are presented in Table 6 for cases in the last two weeks. The first column gives zero-order correlations with Litrosol use and indicates that while the magnitudes are low, the consistency of relationships is high. That is, all the severity indicators have positive relationships with Litrosol use in keeping with the hypothesis advanced. The two additional columns of numbers give beta and t values for multiple regressions and suggest the following. Episodes

Table 5: Variables used in multiple regressions

| Variables | Coding | Description |
|---|---|---|
| LITSOL1Q | 1=yes, 0=n | Litrosol use |
| D1 | Municipl=1,other=0 | Sabanagrande county* |
| D2 | Municip2-1,others=0 | Yuscaran county* |
| INWAVE2 | 1=yes,0=no | Case in morbidity Wave 2 |
| INWAVE3 | 1=yes,0=no | Case in morbidity Wave 3 |
| INWAVE4 | 1=yes,0=no | Case in morbidity Wave 4 |
| URBAN | Urban=1,rural=0 | Urban/rural |
| DAYSD | Continuous | Days with diarrhea |
| FEVER | 1=yes,0=no | Fever |
| MUCUS | 1=yes,0=no | Mucous in stools |
| BLOOD | 1=yes,0=no | Blood in stools |
| DUMPS | Continuous,1 or more | Number of stools on worst day |
| BARFS | Continuous,0 or more | Instances of vomiting on worst day |
| HNGR | 1=same,2=less,3=much less | Child's appetite |
| EPSD | 1=mild,2=moderate, 3=serious | Seriousness of case |
| MTH** | 1=yes,0=no | Dry mouth |
| FONT** | 1=yes,0=no | Fallen fontanelle |
| EYES** | 1=yes,0=no | Sunken eyes |
| DDRYEY** | 1=yes,0=no | Dry eyes |
| URINE** | 1=yes,0=no | Dark urine |

* Reference would be the municipio of Danli.
**Measured only if ill on day of interview.

Table 6: OLS Regressions of symptoms of severity predicting Litrosol use for cases in the last two weeks, waves 2-5 pooled.

| Variable | Zero-order correlations with Litrosol | beta* | t* | F values for blocks of variables |
|---|---|---|---|---|
| MUNICIPIO 1 | -.084 | -.066 | -1.22 | |
| MUNICIPIO 2 | .038 | | | 7.77[b] |
| URBAN | -.171 | -.169 | -4.29[b] | |
| DAYS | .070 | | | |
| FEVER | .051 | | | |
| MUCUS | .101 | .075 | 1.80 | 2.64[a] |
| BLOOD | .065 | | | |
| DUMPS | .159 | .091 | 2.14[a] | |
| BARFS | .118 | .079 | 1.94 | |
| HUNGER | .067 | | | |
| EPISODE | .155 | .089 | 2.06[a] | 4.24[a] |
| INWAVE2 | -.025 | | | |
| INWAVE3 | .062 | -.070 | -1.25 | 3.21[a] |
| INWAVE4 | -.112 | -.139 | -2.66[b] | |

Multiple R .310

$R^2$ .096

N = 623 cases

Note: a) $p \leq .05$
b) $p \leq .01$
*beta and t values provided only if $t > 1.0$ or $t < -1.0$

occurring in the rural area and not reported in wave 4 were associated with higher rates of Litrosol use. The lower frequency of Litrosol use in wave 4 was due to an interruption in the supply of ORT packets at the time of the survey. Maternal impressions of increased severity (EPISODE) and number of stools (DUMPS) were also significant predictors of Litrosol use. Borderline in significance were two other episode characteristics, mucus in the stools, and vomiting (BARFS).

Stepwise regressions (Table 7) showed that the best predictors of Litrosol use are urban/rural residency (URBAN) mothers' impressions of the severity of the episode (EPISODE), stool frequency (DUMPS), the timing of wave 4 (INWAVE 4) and vomiting (BARFS).

Similar regressions were run for symptoms of severity on the day of the interview. Unfortunately, the sample size is reduced and the estimates may be more unstable. Thus, there were 623 cases for episodes in the last two weeks, but only 251 for cases on the day of the interview. Table 8 shows the regression results. These continue to indicate the importance of the variables included in Tables 6 and 7. However, none of the new variables, representing dehydration severity characteristics observed on the day of the interview, are significant predictors. When variables are examined as blocks, only those representing severity indicators recorded for episodes in the last two weeks, are significant. Stepwise regressions (Table 9) show only three significant predictors: frequency of bowel movements (DUMPS), residency (URBAN) and maternal impressions of severity (EPISODE).

The analyses presented strongly support the hypothesis that mothers are more likely to use Litrosol if they perceive the episode of diarrhea is serious. Combined with the fact that mothers tend to treat infants and toddlers more often than older children, it seems that the intervention appears to have focused on the episodes of diarrhea more likely to threaten health and survival.

Table 7: OLS stepwise regressions of symptoms of severity predicting Litrosol use for cases in the last two weeks, waves 2-5 pooled.

| Variable | beta | t | p |
|---|---|---|---|
| URBAN | -.181 | -4.68 | .000 |
| EPISODE | .103 | 2.52 | .012 |
| DUMPS | .103 | 2.51 | .012 |
| INWAVE 4 | -.105 | -2.69 | .007 |
| BARFS | .084 | 2.11 | .035 |
| Constant | | 3.39 | .001 |

Multiple R .291

$R^2$ .085

N = 623

Table 8: OLS Regressions of symptoms of severity predicting Litrosol use for cases on the day of interview, waves 2-5 pooled.

| Variable | Zero-order correlation | beta* | t* | F values for blocks of variables |
|---|---|---|---|---|
| MUNICIPIO 1 | -.045 | | | |
| MUNICIPIO 2 | .040 | | | 2.11 |
| URBAN | -.151 | -.161 | -2.44[a] | |
| DAYS | .108 | .076 | 1.11 | |
| FEVER | .045 | | | |
| MUCUS | .121 | .094 | 1.40 | 2.34[a] |
| BLOOD | .072 | | | |
| DUMPS | .240 | .173 | 2.59[b] | |
| BARFS | .136 | | | |
| HUNGER | .012 | | | |
| EPISODE | .188 | .120 | 1.65 | 2.72 |
| INWAVE2 | .010 | | | |
| INWAVE3 | .060 | | | 1.16 |
| INWAVE4 | -.122 | -.091 | -1.01 | |
| MOUTH | .052 | | | |
| DRYEYES | -.087 | -.089 | -1.14 | |
| EYES | -.045 | | | 0.75 |
| URINE | .077 | .067 | 1.02 | |
| FONTANEL | .025 | | | |

Multiple R .379

$R^2$ .144

N = 251 cases

Note: a) $p \leq .05$ b) $p \leq .01$
*beta and t values provided if $t > 1.0$ or $t < -1.0$

Table 9: OLS stepwise regressions of symptoms of severity predicting Litrosol use for cases on the day of the interview, waves 2-5 pooled.

| Variable | beta | t | p |
|---|---|---|---|
| DUMPS | .193 | 3.04 | .003 |
| URBAN | -.172 | -2.82 | .005 |
| EPISODE | .153 | 2.39 | .018 |
| Constant | | .03 | .97 |

| | |
|---|---|
| Multiple R | .318 |
| $R^2$ | .101 |
| N | 251 |

## C. Mortality Trends

Several approaches to the collection of mortality information were attempted. The first, collection of data about children of the 750 sample families who died during the intervention, was discontinued after it became clear that the numbers involved were so small as to be statistically useless. A second effort, expanding the data collection from the families in the sample to all the families in the sample communities provided a hope of generating a large enough base for the calculation. However, it soon became evident that community members were either unwilling or unable to help us identify and follow up on all early childhood deaths occurring in their highly dispersed communities. It was clear from the data that those cases which were identified by interviewing community members were only a small proportion of those cases that must be occurring. After intensified efforts to identify additional cases yielded little improvement, this effort was also discontinued.

The evaluation then turned to an external source for mortality data on large numbers of cases. These data were obtained from the Official Death Registry maintained in each county seat. Honduran law requires that all deaths be entered into the Registry within six months, but in practice an unknown proportion of deaths is not recorded. This source provides data on age at death and the cause of death as described by the person reporting the information to the county clerk, usually a family member. The reported causes of death range from traditional causes such as worm fever (fiebre de lombrices) to precise medical terminology, when a physician has told the family what the cause of death was.

### 1. Methods

For cases that are recorded, the data are generally

complete. Data were transcribed for all deaths of children five years or less in age at the time of death for a period from late 1978 through March of 1983. Data were taken from the Death Registers from several sites in Health Region I where the intervention was focused. The transcription was done by a Honduran physician who was experienced in rural health care. The transcribed data included the child's date of death, the reported age at death in months, and the exact textual description of the cause of death. The cause of death was subsequently coded into three categories - - causes for which diarrhea was reported to be the cause of death, causes which involved diarrhea but also involved other reported symptoms (e.g., Diarrhea and Vomiting), and causes not involving diarrhea. The coding was done by the Division of Epidemiology of the Honduran Ministry of Public Health. In the analyses that follow, the first two categories are grouped together as those cases involving diarrhea in any way. This is necessitated by two factors - - the ambiguity of many of the reported causes of death, and the small numbers of cases that result from further disaggregation. The reason for emphasizing deaths associated with diarrhea rather than mortality rates is that registry data are unreliable for estimating the latter because of underreporting.

The total number of cases copied from the Death Register is 402, with 217 occurring before the start of the intervention and 185 occurring afterwards. In the analyses, some of these cases are excluded, usually because the child was actually older than 5 years at death. After the exclusions, 378 cases remain, with 206 occurring before the intervention and 172 occurring after it starts.

The majority of deaths are among children less than one year old, with numbers dropping precipitously in the older age categories. In the "Less than One Year Old" category, a total of 223 deaths were recorded; between one and two years of age, that number drops to 61. In the three year age span from three to five years, only a total of 94 deaths occurred. This distribu-

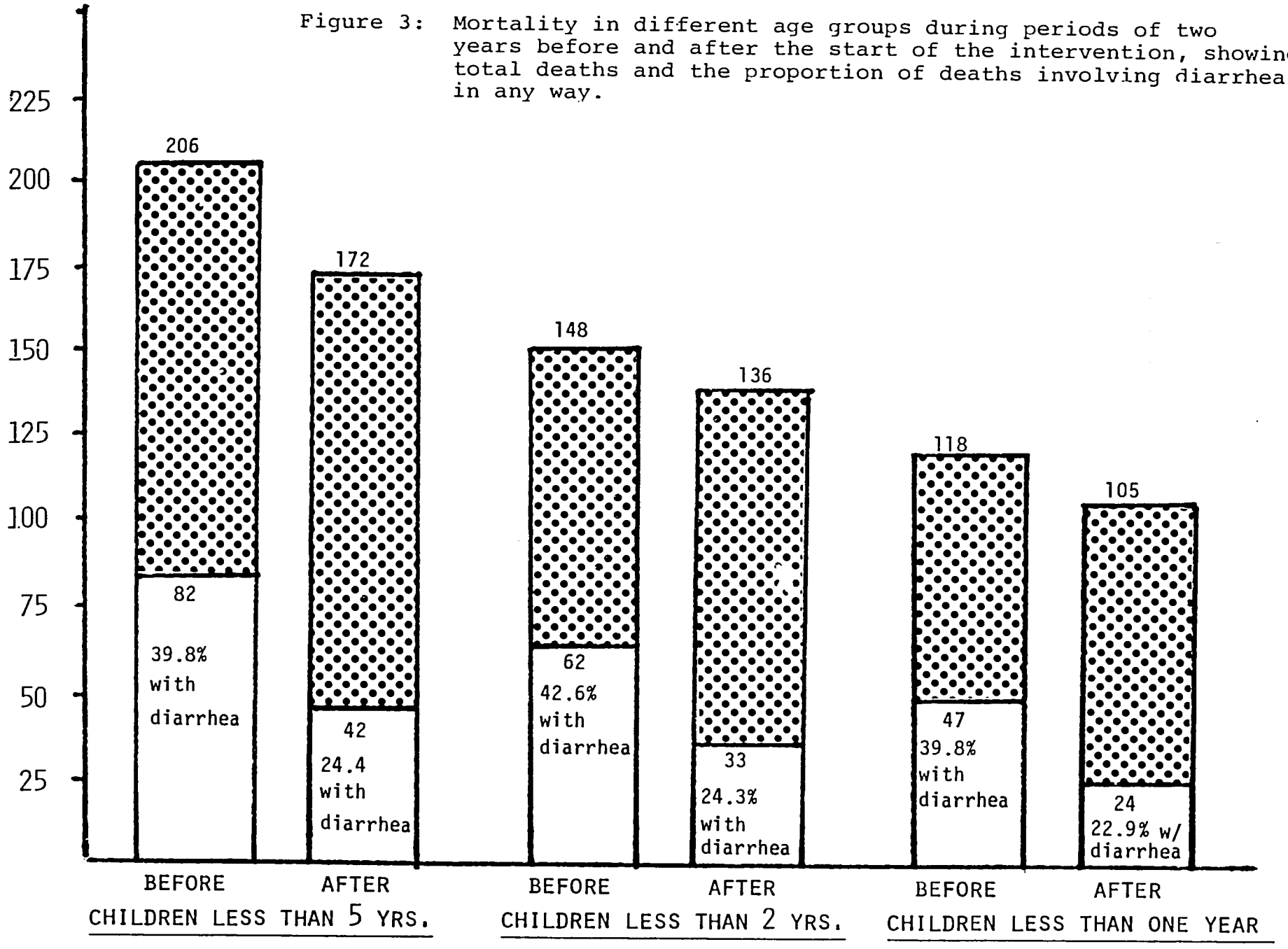
tion parallels what one would expect, but it adds an analysis problem - - the number of cases in the older age groups are too small for many statistical tests. For that reason, the cases have been grouped into non-exclusive age groups defined as "Less than One Year," "Less than Two Years," and "Less than Five Years," and these groups have been divided according to whether the deaths occurred before or after the start of the intervention. Figure 3 presents the information on these groups, with each vertical bar showing the total number of deaths in the group and the unshaded portion of the bar giving the number and percentage of deaths that involved diarrhea in any way.

## 2. Findings

The most prominent finding is that the proportion of deaths involving diarrhea in any way drops sharply after the intervention starts. For children less than a year old, the percentage of deaths involving diarrhea falls from 39.8 percent before to 22.9 percent after the intervention. This drop is statistically significant (chi-square = 6.6, df=1, $p < .01$). It is paralleled by drops in each of the other age groups; although the numbers are too small to achieve statistical significance, the pattern is completely consistent. The figure shows the proportions for all children less than certain ages. If one considers only those children within a specific age range, the effect is still the same. For example, for those children between one and two years of age, the percentage of diarrhea-involved deaths drops from 50 percent before to 29.0 percent after the intervention, on a total N of 61. Similarly, for children less than five but older than two years, the percentages fall from 34.5 percent before to 25 percent after the intervention, on an N of 94. Thus the data show that there is a large, consistent drop in diarrhea as a reported cause of death across all age groups.

