

DECLINING IMPACT OF ORAL REHYDRATION THERAPY IN A PAPUA NEW GUINEA HIGHLANDS PROVINCE : A CASE STUDY WITH IMPLICATIONS FOR PAPUA NEW GUINEA'S NATIONAL DIARRHEAL DISEASE CONTROL PROGRAM

S Rogers¹, M Mauludu² and W Alto^{2,3}

¹Papua New Guinea Institute of Medical Research, Tari, Southern Highlands Province; ²Division of Health, Department of Southern Highlands Province, Mendi, Southern Highlands Province, PNG; ³Family Practice Residency Programme, 2333 North Sixth Street, Grand Junction, Colorado 81501, USA.

Abstract. A provincial diarrheal disease control program that was based on the delivery of oral rehydration solution (ORS) from health facilities now places greater emphasis on the management of diarrhea with fluids at home. The change in strategy has been associated with decreasing utilization of health facilities and increasing mortality from diarrheal disease. The declining impact is attributed to the promotion of home-based management with little preparation of the target population for their therapeutic role. National policy recommends home-based management for mild cases of diarrhea and ORS for more severe cases. Our observations in the Southern Highlands Province have important implications for the diarrheal disease control program in Papua New Guinea.

INTRODUCTION

While diarrheal disease is a less serious problem in Papua New Guinea than in the developing countries of Africa and Asia, the condition remains a significant cause of morbidity and mortality, especially in children. Diarrheal disease accounts for up to 22% of admissions in under fives and ranks as the second most important cause of death in the same age group (Papua New Guinea Department of Health, 1986).

In late 1979 the Southern Highlands Province of Papua New Guinea became the first province in the country to institute an oral rehydration program for the management of diarrheal disease. Health workers at all levels were taught how to manage diarrhea under the new regime and a health education campaign was launched to inform the public of oral rehydration therapy. The program was based on the delivery of Oralyte solution from health facilities and its use was encouraged both for the prevention and for the treatment of diarrheal dehydration, with mothers providing supplementary fluids at home. A previous evaluation of the intervention demonstrated a striking effect on mortality from diarrheal disease by

1981-82, but doubts were raised whether the impact of the program would be maintained. Growing disillusionment with therapy was predicted, stemming from a failure of ORS to arrest symptoms and from perceived difficulties in its administration (Frankel and Lehmann, 1984).

This paper reviews information covering a further five years of oral rehydration therapy in the Southern Highlands Province. Earlier predictions are examined in retrospect, subsequent changes in strategy are rationalized and problems with program delivery are discussed and related to the situation in Papua New Guinea generally. Our review forms a basis for securing improvements in the provincial program and for consolidation of program planning at national level. As a case study our work reinforces the need for evaluation and process audit in disease control activities and illustrates ways in which routine health-service data can be effectively exploited for monitoring disease.

MATERIALS AND METHODS

Setting

The Southern Highlands Province is situated

Current address : S Rogers, Maternal and Child Epidemiology Unit, Department of Epidemiology and Population Sciences, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK.

at the broader southwestern section of the highlands of Papua New Guinea and is characterized topographically by a series of rugged ranges, valleys and volcanic plains. The vast majority of the population of 300,000 depends upon subsistence farming for their livelihood, with only limited income generated from coffee trees or wage labor. About 20 ethnolinguistic groups are represented, the largest by far being the Huli who occupy the Tari area in the west of the province.

The health infrastructure is well developed. Aid posts are the basic tier of rural health services in Papua New Guinea. Each is staffed by an orderly trained to administer simple treatments to a population of about 1,500 individuals. Health centers are responsible for the supervision and support of maternal and child health clinics, sub-centers and aid posts within a catchment area of about 15,000 people and include inpatient facilities. Hospitals fulfil the same functions in their own localities, but in addition accept difficult cases referred from health centers.

Study design

Trends in utilization of health care were investigated using data collected routinely on behalf of the Division of Health. Aid post attendance data were abstracted from available aid post daily rolls covering given months at preselected aid posts situated in the Mendi Valley, the Tari Basin and the Nembi Valley of the Southern Highlands Province. Discharge data for the principal inpatient facility in each area (Mendi provincial hospital, Tari district hospital and Det health center) were recovered from relevant discharge books or computer files.