In addition to consistency across age groups, we examined

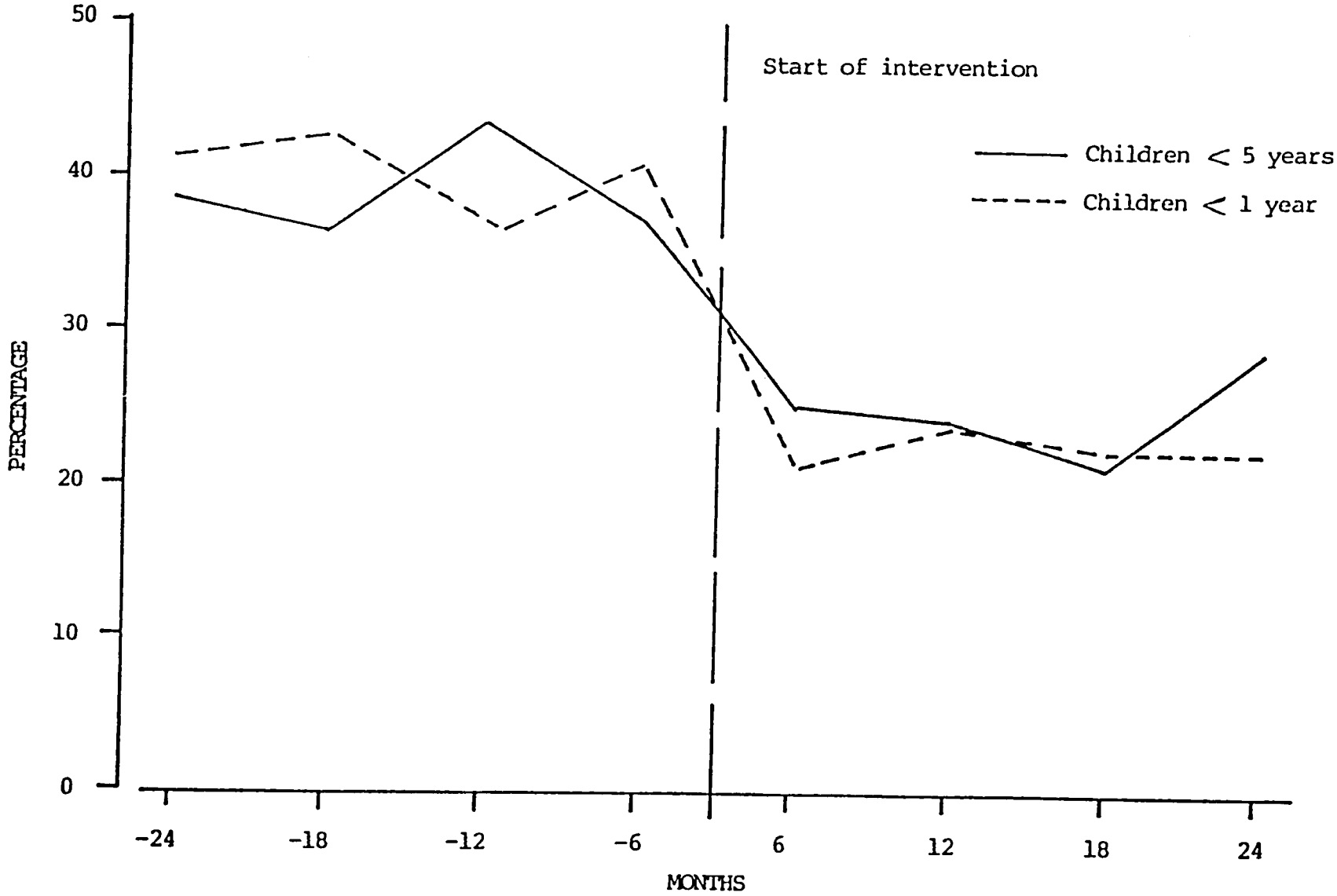
Figure 3: Mortality in different age groups during periods of two years before and after the start of the intervention, showing total deaths and the proportion of deaths involving diarrhea in any way.



consistency across time. The data were categorized according to when the death occurred in relation to the start of the intervention. They were categorized into six-month periods, yielding groups of cases that occurred 6, 12, 18, and 24 months before and after the start of the intervention. These data are presented in Figure 4, for children less than a year, and for all children under five years. From these data we can see that the effect is stable in time and occurs immediately at the start of the intervention. There is no overlap between the proportions of diarrhea-involved deaths before and after the intervention; <u>every</u> percentage value for both age groups after the intervention is lower than <u>any</u> percentage value before. The abruptness and consistency of this pattern strengthens the interpretation that the drop is related to the campaign.

There were 34 fewer deaths reported in the intervention period than in the pre-intervention period for children less than five years of age. This number is less than the drop in deaths associated with diarrhea which declined by 40 cases from 82 to 42. For children less than two years of age, the discrepancy is even larger. While only 12 fewer deaths were reported in the intervention period relative to the pre-intervention period, there was an apparent decline of 29 cases of diarrhea associated deaths. There are at least two possibilities. Errors associated with Registry data accounted for the discrepancy and in reality the total mortality decline was due entirely to a drop in diarrheal deaths. In view of the large discrepancy in children less than two years of age, this explanation would not seem to be the only one. Or, some of the children saved by the use of ORT later died of other causes such as lower respiratory infections. Our data do not allow us to ascertain which possibility is more likely, or in which combination, but, in both instances, the point is clear that mortality due to diarrheal diseases appears to have dropped substantially.

Figure 4: Percent of deaths that involve diarrhea in any way, for two years before and after the start of the intervention.




Time relative to start of intervention

3. Interpretation of the mortality findings.

Three clearcut findings emerge from this analysis. One is that reported diarrheal mortality is sharply lower after the campaign than before, and that this drop occurs precisely and suddenly at the introduction of the ORT campaign. The second is that this effect is stable over time and across age groups, so it is unlikely to be the result of random fluctuations. The third is that total mortality, while lower after the campaign, does not fall as much as diarrheal mortality.

The simplest interpretation of the findings is that the introduction of ORT produced a decline in diarrheal mortality, but that some of the children who were saved from a diarrheal death by ORT soon succumbed to some other malady. There is good corroborating evidence that ORT was available and was practiced with sufficient accuracy by enough mothers to have an impact of this magnitude on the diarrheal mortality rate. Other changes also occurred which may have also helped bring about a decline: increases in breastfeeding and decreases in bottlefeeding and increased feeding during diarrhea. Also, ORT treatment became available in clinics at about the same time as it was introduced to the population at large. Clinic coverage of rural populations in Honduras is good, so it is possible that decline in mortality was brought on by the sudden and pervasive availability at both clinic and home treatment levels as well as by changes in infant feeding.

While the causal explanation given above is reasonable, there are several anomalies in the data that make other interpretations of these findings plausible as well. Reported diarrheal death rates are relatively constant across age groups, as can be seen in Figures 3 and 4. This would not normally be expected, as diarrheal mortality is usually much more prevalent among younger children. A second anomaly is that the timing of the drop is so abrupt. One might expect to see a more gradual drop as the

treatment is gradually adopted by more and more mothers. Mothers are the main source of reported cause of death, and it may be that they are responding in some way to the saturation of messages about diarrhea and ORT. They might, for example, be less likely to report diarrhea as a cause of death after exposure to messages pointing out that there is now an effective way to treat it.

At this point there is reason to believe that at least some of the reduction in reported diarrheal deaths does reflect a direct effect of the introduction of ORT. The evidence on the availability and adoption of the ORT indicates treatment levels that are high enough to have an effect of this magnitude. Other evidence shows that mothers are more likely to treat more serious cases. The accuracy of mothers' knowledge and performance, and the concurrent introduction of ORT in clinics both support the interpretation that ORT is having an effect on mortality from diarrhea. Improvements in infant feeding may have also contributed to this decline.

# Chapter III

## Morbidity and Mortality in The Gambia

### A. Morbidity Change

The Medical Research Council team in The Gambia has provided detailed data on the growth, nutrition, and health of children. One of the striking aspects of these data is the seasonal variation they reveal. The peak of diarrheal disease incidence occurs during the rainy season which lasts from June to October. The infectious agents during the rainy season are likely to be bacterial although giardiasis also plays an important role. A smaller peak in incidence occurs in the dry season, with cases more likely being caused by rotavirus. Episodes occurring during the rainy season are likely to be of longer duration while those in the dry season tend to be shorter and more severe. For this reason, children are at a greater risk of severe dehydration and death in the dry season (Rowland, 1983).

Bacteriological studies show that children come into contact with bacterial agents of diarrheal diseases (among other pathways) through the use of contaminated water in the preparation of foods. Water sources are most polluted during the rainy season and not surprisingly, the contamination in weaning foods is greatest at this time (Rowland, Barrell, and Whitehead, 1978). The rainy season is the time of greatest food scarcity but also the time when demands for agriculture are at their peak. Mothers spend much of the day away from home in the fields and infants are often left under the care of someone else. Studies show that birth weights are less during the rainy season and that the milk output of mothers is decreased (Roberts et al, 1982). The rainy season is therefore a time when the nutritional status of children rapidly deteriorates.

1. Changes in the prevalence of diarrheal diseases

The results of this study corroborate the findings of the MRC unit. Mothers were interviewed using the morbidity instrument on 13 different occasions between March 1982 and June-July, 1984, providing data for two years. The information obtained includes whether the mother's preschool children were ill with diarrhea on the day of the interview and in the previous two weeks, and the characteristics of the episode for each ill child.

Table 10 and Figure 5 show the marked seasonal variation in diarrhea prevalence in the last two weeks and on the day of the interview for all children. The peak value of 34 percent of children with diarrhea occurred during the 1982 rainy season and prevalence for the previous two weeks remained consistently low at between 10 and 13 percent during the subsequent dry season. Diarrheal prevalence rose again during the 1983 rains, but was lower than during the previous rainy season by ten percent, probably due to decreased rainfall during the 1983-84 drought.* Diarrhea prevalence for the subsequent dry season was slightly higher than the year before, although still lower than rainy season prevalence for cases ill in the last two weeks. Prevalence was beginning to rise again at the last data point in July 1984, as the rains were beginning.

Point prevalence (percent of children with diarrhea on the day of the interview) also reflects seasonal variation (Table 10 and Figure 5). As with cases of diarrhea within the previous two weeks, point prevalence over the two years under study was highest during the 1982 rains, with nine percent of the children having diarrhea on the day of the interview in June 1982. Rates decreased to between 1.2 and 2.4 percent in the subsequent dry season, increased to only 3.7 percent during the very light 1983 rains, and fell afterwards back to between 1.2 and 2.3 percent.

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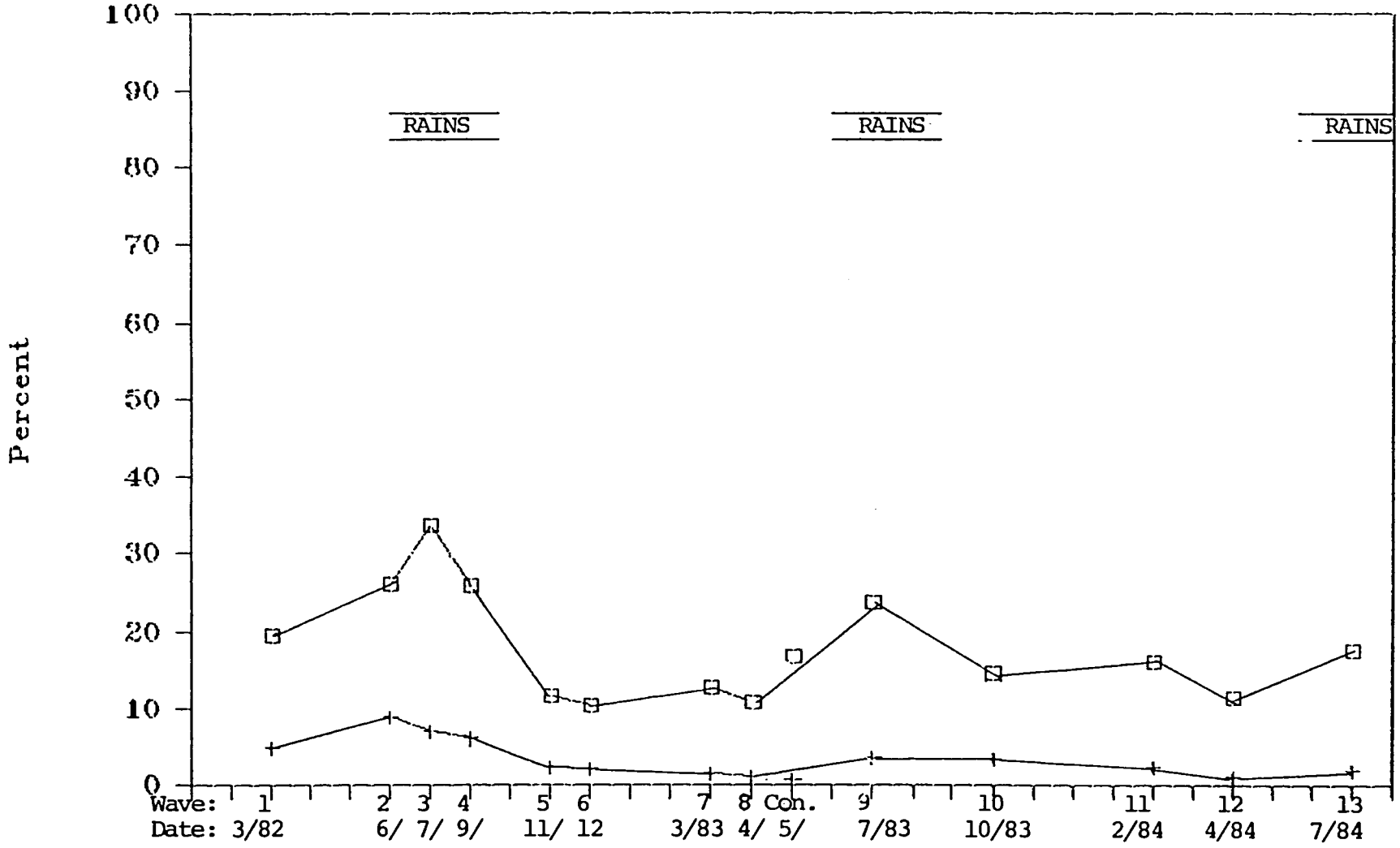
* October 1983 received very little rain and is therefore considered part of the dry season in the graphs.

Table 10: Prevalence of diarrhea: percentage of all children ill with diarrhea during the previous two weeks and on day of interview, over time

| | MORBIDITY WAVES | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3/82 | 6/82 | 7/82 | 9/82 | 11/82 | 12/82 | 3/83 | 4/83 | 5/83* | 7/83 | 10/83 | 2/84 | 4/84 | 7/84 |
| Percent of children having diarrhea in previous two weeks | 19.5 | 26.0 | 33.7 | 25.9 | 11.9 | 10.4 | 12.7 | 10.9 | 16.8 | 23.8 | 14.7 | 16.2 | 11.5 | 17.7 |
| Percent of children with diarrhea on day of interview | 5.0 | 9.0 | 7.1 | 6.2 | 2.4 | 2.1 | 1.6 | 1.2 | 0.8 | 3.7 | 3.5 | 2.3 | 1.2 | 2.0 |
| n = | 1004 | 885 | 960 | 956 | 912 | 1041 | 1027 | 1021 | 250 | 951 | 936 | 1060 | 968 | 972 |

MORB
* Control group

Figure 5: Prevalence of diarrhea: percentage of all children ill with diarrhea during the previous two weeks and on day of interview, over time




□ Children with diarrhea in in the last two weeks

+ Children with diarrhea on day of interview

Thus, the results indicate higher rates of diarrhea during the rains than during the dry season. Over the two years of the study, incidence was highest during the 1982 rains, and lower during the 1983 rains, when rainfall was unusually low. The rainy and dry season peaks in 1982 conform with previous research in The Gambia on diarrhea incidence, varying slightly from year to year.

2. Trends in severity indicators

The mean duration of episodes in Gambian children older than six months is four days according to MRC estimates (Rowland, 1983). In our sample, the mean duration for cases of diarrhea during the last two weeks ranged from 3.9 to 4.4 days for episodes occurring during the rainy seasons, to 3.1 through 3.9 days during the dry seasons (Table 11). Because many of the episodes of diarrhea were still in progress on the day of the interview, our duration data are not a true estimate of the average duration of episodes. However, the data do provide a relative indicator of the duration of cases at different times of the year. The percentage of cases with more than four days of diarrhea in the past two weeks are plotted in Figure 6. There were more cases of diarrhea over four days long in the rainy seasons than in the dry seasons, except for the last data point, which is anomalously low for a rainy season measure. The 1982-83 dry season is much below March 1982 and 1983-84 dry season estimates, again, pointing to yearly variation.

Mothers of children ill with diarrhea in the past two weeks were asked if they thought the case was mild, moderate, or severe and were also asked to report whether the child lost a lot of weight. The percent of episodes of diarrhea with a lot of weight lost, as perceived by the mother, are shown in Figure 7. In Figure 8, similar data are plotted for percent of cases reported by mothers to have moderate or severe diarrhea (combination of moderate and severe categories given in Table 11).

Table 11: Measures of diarrhea severity: Length of episodes, weight loss, and mother's perception of severity for cases in the previous two weeks

| | MORB WAVES | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Cont. 9 | | 10 | 11 | 12 | 13 |
| | Mar | Jun | Jul | Sep | Nov | Dec | Mar | Apr | May | Jul | Oct | Feb | Apr | Jul |
| Mean duration of episode, in days | 3.9 | 4.0 | 4.4 | 4.0 | 3.6 | 3.1 | 3.1 | 3.3 | 3.6 | 3.9 | 3.6 | 3.5 | 3.9 | 3.3 |
| % of episodes lasting more than 4 days | 21.1 | 25.2 | 29.0 | 31.6 | 20.6 | 6.5 | 8.5 | 9.0 | 23.8 | 34.8 | 28.1 | 28.6 | 29.1 | 13.6 |
| % of episodes with a lot of weight lost | 41.3 | 29.1 | 14.9 | 12.9 | 20.4 | 15.7 | 11.5 | 9.0 | .8 | .4 | 23.2 | 11.6 | 9.9 | 11.1 |
| % of moderate cases (mother's perception) | 32.0 | 5.2 | 4.0 | 6.9 | 15.9 | 8.3 | 13.2 | 1.8 | .8 | .9 | 20.3 | 11.6 | 7.3 | 24.0 |
| % of severe cases (mother's perception) | 47.7 | 24.0 | 15.9 | 7.7 | 19.6 | 17.6 | 4.7 | 6.3 | .4 | .0 | 12.3 | 2.9 | 0 | 1.2 |
| N | 196 | 230 | 323 | 248 | 108 | 108 | 130 | 111 | 41 | 227 | 138 | 171 | 110 | 172 |

MORB:DAYSDGQ,LOSTGQ,DITYPGQ

DAYSDGQ,LOSTGQ,DITYPGQ

Figure 6: Percent of episodes lasting more than four days ( ⊙ is control data point).

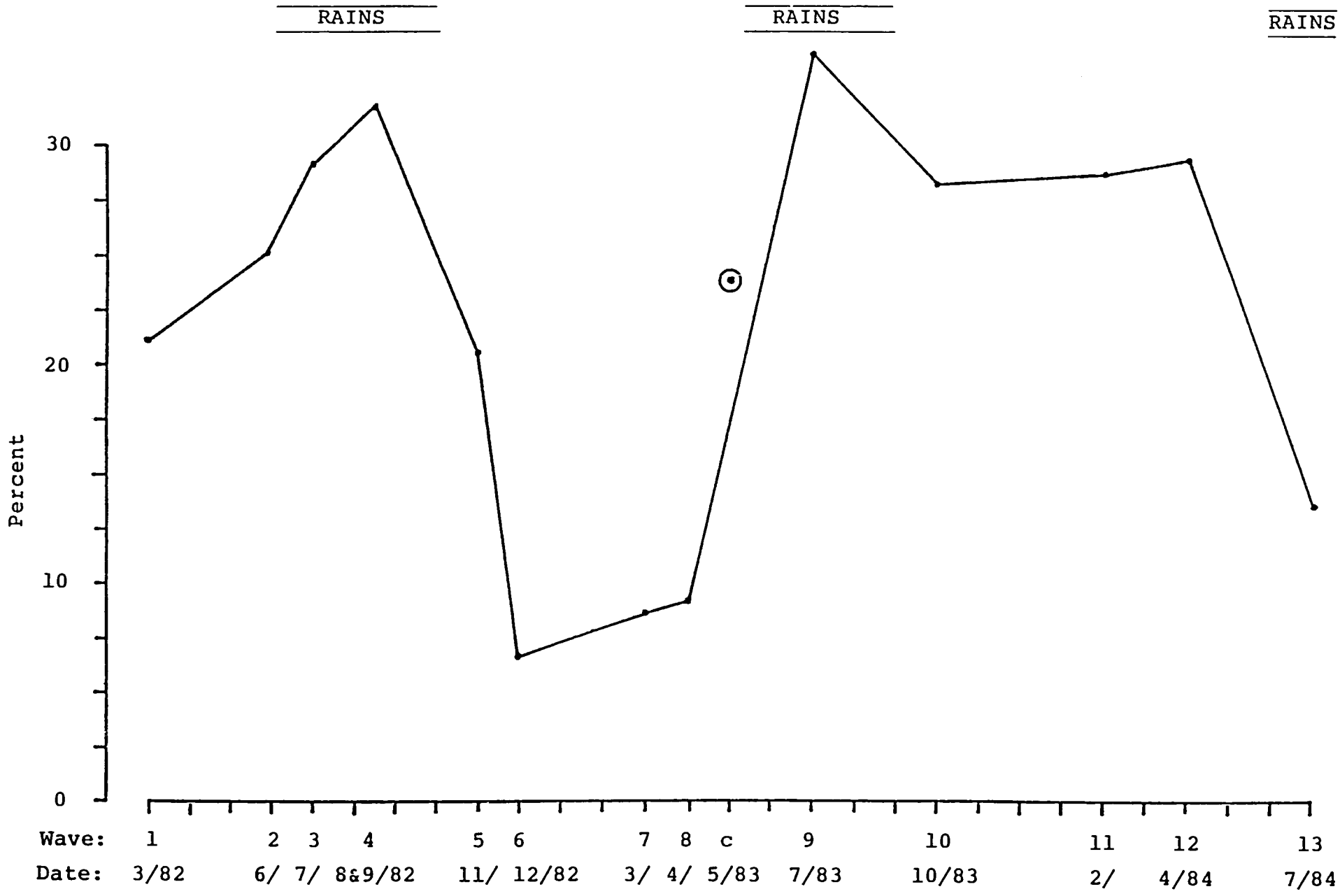


Figure 7: Percent of episodes of diarrhea with a lot of weight loss ( ⊙ is control data point).

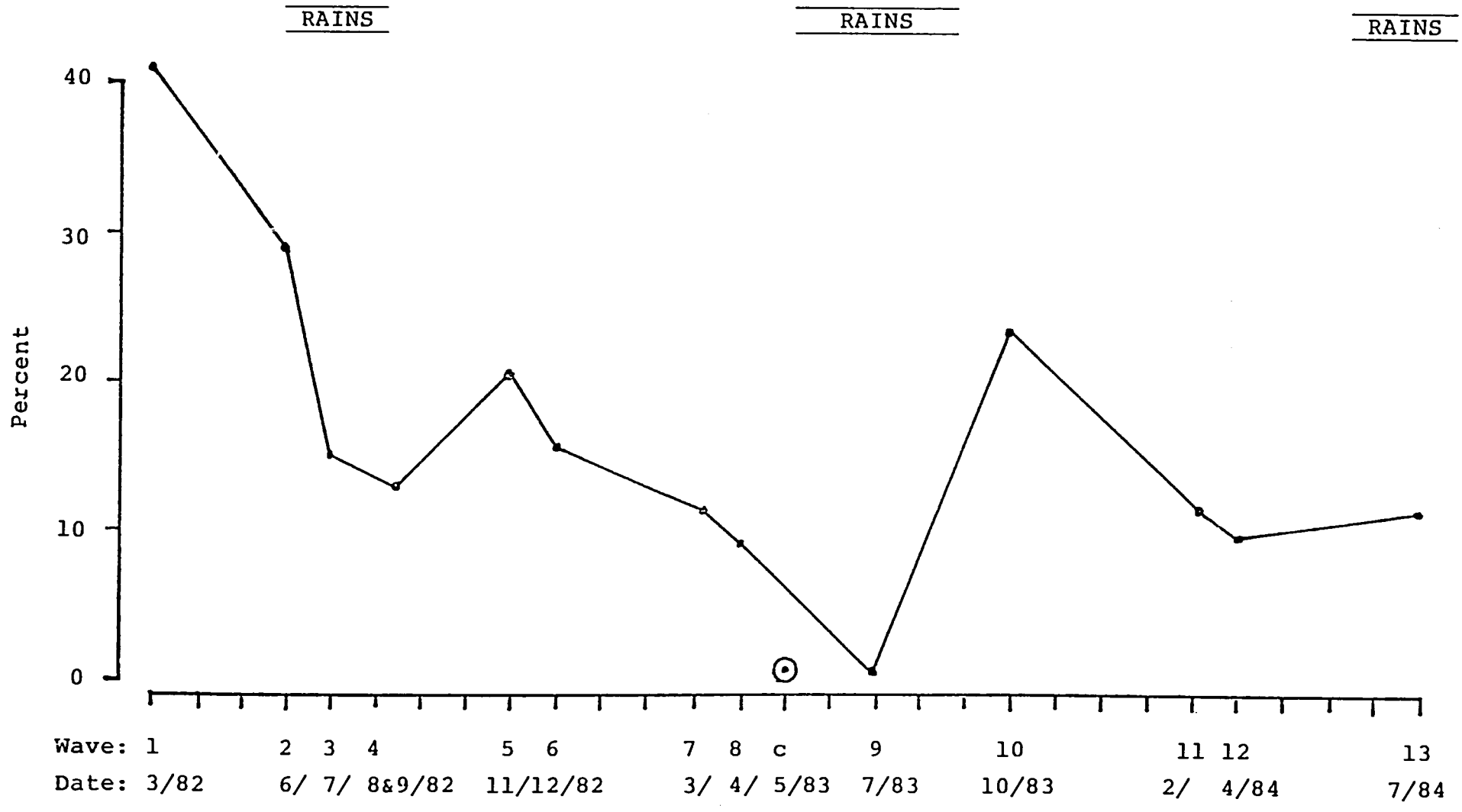
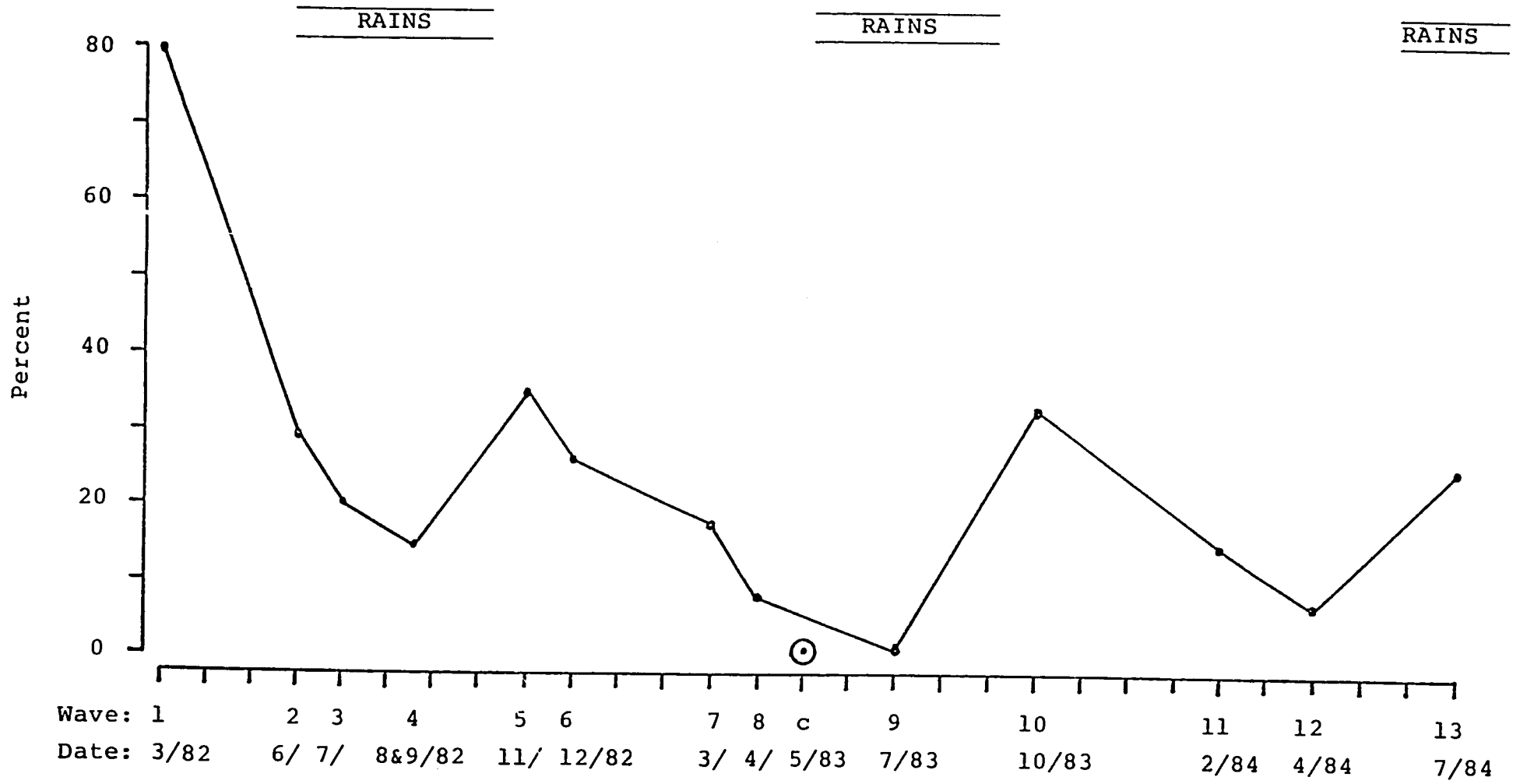


Figure 8: Mother's perception of severe and moderate episodes of diarrhea in the previous two weeks ( ⊙ is control data point).



With the onset of the campaign, these indicators of mothers' perceptions of severity declined. The number of cases losing a lot of weight dropped from a high of 41.3 percent in March 1982 to 29.1 percent by June of that year, and continued to drop further during the rainy season, which was a period of heavy campaign promotions. Rates of perceived severe weight loss rose slightly in March 1983, then dropped again through the heavy feeding/WSS message promotion in 1983. October 1983 shows an odd peak of 23.2 percent, after which the rates of perceived severe weight loss dropped again. In October, the implementation team turned their efforts towards planning a mini-campaign on sanitation, while health workers were probably concentrating more on the meningitis inoculation campaign; less public attention was focused on diarrhea management. Thus, the rates of perceived severe weight loss for children ill in the last two weeks declined over the course of the campaign, and was lowest during periods of heavy promotion during the rainy season. It would not be unreasonable to find less weight loss during the rainy season since episodes tend to be less severe at this time.

In a similar manner, the percentage of moderate and severe cases perceived by mothers for episodes in the last two weeks prior to the interview may reflect campaign effects and/or seasonal patterns. The high measures in March 1982 were not repeated once the campaign was underway. Perceptions of severity rose again, but not to the pre-campaign level, during the dry-season diarrhea promotion, which emphasized the danger of dehydration deaths for small children. These messages may have been repeated after the feeding campaign wound down in October 1983, when perceptions of severity rose again. Finally, perceptions of severity unexpectedly rose during the July 1984 rains. Thus, the most striking feature was the steady decline overall in mothers' impressions of severity, especially during heavy rainy season promotions. Perceptions of severity were slightly higher during dry season messages about the danger of diarrhea deaths.

Mothers were asked about the presence of blood and mucus in

the stools, telltale signs of bacterial diarrhea. Figure 9 and Table 12 show the lowest levels of mucus in children's stools among diarrhea cases in the two weeks prior to the interview during the 1982-83 dry season. Rates are higher during the rains in 1982, 1983, and 1984, but two of the dry seasons also show high rates of mucus in the stools - - March 1982 and all measures in 1983-84 dry season, especially the April 1984 data point. Blood levels were highest in March 1982, reporting a quarter of the cases with blood in stools. Rainy season levels were higher in 1982 than dry season rates, but the rise in blood levels in 1983 occurred after the rainy season measure in July, with higher rates in October 1983 and February 1984, and a subsequent decline by April and July 1984. Thus, aside from the first data point, the first year shows the expected relation between seasonality and two indicators of bacterial diarrhea, the presence of blood and mucus in stools - - namely, that there is more bacterial diarrhea during the rainy season. However, the second year does not show the expected dry season drop in bacterial indicators, perhaps due to conditions caused by the drought. The first data point, from the 1982 dry season, matched the October 1983 and February 1984 levels for mucus in the stools, but was anomalously high in cases with blood in their stools. Control community levels in May 1983 matched sample communities during the same period, indicating that there was not an interview reaction at that time.

Data for two indicators of dehydration are plotted in Figure 10 and the data are given in Table 13: percent of children urinating less and percent of children with dry eyes. In both instances the data refer to only those cases with diarrhea on the day of the interview. The data on the extent of urination was provided by the mother while the degree of dryness in the eyes was determined by the fieldworker. It is clear that the indicators show greater dehydration during the dry season than in the rainy season (as expected from the MRC data). The steady rise in the dehydration indicators during the dry season may represent

Figure 9: Measures of bacterial diarrhea: presence of blood and mucus in stools for cases ill in the last two weeks ( ⊙ is control data point).

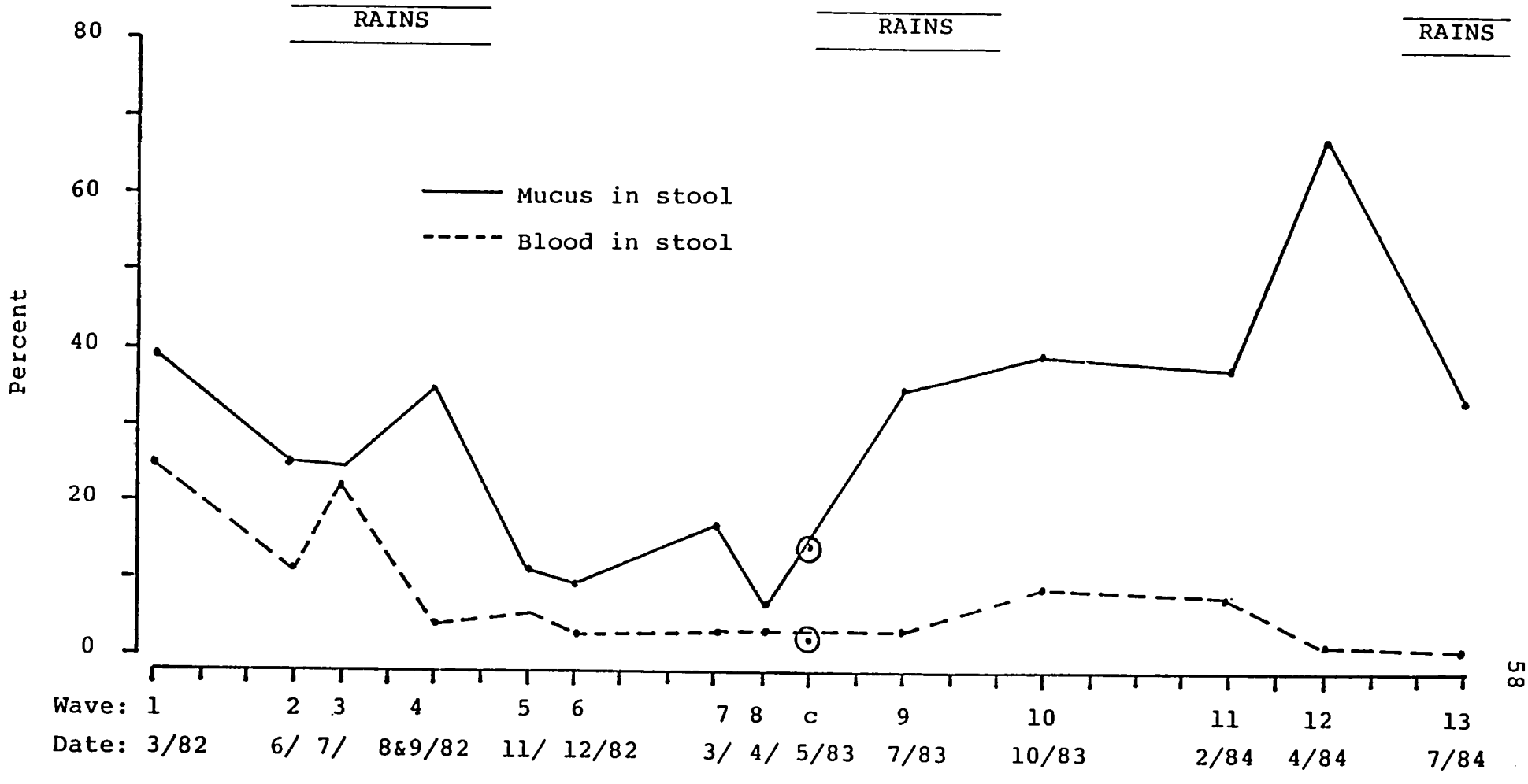
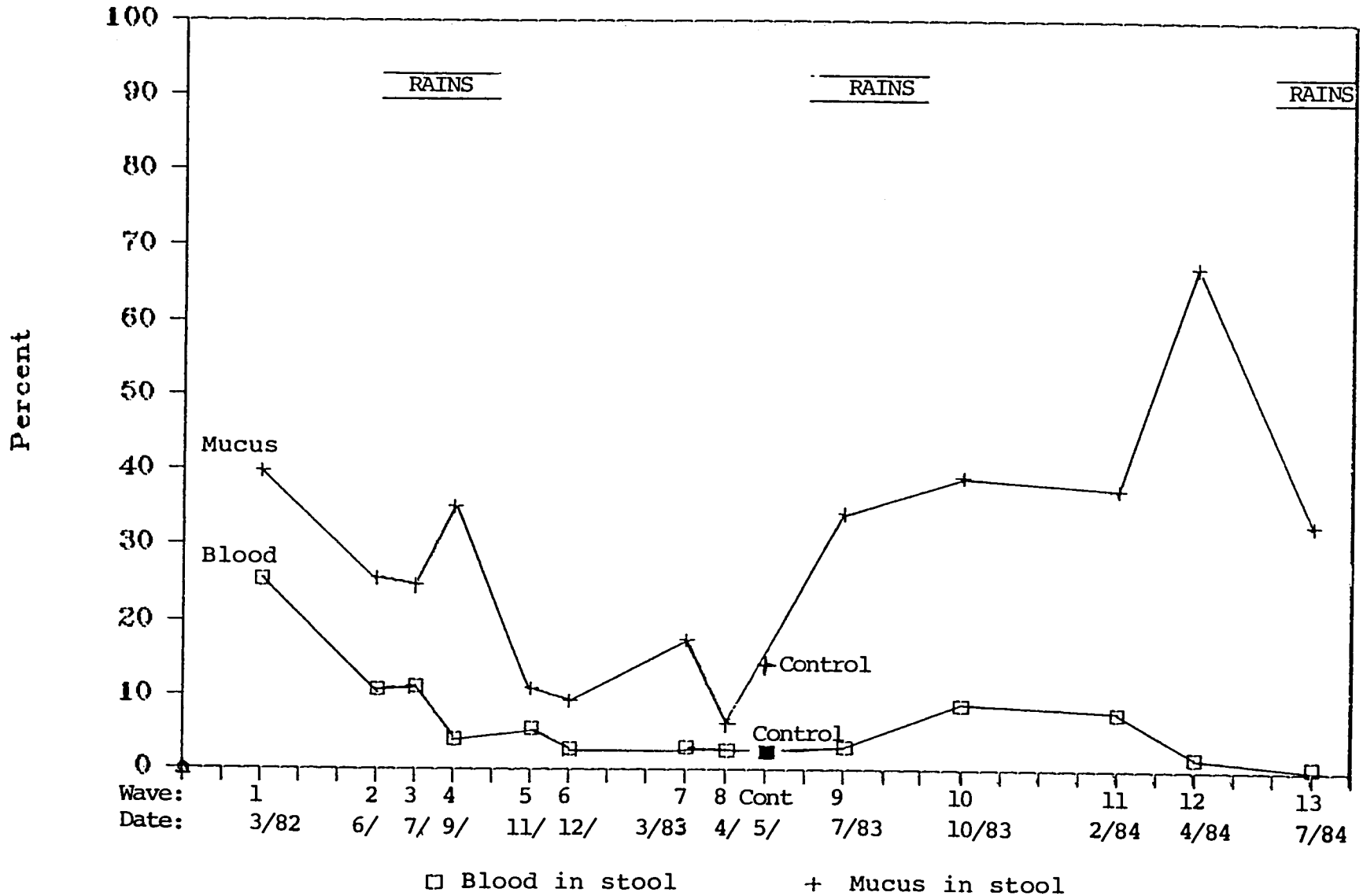


Table 12: Measures of bacterial diarrhea: presence of blood and mucus in stools for cases ill in the last two weeks

| | MORBIDITY WAVES | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3/82 | 6/82 | 7/82 | 9/82 | 11/82 | 12/82 | 3/83 | 4/83 | 5/83* | 7/83 | 10/83 | 2/84 | 4/84 | 7/84 |
| Percent of cases in last two weeks with blood in stools | 25.5 | 10.9 | 22.3 | 4.0 | 5.6 | 2.8 | 3.1 | 2.7 | 2.4 | 3.1 | 8.8 | 7.6 | 1.8 | 0.6 |
| Percent of cases in last two weeks with mucus in stools | 39.8 | 25.7 | 24.8 | 35.1 | 11.1 | 9.3 | 17.7 | 6.3 | 14.3 | 34.4 | 39.1 | 37.4 | 67.3 | 33.1 |
| n = | 196 | 230 | 323 | 248 | 108 | 108 | 130 | 111 | 42 | 227 | 138 | 171 | 110 | 172 |

MORB
* Control group

Figure 10: Measures of bacterial diarrhea: presence of blood and mucus in stools for cases ill in the last two weeks




MORB:BLOOD,MUCUS

Table 13: Measures of dehydration: Children with dry eyes and urinating less for cases of diarrhea on the day of interview

| | 1982 | RAINY SEASON | | | | | 1983 | | RAINS | | 1984 | | RAINS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mar. | June | July | Sept | Nov. | Dec. | Mar | Apr | July | Oct. | Feb | Apr | June |
| Percent of cases with dry eyes | 22.0 (11) | 20.0 (16) | 20.6 (14) | 11.9 ( 7) | 33.3 (7) | 31.8 (7) | 43.8 (7) | 41.7 (5) | 5.7 (2) | 24.2 (8) | 8.3 (2) | 8.3 (1) | 31.6 (6) |
| Percent of cases urinating less | 18.0 (9) | 11.3 (9) | 7.4 (5) | 10.2 (6) | 23.8 (5) | 22.7 (5) | 25.0 (4) | 33.3 (4) | 2,9 (1) | 27.3 (9) | 8.3 (2) | 8.3 (1) | 15.8 (3) |
| n = | 50 | 80 | 68 | 59 | 21 | 22 | 16 | 12 | 35 | 33 | 24 | 12 | 19 |

MORB:AMURNGQ,NORMGQ

the rising prominence of rotavirus and the declining role of bacterial agents of diarrhea. During the 1983 rainy and dry season, however, there seems to have been less dehydration than from the previous year. The July 1983 levels of both dry eyes and less urine are lower than July 1982 levels. October 1983 looks fairly comparable to the previous November, but the February and April 1984 rates are much lower than March and April 1983 levels of these two dehydration indicators. The low rates in 1984 are surprising, due to the drought in The Gambia; by this time in 1984, many wells were dry, while many of those left were low and presumably more contaminated, and food and gasoline shortages were more pronounced. During the 1984 drought, however, episodes lasted longer, fewer children showed signs of dehydration, and levels of mucus in the stools were high.

3. Discussion of trends in prevalence of severity

Overall, the data show the expected seasonal fluctuations in the prevalence of diarrheal disease. The similarity to trends found by the British Medical Research Council in The Gambia tend to support the reliability of our findings. We found higher rates of diarrheal disease and longer-lasting episodes during the rainy seasons than during the dry seasons. The rainy season peak in 1983 is less than the year before, however. This is probably due to diminished rains during the beginning of the drought, since MRC research has pointed to a strong relationship between rainfall levels and diarrhea incidence during rainy seasons. MRC also cautions that there may be considerable variation across communities and years (Rowland, 1983).

Feachem et al (1983) would not expect an ORT campaign to lead to lower diarrheal prevalence because the transmission of disease causing pathogens is not likely to be interrupted. It might be possible, however, that an ORT campaign would shorten the duration of a case. Thus, we feel that the observed changes

in prevalence are more likely the result of annual and seasonal factors, not a result of the intervention. Because we have only two years of data, it is problematic to interpret trends which feature such great seasonal and yearly fluctuation.

Rowland, Barrell, and Whitehead's differentiation between bacterial diarrhea during the rainy season and rotavirus diarrhea during the dry season is only partially supported by our data. The first year shows the expected trends, apart from the first data point, but the second year does not. Blood and mucus in stools, two indicators of bacterial diarrhea, remained high during the 1983-84 dry season, contrary to expectations. Two measures of dehydration, which MRC research relates to rotavirus diarrhea peaking normally during the dry season, were found to be low in February and April 1984, and high as the rains began in 1984.

The findings with respect to severity are intriguing. The percent of episodes lasting more than four days was highest during the rainy season as expected and did not appear to decline over the course of the study. Seasonal variations were also noted with respect to two indicators based on maternal impressions: percent of episodes with a lot of weight loss and percent of episodes which are moderate or severe. Consistently and as expected, these severity indicators were highest during the dry season and lower during the rainy season. The interpretation is not as simple however, because campaigns were intensified during the dry season when more severe diarrhea was expected. Whether mothers reported more severe episodes as a result of reality or the campaign is not clear. The point must be stressed that, whatever the explanation, the findings are not inconsistent with what has been reported before. In addition to seasonality, there is a clear decline in these reported conditions over the course of the two years. There are two questions that are important. Is the decline real? Is the decline due to the effects of the campaign? With respect to the first question, repeated campaigns may have raised the level of awareness of the problems of

diarrhea and increased the reporting of severity. This would have produced an increase and not a decline over the course of the campaign. For this reason, we believe the decline in severity is probably real. Was the decline caused by the campaign? While certainly possible, we also have to realize that there is a lot of year to year variation in the prevalence of diarrhea, and its pathogenesis and clinical manifestations. Thus, our findings could easily represent a yearly fluctuation not explained by WSS or, just as likely, they could represent a campaign effect.

## B. WSS Use and Severity Indicators

### 1. Trends in WSS use

When a rural Gambian mother discovers her child has diarrhea, she has several treatment alternatives. She may take her child to a local healer, such as a herbalist or Islamic marabout, if she feels that the illness is curable by traditional means; but observations by Peace Corps volunteers and others suggest that diarrheal disease is usually not seen as curable by these methods. The mother may also seek help from a health center, dispensary, or clinic. If she wishes to treat the bout herself, she may give teas, pharmaceutical drugs, purges, or the campaign prescribed water-sugar-salt solution (WSS).

One of the objectives of the campaign - - to introduce the WSS treatment - - would have multiple consequences if it were successful. At one level, a successful introduction would lead to an increase in the proportion of mothers who treated at home when their children fell ill with diarrhea. At another level, it would replace other treatments for women who treat cases themselves. Thus a drop in the proportion of mothers seeking care in the health centers should be construed as an indicator of success for the program. A finding of displacement of other home

treatments by WSS would also indicate success. We therefore conducted an analysis of the treatment choices mothers made.

(a) Analyzed for all episodes

During the course of the campaign, there was a dramatic shift in favor of home treatments, especially WSS. At the start of the campaign, 80.6 percent of the children were taken to a health center, and only 16.6 percent were treated at home (Table 14). By the end of the campaign, the percent going to the health center had taken a somewhat uneven downward path to 24.2 percent or roughly a third of its earlier levels. The percent treating at home rose to 82.9 percent, or more than five times its earlier level. The size of the change during the final sweep was unexpected but was consistent with the overall trend of the data. Several factors in addition to the campaign may have contributed to the magnitude of the change in the final interval, including economic factors for the Ministry of Health that severely curtailed their ability to provide services, and the arrival of the long awaited rains which had the twin impact of making travel more difficult and making mothers very busy with agricultural tasks. The percent of all episodes that received WSS treatment rose from almost none (3.6 percent of cases) at the beginning to more than two-thirds (69.9 percent of cases) at the end. This value refers to the last bout a child suffered and so represents an estimate of the coverage of diarrhea episodes with oral rehydration therapy. The final period's percentage was substantially higher than the preceding waves, but is still consistent with the trend, as the average coverage in the sample over the second half of the study was over 50 percent. Part of the rise in the final period may reflect a lack of alternatives, but it was building upon a very high base.

Other possible treatment sources, such as local healers, were reported only rarely. Less than five percent of the children were taken to local healers initially; this figure dropped to

Table 14: Treatments given to children for their last bout of diarrhea

| Treatment | Morbidity Waves 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Ctrl | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Went to health center | 80.6% | 83.1 | 78.0 | 82.0 | 78.3 | 59.8 | 45.8 | 53.7 | 53.2 | 54.2 | 68.8 | 59.3 | 59.2 | 24.2 |
| Went to local healer | 4.3 | 0.7 | 0.2 | 0 | 0.1 | 0.3 | 0.6 | 0.4 | 0.8 | 1.0 | 2.6 | 1.9 | 2.6 | 5.0 |
| Treated at home | 16.6 | 21.8 | 31.2 | 31.3 | 31.7 | 53.9 | 62.2 | 53.3 | 58.8 | 58.2 | 42.4 | 60.0 | 52.5 | 82.9 |
| Gave WSS | 3.6 | 15.5 | 22.2 | 25.5 | 26.2 | 48.1 | 59.1 | 51.2 | 54.4 | 56.6 | 35.5 | 53.2 | 49.4 | 69.9 |
| Gave tea | 9.6 | 5.7 | 7.0 | 5.6 | 4.3 | 5.4 | 3.2 | 2.2 | 3.2 | 2.0 | 6.6 | 10.2 | 3.4 | 22.8 |
| n = | 1004 | 885 | 960 | 956 | 912 | 1041 | 1027 | 1021 | 249 | 951 | 936 | 1060 | 969 | 970 |

MORB: SELFGQ,HEALRGQ,CENTRGQ,TROTHGQ

nearly nothing during the campaign and rose again only at the last data collection point in June-July 1984.

The second indicator of impact was the displacement of alternative home treatments by WSS. This analysis was conducted for episodes in which mothers chose to treat the case themselves, rather than for all episodes. Among self-treaters, WSS was preferred from the time of the Happy Baby Lottery onward (see Table 15). Of those children treated at home, most were given WSS. Tea dropped quickly and remained a distant second choice, while drugs, purges, and tea made from chalk washed from a slate on which a saying from the Koran had been written were hardly used at all. The rapidity of which this happened is striking. From the earliest point at which information about how to mix and administer WSS was available, mothers virtually abandoned other ways of treating the case. The proportion of home-treated cases that received WSS treatment jumped from around twenty percent in the first measurements to the high eighty and ninety percent ranges. Because the proportion of cases treated at home also rose during this time, the impact on coverage of all cases was even more strongly affected. Figure 11 shows the coverage over time of all episodes and of home treated episodes.

(b) Analyzed for episodes occurring in the previous two weeks

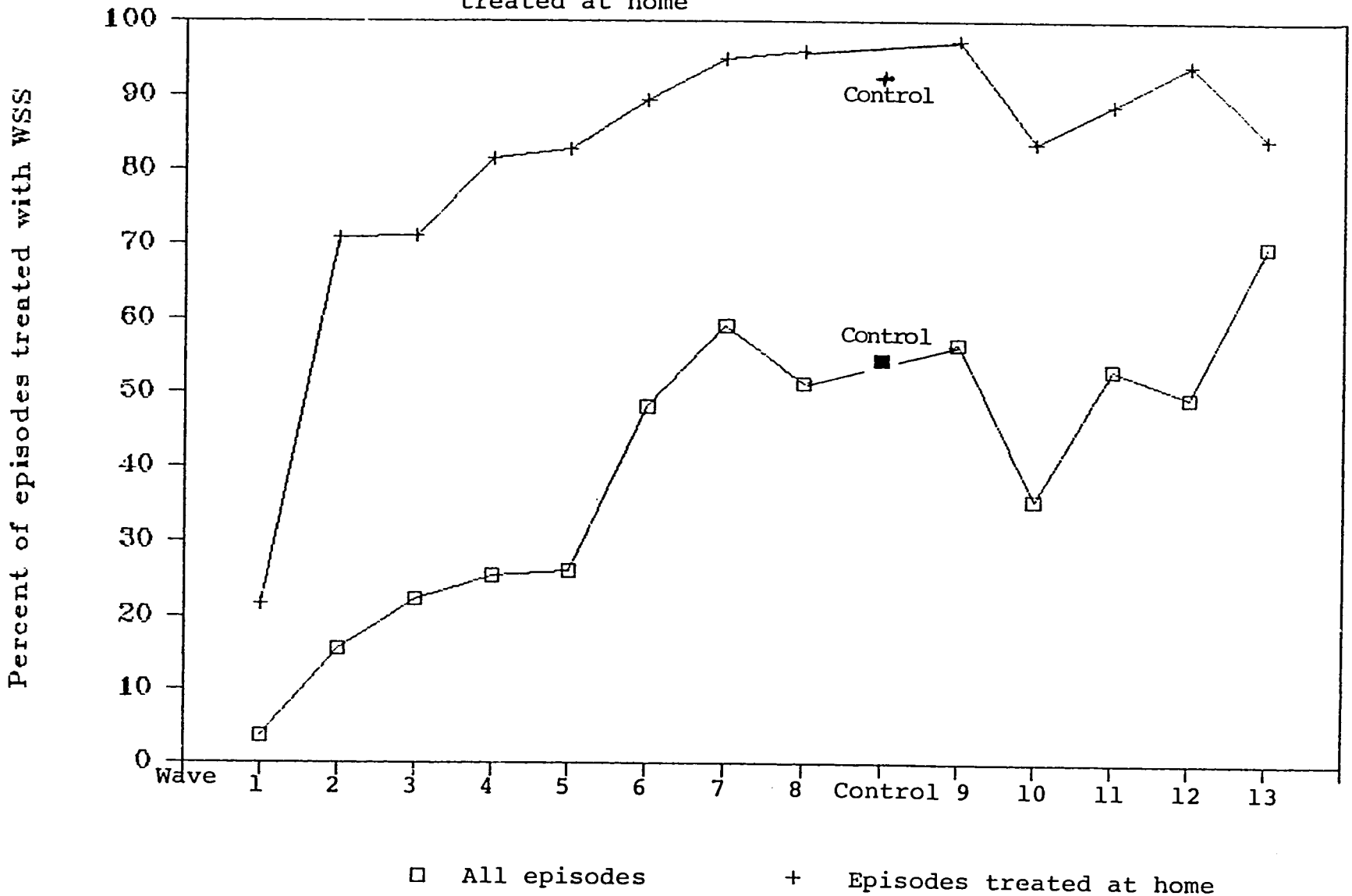
We have repeated the analysis for only those children sick with diarrhea within the last two weeks prior to the interview. There are two main reasons for the analysis of this subset of recent cases. Evidence from other contexts indicates that recall of prior events loses accuracy quite quickly and the event fades into the past. We have chosen to limit this analysis to a two-week recall because earlier studies at the Institute for Nutrition for Central America and Panama (INCAP) have demonstrated deterioration of accuracy in periods greater than two weeks. Thus we feel that the most accurate estimates of behavior are those based on the shortest recall period. Shorter recall

Table 15: Choice of treatments given to children at home*

| Treatment | Morbidity Waves 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Ctrl | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Given WSS | 21.7 | 71.0 | 71.2 | 81.6 | 82.7 | 89.3 | 95.0 | 96.1 | 92.5 | 97.3 | 83.6 | 88.7 | 94.1 | 84.3 |
| Given tea | 57.8 | 25.9 | 22.4 | 18.1 | 13.5 | 10.0 | 5.2 | 4.0 | 5.4 | 3.4 | 15.6 | 17.0 | 6.5 | 28.3 |
| Given pharma-ceutical drugs | 9.0 | 1.6 | 5.7 | 2.0 | 2.4 | 1.1 | 0.2 | 0.2 | 3.4 | 0 | 2.3 | 0.6 | 2.0 | 2.3 |
| Given Koran water | 2.4 | 0.5 | 0 | 0 | 0 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0.2 | 3.1 | 6.2 |
| Given purge | 2.4 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0 | 0 | 0 | 9.4 | 1.2 |
| n = | 166 | 193 | 299 | 299 | 289 | 561 | 639 | 544 | 147 | 553 | 397 | 636 | 509 | 780 |

MORB; TEAGQ, WSSGQ, PURGEGQ, KORANGQ, PHARMGQ
* Percent children treated by their mothers, not total.

Figure 11: Episodes treated with water-sugar-salt solution, shown as a proportion of total episodes and of episodes treated at home




MORB:SELFSQ,WSSGQ

periods reduce the number of cases in the sample and therefore reduce the accuracy of the estimates; there is a balance to be struck between short recall periods and numbers of cases, and we feel that two weeks is an optimal period.

A second reason for limiting the recall period is that it eliminates the risk of possible double counting of cases under the "last bout" approach. If a child has not had diarrhea since the last questionnaire, the mother will repeat the information she gave in the previous cycle. This introduces a descriptive bias to make the aggregate behavior appear more like the behavior of mothers when "seldom-sick" children become ill. Age and other characteristics of the child are correlated with the probability of becoming ill, so one type of bias may be introduced from over counting of "seldom-sick" children. Additionally, mothers may behave differently, either because of characteristics of the child (they may treat older children differently) or because of specific concerns when a usually hardy child does become sick. For these reasons, we have repeated the previous analysis on the subset of episodes that occurred in the two weeks prior to the interview. This eliminates any potential double-counting and it increases the probability of accurate recall. The results of that analysis, presented below, are very similar to those of the preceding analysis.

Figure 12 and Table 16 compare giving WSS or tea, and going to a health center or local healer for episodes occurring in the last two weeks. Some women chose more than one type of treatment. The control villages' figures match evaluation villages' estimates, suggesting that the mothers were not sensitized to treatment messages by the evaluation team. As more women adopted WSS, fewer went to the health center for diarrhea. WSS use rose steeply during and just after the Happy Baby Lottery, fluctuated around 50 percent during 1983, and rose again in 1984 to a high of 73.8 percent of the bouts treated with WSS.

Health center use showed the opposite trend - - declining to 46.8 percent in April 1984 and a low of 27.3 percent in June-July

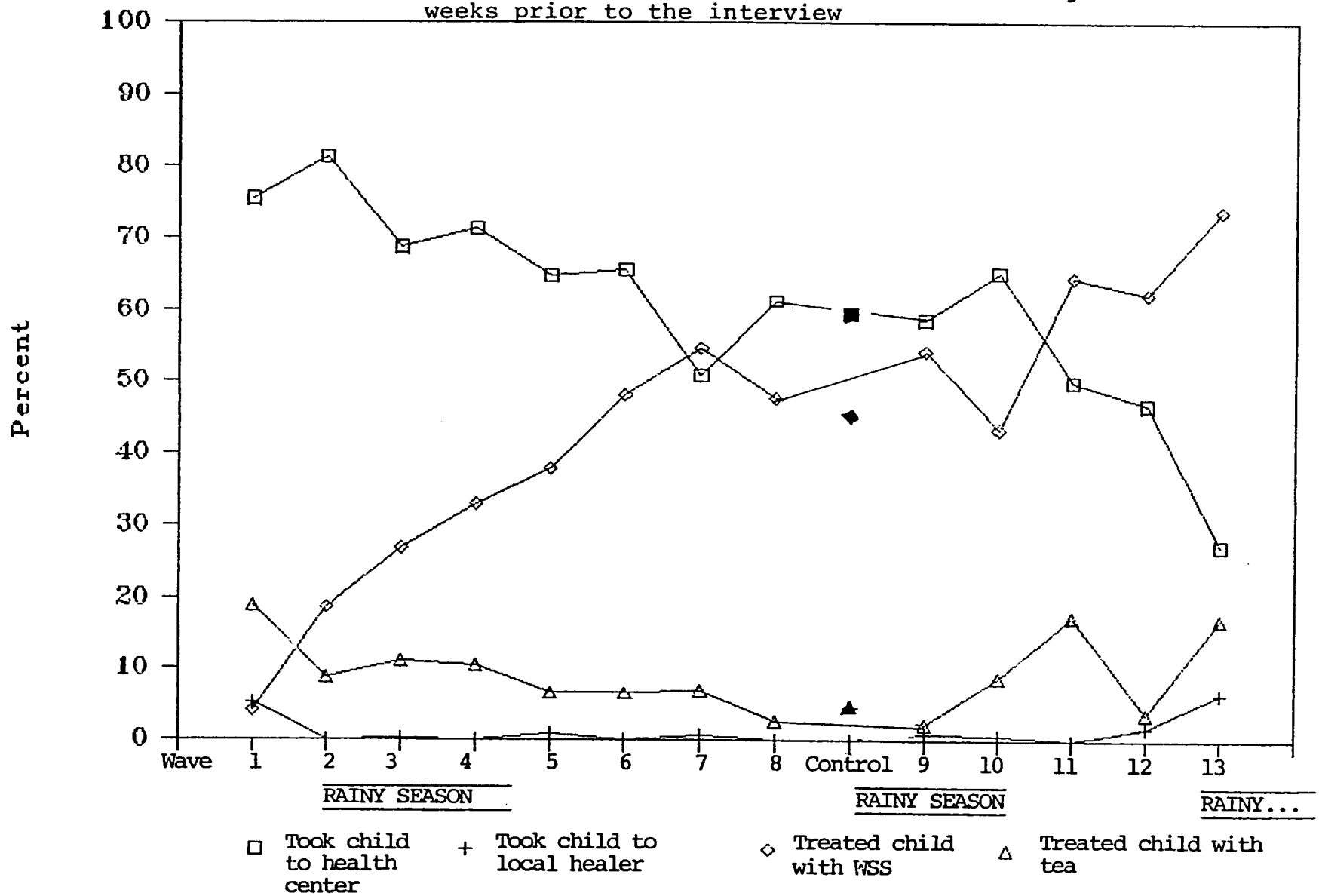
1984. With the swift drop in health center use at the last data collection point came an increased use of tea. The increase in home treatments during the beginning of 1984 may be related to a convergence of external factors: the heavy work season beginning, Ramadan fasting during June which reduced energy levels and free time, and an acute gas shortage which limited taxi/bus availability. It must be remembered that few women lived in a town with its own health center, and during gas shortages most women would be forced to walk with a child on their back for many miles. (On the other hand, when clinics are nearby and time is not in short supply, it can be pleasant to meet other women in line at the clinic.)

2. Associations between WSS use and severity indicators.

To examine whether episode characteristics can help explain whether or not a mother chose to give WSS, we did two regression analyses. The first is for all cases of diarrhea in the two weeks prior to the interview. The second is for cases of diarrhea on the day of the interview, and includes dehydration indicators. The data were pooled across time, including all diarrhea cases after the baseline measure. The baseline was excluded as in the Honduras analysis.

The variables listed in Table 17 were included in the analysis. Dummy variables were created representing the divisions; McCarthy Island Division is the reference. A variable called "urban" was created from the village; the three largest towns were coded as urban, although one should note that differences between urban and rural areas in The Gambia are not as great as in Honduras. Also added to the analyses were season and date of measurement. Finally, the table shows the severity indicators for diarrhea and dehydration in The Gambia. The indicators correspond as much as possible to the analysis in Honduras. One difference between Honduras and The Gambian analysis is that season was included for The Gambia because of

Figure 12: Treatments for children with diarrhea during the two weeks prior to the interview




MORB:CENTRGQ,HEALRGQ,WSSGQ,TEAGQ,PHARMGQ,IF HADDIGQ

Table 16: Treatment for children with diarrhea during two weeks prior to the interview

| Treatment | Morbidity Waves 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Ctrl | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Went to health center | 75.5% | 81.3 | 68.7 | 71.4 | 64.8 | 65.7 | 50.8 | 61.3 | 59.5 | 58.6 | 65.2 | 50.0 | 46.8 | 27.3 |
| Went to local healer | 5.1 | 0 | 0.3 | 0 | 0.9 | 0 | 0.8 | 0 | 0 | 0.9 | 0.7 | 0 | 1.8 | 6.4 |
| Gave WSS | 4.1 | 18.7 | 26.9 | 33.1 | 38.0 | 48.1 | 54.6 | 47.7 | 45.2 | 54.2 | 43.5 | 64.5 | 62.2 | 73.8 |
| Gave tea | 18.9 | 8.7 | 11.1 | 10.5 | 6.5 | 6.5 | 6.9 | 2.7 | 4.8 | 2.2 | 8.7 | 17.4 | 3.6 | 16.9 |
| Gave pharmacy drug | 2.6 | 0.4 | 4.6 | 1.6 | 1.9 | 0 | 0 | 0.9 | 2.4 | 0 | 3.6 | 0.6 | 2.7 | 2.3 |
| n = | 196 | 230 | 323 | 248 | 108 | 108 | 130 | 111 | 42 | 227 | 138 | 172 | 111 | 172 |

MORB:CENTRGQ,HEALRGQ,WSSGQ,TEAGQ,PHARMGQ, IF HADDIGQ

Table 17: Variables used in regressing severity on WSS use

| Variables | Coding | Description |
|---|---|---|
| Division 1* | 1 = Western Division, 0 = Other | Western Division |
| Division 2* | 1 = North Bank, 0 = Other | North Bank Division |
| Division 3* | 1 = Lower River, 0 = Other | Lower River Division |
| Urban | 1 = more urban, 0 = rural | Gunjur, Kerewan, Bansang |
| Season | 1 = rainy, 0 = dry | Rainy/dry |
| Date | continuous, year-month-day | Day of interview |
| Days | continuous, 0 or more | No. of days of diarrhea |
| Blood | 1 = yes, 2 = no | Blood in stools |
| Mucus | 1 = yes, 2 = no | Mucus in stools |
| Fever | 1 = yes, 2 = no | Fever |
| BMNUM | continuous | No.of stools on worst day |
| Vomit | continuous | Instances of vomiting on worst day |
| Ditype | 1=mild, 2=moderate, 3=severe | Mother's impression of severity |
| Mouth** | 1 = normal, 2 = dry | Interviewer observes: mouth |
| Fontanel** | 1 = normal, 2 = sunken | Interviewer observes: fontanel |
| Eyes** | 1 = normal, 2 = sunken | Interviewer observes: eyes |
| Norm** | 1 = normal, 2 = dry | Interviewer observes: dry eyes |
| Amurn** | 1 = normal, 2 = less | Amount of urine |
| Color** | 1 = normal, 2 = very yellow | Color of urine |

* McCarthy Island Division is the reference.

** Measured only if ill on day of interview.

its demonstrated importance in the work of the MRC and our own results. In addition, sample sizes are larger in the Gambian data than in Honduras.

The hypothesis tested was similar to the one tested for in Honduras: the probability of WSS use rises as a function of maternal perception of severity. The analytic plan was also similar to that used for Honduras data.

OLS regressions of symptoms of severity predicting WSS use for cases in the last two weeks are given in Table 18. Only one of the severity indicators, mucus, was statistically significant; its presence was associated with greater WSS use. Other variables which were statistically significant were Division 1, 2 and 3 (lower use in all these areas) and season (higher use in the rainy season). The blocks of variables which proved significant were Division, season, date, and severity.

Stepwise regressions were carried out on the above variables (Table 19). The best predictors were season, mucus and Division 3.

The model was expanded to accept signs noted by the observer (Table 20). Since these apply only to cases with diarrhea on the day of the interview, sample sizes became less (from 1639 in Table 18 to 287 in Table 20). The results indicate that Division is as important as before. This time, date as well as season are important. WSS use is greatest in the rainy season and later dates are negatively related to WSS use. Number of bowel movements (BMNUM) rather than mucus is significant and dryness of the eyes (EYES) is also significant. In terms of blocks of variables, only season and date are significant.

It is odd that date relates negatively with WSS use in treating cases; therefore we have repeated the analysis including only the time period after the lottery, Waves 7 to 13, and excluding measurement waves 1-6 taken in 1982. As Table 21 shows, more mucus, fewer number of bowel movements, and mother's judgement of increased severity are all significantly related to more WSS use.

Table 18: OLS Regressions of symptoms of severity predicting WSS use for cases in the last 2 weeks, waves 2-13 pooled.

| Variable | Zero-order correlation | beta* | t* | F values for blocks of variables |
|---|---|---|---|---|
| Division 1 | -.007 | -.077 | -2.61[b] | |
| Division 2 | .001 | .099 | -2.61[b] | 4.21[b] |
| Division 3 | -.103 | -.134 | -3.37[b] | |
| Urban | .008 | | | 0.32 |
| Season | .271 | .253 | 9.93[c] | |
| Date | -.123 | -.031 | -1.19 | 56.05[c] |
| Days | .031 | | | |
| Blood | -.031 | | | |
| Mucus | .090 | .072 | 2.44[a] | |
| Fever | -.054 | -.038 | -1.37 | 2.43[a] |
| BMnum | .021 | -.032 | -1.19 | |
| Vomit | .037 | .031 | 1.26 | |
| Weight lost | .076 | .033 | 1.35 | |
| Ditype | .045 | .028 | 1.06 | 1.12 |

Multiple R .314

$R^2$ .098

N = 1639 cases

Note: a) $p \leq .05$ b) $p \leq .01$ c) $p \leq .001$
*beta and t values provided if $t > 1.0$ or $t < -1.0$

Table 19: OLS stepwise regressions of symptoms of severity predicting WSS use for cases in the last two weeks, waves 2-13 pooled.

| Variable | beta | t | p |
|---|---|---|---|
| Season | .273 | 11.51 | .000 |
| Mucus | .085 | 3.31 | .001 |
| D3 | -.058 | -2.27 | .023 |

Multiple R .296

$R^2$ .088

N = 1639 cases

Table 20: OLS Regressions of symptoms of severity predicting WSS use for cases on the day of interview, waves 2-13 pooled

| Variable | Zero-order correlation | beta* | t* | F values for blocks of variables |
|---|---|---|---|---|
| Division 1 | -.032 | -.181 | -1.96[a] | |
| Division 2 | .090 | -.122 | -1.58 | 1.76 |
| Division 3 | -.182 | -.228 | -1.89[a] | |
| Urban | .036 | | | 0.05 |
| Season | .205 | .165 | 2.59[b] | 11.06[b] |
| Date | -.305 | -.186 | -2.76[b] | |
| Days | .109 | | | |
| Blood | -.080 | | | |
| Mucus | .109 | .103 | 1.32 | |
| Fever | -.012 | | | 1.11 |
| BMnum | -.018 | -.144 | -2.08[a] | |
| Vomit | .003 | | | |
| Weight Lost | -.051 | -.079 | -1.34 | |
| Ditype | .057 | -.078 | - .98 | 0.97 |
| Mouth | .115 | | | |
| Fontanel | .113 | | | |
| Eyes | .186 | .222 | 2.07[a] | 0.75 |
| Norm | .048 | | | |
| Amurn | .004 | | | |
| Color | .091 | | | |

Multiple R .425
$R^2$ .180
N = 287 cases

Note: a) $p \leq .05$ b) $p \leq .01$

*beta and t values provided if $t > 1.0$ or $t < -1.0$

Table 21: OLS regressions of symptoms of severity predicting WSS use for cases in the last two weeks, waves 7-13 pooled (1983-1984)

| Variable | Zero-order correlation | beta* | t* | F values for blocks of variables |
|---|---|---|---|---|
| Division 1 | .062 | .128 | 2.79[b] | |
| Division 2 | .095 | .209 | 3.53[c] | 4.85[b] |
| Division 3 | -.111 | .118 | 1.97[a] | |
| Urban | .071 | .042 | 1.26 | 1.60 |
| Season | .245 | .216 | 6.46[c] | 51.64[c] |
| Date | .191 | .229 | 6.67[c] | |
| Days | -.029 | | | |
| Blood | -.006 | | | |
| Mucus | .094 | .111 | 3.05[b] | |
| Fever | -.068 | -.041 | -1.21 | 3.44[b] |
| BMnum | -.028 | -.088 | -2.51[a] | |
| Vomit | .024 | | | |
| Weight lost | .043 | | | |
| Ditype | .111 | .073 | 2.15[a] | 4.63[a] |

Multiple R .374

$R^2$ .140

N = 891 cases

a) $p \leq .05$ ; b) $p \leq .01$ ; c) $p \leq .001$
Note: beta* and t values provided if $t > 1.0$ or $t < -1.0$

Date is now positively related to WSS use, meaning that in the last year and several months of the campaign, use continued to rise over time. We may thus deduce that in the first six months of the campaign, there was an early burst of WSS use, probably because of the rains and the lottery promotion at the end of the rains, which caused the slight negative correlation between the date and use for the two years of the campaign as a whole. The dummy variables for the divisions are also positively related to WSS use, whereas they were negative before. Season continues to be the strongest covariate with use.

In terms of blocks of variables, division, season and date, severity indications, and mother's subjective estimate of severity were all significant (Table 22).

When a stepwise regression was performed for cases of diarrhea in 1983-84 on the day of the interview, dry eyes was the only variable entered (beta=.256, t=2.85, significant at alpha=.01 level, R squared=.065, n=118). Unlike the results for Waves 2-13 together (Table 23), date was not significant. However, the number of cases in this subgroup is very low, which makes it difficult to achieve significance. For that reason, no other analyses were performed with the subgroup.

Overall, the relationship between severity indicators and use of WSS for a diarrheal bout was not as clear as that seen in Honduras. Few of the indicators of severity were significantly associated with WSS use. However, it appears that, as WSS use moved towards becoming more of a routine behavior in the latter part of the campaign, women were linking severity to WSS use much more. Rainy season use was more prevalent than dry season use, despite greater risk of dehydration in the dry season. Dry eyes and mucus in the stools were the most significant indicators of diarrhea and dehydration severity linked to more WSS use.

Table 22: OLS stepwise regressions of symptoms of severity predicting WSS use for cases in the last two weeks, waves 7-13 pooled (1983-1984)

| Variable | beta | t | p |
|---|---|---|---|
| Season | .211 | 6.55 | .000 |
| Date | .221 | 6.56 | .000 |
| Mucus | .105 | 3.06 | .002 |
| D2 | .133 | 3.68 | .000 |
| Ditype | .074 | 2.26 | .024 |
| BMnum | -.097 | -2.90 | .004 |
| D1 | .085 | 2.43 | .016 |

Multiple R .364

$R^2$ .133

N = 891 cases

Table 23: OLS stepwise regressions of symptoms of severity predicting WSS use for cases on the day of the interview, waves 2-13 pooled.

| Variable | beta | t | p |
|---|---|---|---|
| Date | -.291 | -5.21 | .000 |
| Eyes | .162 | 2.89 | .003 |
| Constant | | 15.26 | .000 |

Multiple R .345

$R^2$ .119

N = 287

## C. Child Mortality and Mother's Pregnancy History

### 1. Community mortality

Past research has shown that oral rehydration is an effective treatment in reducing mortality due to dehydrating diarrheas, but only of limited use in the treatment of chronic or dysenteric diarrheas (Feachem, 1983). Much of the diarrhea in The Gambia occurs during the rainy season, and seems to be caused by bacteria. MRC research describes this rainy season diarrhea as chronic, caused by water-borne vectors, and not leading to severe dehydration. Thus, we can only expect limited reduction in diarrhea-related mortality rates during the rainy season due to campaign interventions. Dry-season diarrhea is different, however, for it is of the dehydrating variety, such that one could expect an impact on mortality rates through the use of ORT. However, this type of diarrhea is less common in The Gambia.

Still, the evaluation team attempted to measure changes in mortality by monitoring all child deaths in our 20 sample villages during the two years of study. On four separate occasions, fieldworkers attempted to collect community-wide mortality data for the prior six months by interviewing sample mothers, village officials, traditional birth attendants, and village health workers. Upon discovering a death, a follow-up interview was done with the mother of the deceased, to record cause and date of death, age, and treatments sought for the child before death.

Unfortunately, we found that Gambian mothers were unwilling to discuss their children's deaths with outside researchers, even though our fieldworkers were Gambian women who were currently living in one of the sample villages. Our figures under-identified child deaths in these communities by an estimated factor of four. According to Gambian officials of the Primary Health Care

system, even Village Health Workers, who are from the village they work in, can identify only one-third of child deaths. We thought we might get better data from the four villages where our Gambian fieldworkers resided, but our experience was as unsuccessful as that of the Village Health Workers. In addition, mothers' attributions of cause of death were unreliable. Many mothers in our surveys identified spiritual agents such as God, Satan or witches as the cause of death; for those children, we cannot tell whether diarrhea was in evidence or not before the child died. Thus, we learned that we could not rely on mothers' recall to adequately record child deaths community-wide in sample villages over two years. To get a better record, we would have needed other data collection techniques and a much larger sample. Because our figures are too unreliable, they will not be presented.

Using MRC estimates of child mortality in The Gambia, we would have needed to closely monitor about 20,000 children under five years old to find 100 deaths attributable to dehydrating diarrhea. The figures estimating this are as follows: of each 1000 children under five, 250 will die before their fifth birthday, or 50 will die each year. Of these 50, 20 will die from diarrheal diseases; and of these 20, 15 will die from chronic rainy season diarrhea-malnutrition-infection and five will die from acute dehydrating diarrhea. So, to identify and diagnose five dehydrating diarrhea deaths, a sample of 1000 is needed. To find 100 dehydration deaths, we would have needed enough resources to monitor 20,000 children under five.

Thus, by monitoring child deaths in The Gambia in 20 sample villages, it was not possible to look for an impact on child mortality attributable to the campaign. We did not have adequate resources to increase the sample size to the point where we might have found enough deaths due to diarrhea of any type. In addition, because deaths from dehydrating diarrhea represent a small proportion of diarrheal deaths in The Gambia, it would have been even more costly to detect campaign effects on mortality

from dehydrating diarrhea. Furthermore, Gambian women are reluctant to discuss child deaths, leading to gross underestimates of community-wide child mortality rates and unreliable data on causes of death when one relies on mothers' reports.

## 2. Pregnancy history

In another instrument, the pregnancy history questionnaire, we collected enough information to give an estimate of the infant mortality rate and pregnancy outcomes in rural Gambia. Because this information was collected only once, we cannot use it to look for campaign effects on infant mortality. However, it provides a useful description of the high number of pregnancies Gambian women experience and the high death rate of their children.

In August and September 1982, the evaluation team conducted interviews with women in the sample to learn the outcomes of each of their pregnancies. Specifically, the question asked whether the pregnancy had ended in a miscarriage, a stillbirth, a child who was born alive but had since died, or whether the child was born alive and was still alive.

In this sample of 834 women, there were 3681 reported pregnancies, an average of 4.7 per woman (see Table 24). Only 53 women, or 6.4 percent of the sample, had never been pregnant. Seventy percent of the remembered pregnancies ended in the birth of a child who was still living, while 6.2 percent of the pregnancies did not result in a live birth. There were 875 children (23.8%) who had been born alive, but had since died.

Table 25 and Figure 13 show the causes of death mentioned by the mother. The most frequently mentioned causes were fever, kris, or jarala, in the mother's terminology. The actual medical diagnoses for these diseases are probably malaria, cerebral malaria, or meningitis. Diarrhea, with 23.2 percent, ranked as the second most common cause of death among children. Trad-

Table 24: Pregnancy outcomes among women in the sample

| Outcome | Percentage of Pregnancies |
|---|---|
| Child still alive | 70.0% |
| Child born alive, but now is dead | 23.8 |
| Child born dead | 4.2 |
| Miscarriage | 2.0 |
| Total number of pregnancies | 3681 |
| Total number of women | 834 |
| Number of women with at least one pregnancy | 771 |

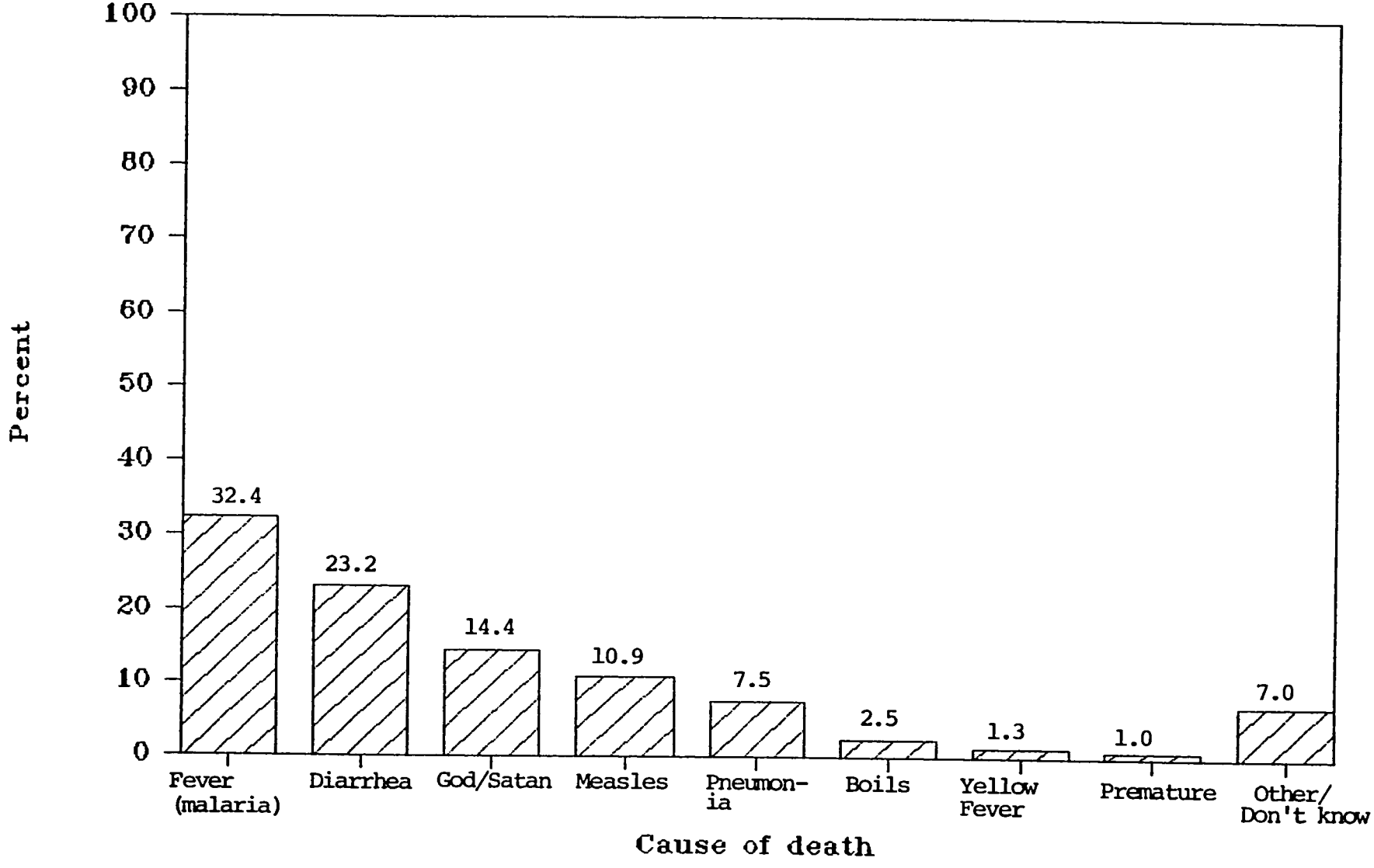
GPREG:Aug/Sept 1982

Table 25: Cause of death of children who had been born alive by women in sample

| Cause | Percentage |
|---|---|
| Fever/kris/jarala (malaria) | 32.4% |
| Diarrhea | 23.2 |
| God/Satan/witches | 14.4 |
| Measles | 10.9 |
| Pneumonia | 7.5 |
| Boils | 2.5 |
| Yellow fever | 1.3 |
| Premature | 1.0 |
| Other/don't know | 7.0 |

GPREG:Aug/Sept 1982
N=875

Figure 13: Cause of death of children who had been born alive to women in sample




n=875
GPREG,8&9/82

itional causes, such as Satan, God or witches accounted for another 14 percent of the responses by the mothers.

Thus, three-quarters of the children born alive were still alive. Among women who had begun childbearing, they had an average of 4.7 pregnancies and 4.5 children born alive. Women attributed nearly one quarter of their children's deaths to diarrhea, so we may conclude that they recognize the danger of diarrheal diseases.

These birth and death rates reflect a bias in the age distribution of sample women, and therefore cannot be taken as true estimates of parity or mortality. Younger women will have lower pregnancy rates, and their infants would not have been exposed to pathogens for as long as older children. In addition, these data suffer from recall problems such as those discussed in the previous section, and probably reflect an under-reporting of child deaths. However, we have higher confidence in sample women's abilities to recall pregnancies and willingness to discuss them than in non-sample women's willingness to discuss their children's deaths directly. Since child-bearing is a very important event in a young woman's life, pregnancy recall by young women should be high. Among older women, however, early pregnancies, particularly unsuccessful ones, may be readily forgotten. Our data, then, is probably more reliable for younger women, and under-estimates overall rates. Therefore, to compute infant mortality rates, we chose a procedure which takes the mother's age into account.

## 3. Estimating infant mortality from pregnancy histories

Table 26 shows the number of children surviving for women in different age ranges. It includes all women who knew their age, at least roughly, and had had at least one child as recorded in the pregnancy history questionnaire (the few women over 49 were excluded because there were not enough in each age category).

Applying a technique developed by Griffith Feeney (1976) we have computed child mortality rates by mother's age. His method allows for changing mortality rates over time, using pregnancy history information. The model assumes (1) a declining mortality rate over time, (2) no differential mortality by the age of the mother, and (3) a known lifetable. The model and necessary tables are in Appendix 1.

Table 27 shows the results of each step of computations. The mean number of children born to women age 15-19 is 1.5, indicating that women begin motherhood relatively young. In the oldest category shown, women aged 45 to 49, the mean number of children born is 6.3, which is probably an underestimate. The proportion of deceased children for each group is computed by subtracting the number of children surviving from the number born, and dividing by the number born. We obtained estimates between 0.239 and 0.371. The mean age of the mother at childbirth is computed from the differences between the mean number of children born in two adjacent categories. The difference between the first two groups is 0.517. This value corresponds to +2 in reference table number 1 in the Appendix, so we added 2 to the mean age of the groups, 20, and ended up with a mean childbearing age of 22. Applying the same technique to age groups 20 to 24 and 25 to 29 yields 25 minus 4, or 21. Further estimates fall out of range of the table, and are not needed. The overall mean, then, is 21.5 years at childbirth.

The infant mortality rate and number of years prior to census were computed from the formulas in Table 2 of the Appendix. The plotted estimates, shown in Figure 14, do not follow the assumption of a declining mortality rate. The lower rates prior to 1969 may be more a product of poor memories than lower mortality; so by ignoring the two earliest measures, a slight decline is observable between 1969 and 1974, but the rates went up again in 1977. The average rate was 153.7 deaths per 1000 children born for 12.1 years prior to 1982, or 1970. This figure is less than MRC estimates. The difference in infant mortality

Table 26: Child survivorship by age of mother

| Age group | No. of women | Number of children Born | Surviving |
|---|---|---|---|
| 15-19 | 92 | 140 | 88 |
| 20-24 | 128 | 377 | 279 |
| 25-29 | 217 | 871 | 663 |
| 30-34 | 134 | 693 | 503 |
| 35-39 | 92 | 516 | 357 |
| 40-44 | 68 | 360 | 258 |
| 45-49 | 18 | 114 | 73 |
| | 749 | 3071 | 2221 |

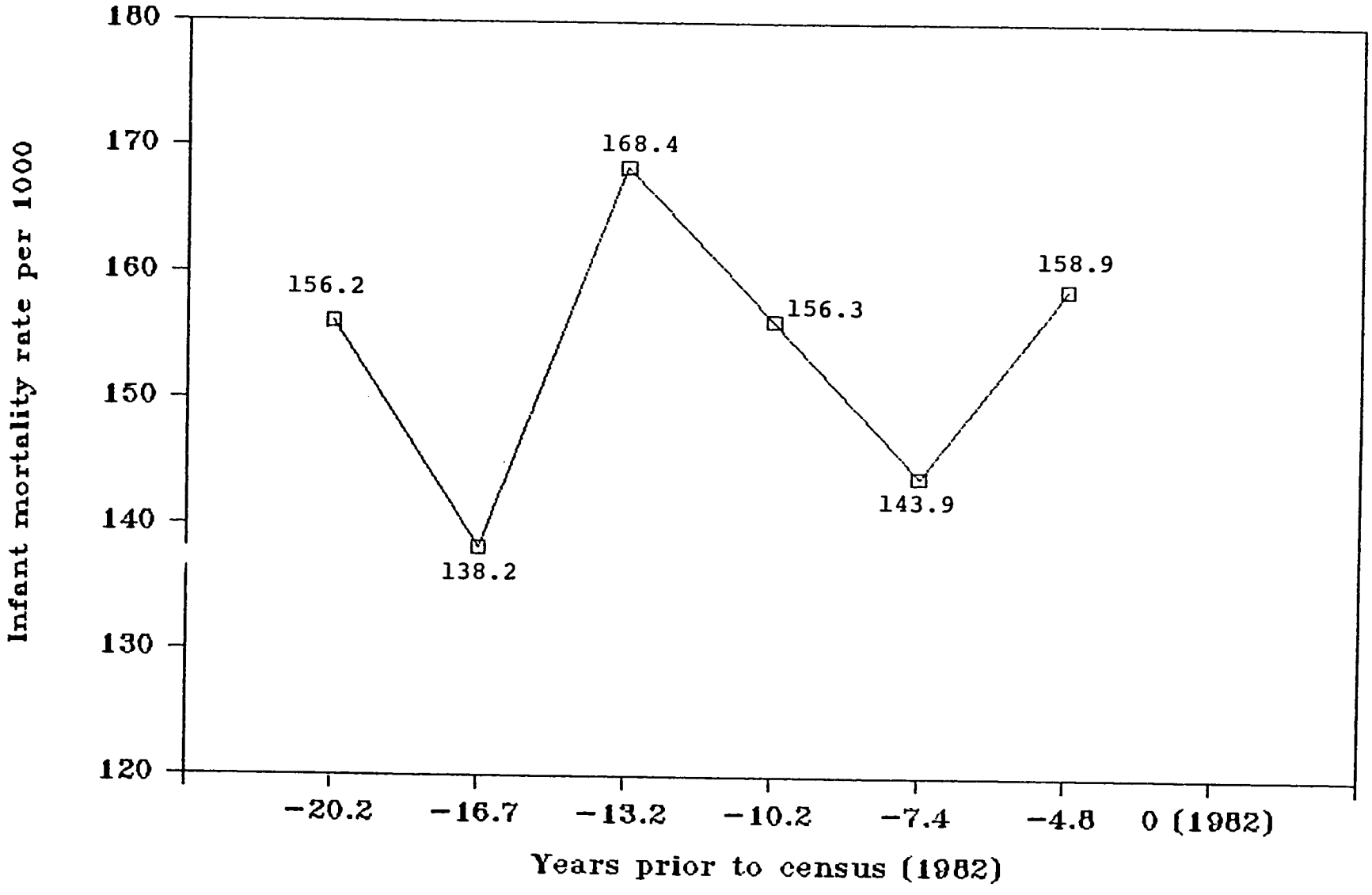
Note: Number surviving includes all children still alive at time of data collection, not just children surviving beyond a given age.
GPREG,GENUM.Aug/Sept 1982

Table 27: Estimation of child mortality rates from child survivorship data by age of mother

| Mother's age group | Mean Number of children born | Mean Age at child-bearing | Proportion of deceased children | Infant mortality rate | Years prior to census |
|---|---|---|---|---|---|
| 15-19 | 1.522 | 22 | .371 | - | - |
| 20-24 | 2.945 | 21 | .260 | 158.9 | 4.8 |
| 25-29 | 4.014 | - | .239 | 143.9 | 7.4 |
| 30-34 | 5.172 | - | .274 | 156.3 | 10.2 |
| 35-39 | 5.609 | - | .308 | 168.4 | 13.2 |
| 40-44 | 5.294 | - | .283 | 138.2 | 16.7 |
| 45-49 | 6.333 | - | .360 | 156.2 | 20.2 |
| Population mean = | | 21.5 | | 153.7 | 12.1 |

GPREG:Aug/Sept 1982, using Feeney (1976)

Figure 14: Estimated infant mortality rates




Computed from GPREG,August/September 1982, using Feeney (1976)

rates may be due to sample composition, our sample containing a wider range of villages and therefore presumably making our sample more accurate. Alternatively, to the extent that women under-report dead children, our estimates are less reliable. In any case, our estimates, ranging between 143 and 168 in recent years, confirm that infant mortality in rural Gambia is very high compared to other nations in the world. These figures are similar to infant mortality estimates in other poor sub-Saharan African nations (World Bank, 1982).

## 4. Summary

In general, we found it was impossible to collect community mortality data from our sample villages with accuracy. Even if we had been successful, the rate of dehydrating diarrhea is too low in The Gambia for us to have been able to attribute any changes in mortality patterns to the campaign. However, by applying a technique using pregnancy history data, we were able to estimate the infant mortality rate between 1969 and 1982 as ranging from 143 to 168 deaths per 1000 children born. Although these estimates might reflect an under-reporting of deaths, they still rank among the worst national estimates in Africa. The mean number of children born to older women was 6.3, and again, the true figure is probably larger. Thus, our conservative estimates still depict very high numbers of children born to rural Gambian women, and correspondingly high risk of infant mortality for those children. In 1982, mothers attributed nearly one-quarter of all child deaths to diarrhea, thus indicating that diarrheal deaths were recognizable and salient to sample mothers as the campaign got underway.

# Chapter IV

## Summary and Conclusions

As we have argued in the text, ORT, by itself, should not be expected to reduce the prevalence of diarrheal diseases for the simple reason that it does not interrupt the transmission of pathogens. We have pointed out however that though ORT was the central focus, the Gambia and Honduras interventions also included messages about preventive behaviors and appropriate infant feeding practices, including breastfeeding. Compliance with the messages to a high degree would disrupt the transmission of disease. Though achievements were significant, it is doubtful that these would reduce the prevalence of diarrheal diseases in the absence of water and sanitation projects.

The Gambia and Honduras interventions would, on the other hand, be expected to reduce the severity of diarrheal disease and to decrease mortality due to diarrhea. Several mechanisms would be involved. By rehydrating the child and replacing his electrolytes, the appetite might return sooner and the course and duration of the episode might be altered for the better. Deaths may be avoided and earlier recuperation achieved from non-lethal episodes. ORT usage in a population might lead to improved nutritional status. This would not affect disease incidence because well-nourished children, once socio-environmental factors are taken into account, are just as likely to be infected as moderately malnourished children. Better nutritional status would however lead to reduced severity as suggested by the literature.

There is no question that the interventions in both countries were remarkably successful in achieving high rates of usage of ORT. In the final reports we have also shown that most mothers knew how to use the solutions properly. Infant feeding practices were also improved. The project in effect revolutionized the management of episodes of diarrhea.

The measurement of morbidity was more extensive in The Gambia (13 waves) than in Honduras (5 waves). Trends over time suggested no change in prevalence in Honduras over the first three waves where comparability of estimates was assured (see Chapter II for reasons for lack of comparability for waves 3 and 4). Also, the five waves of data in Honduras did not reveal changes in severity indicators over time. The more extensive coverage of morbidity in The Gambia, while indicating higher diarrhea prevalence of the rainy season, showed no clear change in the prevalence of diarrhea over the two years of study. Greater severity of bouts was demonstrated in the dry season and a steady decline in severity indicators was evident over the two years of study. Though MRC data has previously predicted higher severity in the dry season, it is also possible that more severity was reported as a result of the intensification of the campaign during the dry season regarding the dangers of dehydration. In other words, the explanation for greater severity in the dry season could be epidemiological factors as well as greater awareness and increased reporting because of the intensified campaign. We are inclined to believe that the important factor was the seasonal effect per se because of the consistency of the seasonal effects across variables and the striking similarity to MRC data.

A major analytical advance was the merging of the morbidity files to explore whether the characteristics of episodes, particularly severity indicators, predicted the use of ORT by mothers. Future analyses will expand this model to include characteristics of the child, mother and household and indicators of exposure and learning from the campaign. The analyses presented showed strong confirmation in the Honduras data of the hypothesis that mothers are more likely to use ORT if the case is perceived to be severe. There was only weak support for this hypothesis in The Gambia. Few of the severity indicators were significantly related to WSS use.

Were the declines in severity in The Gambia caused by the

WSS intervention? MRC data report that epidemiological data vary from year to year presumably on account of epidemiological factors such as type and virulence of pathogens. Thus, we can not attribute the changes observed in The Gambia to the campaign with certainty.

We were unable to document whether the intervention affected mortality in The Gambia. However, we did show, in Honduras, using county registry data, that the mortality due to diarrhea declined significantly after the intervention began. The best explanation for these changes is the ORT project.

Thus, we have evidence of remarkable achievements in the use of ORT in the two countries under study. No changes in morbidity were observed in Honduras but notable declines were evident in The Gambia. Mortality was assessed only in Honduras and the results indicate notable reductions in the mortality due to diarrhea.

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# APPENDICES

## APPENDIX 1

### Estimation of Child Mortality Rates

The procedure by Griffith Feeney (1976), assumes (1) the mortality rate is declining, (2) there is no differential mortality by the age of the mother, and (3) the lifetable is a known, one parameter model family. The formula is:

$$Q = 1- , C \quad P (w,r)$$

where Q is the proportion of deceased children born to women in the age group; C is the proportion of a group of children born in the jth year prior to the census, P (w,r) is the proportion of children born during the jth year prior to census who would survive, w is the infant mortality rate at time of census, and r is the constant rate of decline in the years prior to the census. Since C can be estimated from the mean child-bearing age (M), the formula may be written:

$$Q = 1 - \quad , C \quad (M) \quad p \quad (w,r)$$

Tables 1 and 2 provide the necessary information to compute the mean age at childbearing infant mortality, and the years prior to census.

Table 1: Estimation of the mean age at childbearing from mean parity ratios for successive five-year age groups

| 1000 x Mean parity for women aged x-5 to x / Mean parity for women aged x to x+5 | Displacement of mean age at child-bearing from x |
|---|---|
| 063-110 | +10 |
| 111-167 | + 9 |
| 168-230 | + 8 |
| 231-293 | + 7 |
| 294-353 | + 6 |
| 354-409 | + 5 |
| 410-461 | + 4 |
| 462-508 | + 3 |
| 509-562 | + 2 |
| 563-593 | + 1 |
| 594-630 | 0 |
| 631-665 | - 1 |
| 666-697 | - 2 |
| 698-728 | - 3 |

Table 2 Estimation of infant mortality rates from proportions of deceased children among children born to women in five-year age groups, given the mean age at child-bearing

| Age group | Infant mortality rate | Years prior to census |
|---|---|---|
| 20-24 | (-44.7+30.5M)Q - 2.6 | 11.8 -0.325M-0.17Q |
| 25-39 | (294+14.9M)Q - 2.9 | 16.5 -0.424M+0.16Q |
| 30-34 | (357+10.4M)Q - 2.8 | 20.6 -0.494M+0.77Q |
| 35-39 | (362+ 9.77M)Q -7.8 | 24.9 -0.556M+0.80Q |
| 40-44 | (282+11.0M)Q - 8.5 | 30.1 -0.633M+0.87Q |
| 45-49 | (216+11.1M)Q - 7.5 | 33.4 -0.641M+1.590 |

Note: the proportion of deceased children is representated by Q, the mean age of childbearing by M.
Note: Tables are adapted from Griffith Feeney (1976) "Estimating Infant Mortality Rates from Child Survivorship Data by Age of Mother," Asian and Pacific Census Newsletter, Vol. 3(2), November, 1976.