Mortality data generated from the population database held at Tari Research Unit provided our principal measure of program impact. Tari Research Unit is a section of the Papua New Guinea Institute of Medical Research that maintains a vital registration system based on monthly surveillance of 30,000 persons from the Tari Basin. When a death occurs the history of illness is obtained from relatives of the decedent and from existing health service records.

Official EPINT (communicable disease surveillance) publications and a limited series of diarrhea notifications and death certificates held at the provincial health office were also examined.

These data originate from any one of the 40 hospitals, health centers and health subcenters in the province.

Except for aid post attendances where attendees are classed as "children" (includes children and adolescents) or "adults", epidemiological parameters were based on the health experiences of children under five. Cases of diarrhea by definition included only those patients in whom diarrhea was the principal complaint. Trends were examined and summary statistics were generated for periods corresponding to three phases of diarrheal disease control in the province, namely 1978-80, 1981-83 and 1984-87.

Changes in epidemiological parameters were interpreted in the context of information retrieved from earlier Division of Health and Tari Research Unit documents and from new information collected in the course of the current study. These data included (1) evaluations of the knowledge and practice of primary health care workers based on formal tests of up to 100 aid post orderlies attending inservice training in 1980 or 1988, complemented by systematic observations of a small number of aid post orderlies at work at Tari in 1983 and again in 1988, (2) supplies and equipment surveys by questionnaire involving 100-124 aid post orderlies in 1980, 1982 and 1988 and (3) a community-based inquiry into the experiences and opinions of 84 child carers interviewed at Tari in 1988.

Information on the knowledge of aid post orderlies was abstracted from test papers written in answer to a question "What must you do when a patient with diarrhea comes to the aid post or outpatient department to get treatment?" and the percentages of examinees showing awareness of relevant details were tallied. Qualitative impressions of aid post orderly field performance were included to corroborate or refute these data. The enquiry amongst child carers used an evolving structured interview technique and data presented were abstracted from study notes. Like data on the knowledge of aid post orderlies, interview data were based on answers to open-ended questions.

RESULTS

Changing trends

Aid post attendances for diarrheal disease were

high during the period 1981-83 at aid posts in two of the three areas studied; in the Tari Basin 8.3% of attendances in children and adolescents were for diarrheal disease, and in the Nembi Valley 10.6% were for diarrheal disease during 1981-83 (Table 1). In the Mendi Valley 7.5% of aid post attendances in children and adolescents were for diarrheal disease in 1982, but this high attendance year was preceded by a year with unusually low attendance rates for diarrheal disease and the 1981-83 period rates were similar to those for the preceding period. In 1984-87 aid post attendances for diarrheal disease fell in all areas (Table 1). By 1987 only 3.1% of attendances in the Mendi Valley were for diarrheal disease, 2.5% in the Nembi Valley and 2.2% at Tari.

At the two hospitals in the series there were fewer discharges for diarrheal disease in 1981-83 than in 1978-80 and these decreased further during 1984-87. At Mendi hospital 15.8% of discharges and deaths in under fives were for diarrheal disease in 1981-83 and at Tari hospital 17.0%. In 1984-87 the corresponding figures were 11.7% and 15.0% (Table 2). The period figures disguise more subtle patterns in discharges for diarrheal disease over time; at the three centers studied discharges for diarrheal disease fell for a year or more within the 1981-83 period, then were relatively high in

1984 and 1985 and have tended to fall since. At both Mendi and Tari hospitals diarrheal disease accounted for less than 10% of discharges for under fives in 1987. At Det health center 15.9% of discharges were for diarrheal disease in 1987.

1051 deaths in children under five were recorded on the Tari Research Unit database between 1978 and 1987 corresponding to an under one mortality of 75 per thousand per year and a 1-4 year mortality of 14 per thousand per year. There were considerable fluctuations in diarrheal death rates during the period, these falling from 2.7 per thousand per year in 1978-80 to 1.2 per thousand per year in 1981-83, then increasing annually to at least pre-program levels. Statistics on utilization of health services by decedents accompany mortality data in Table 3.

Health services research

Our studies of aid post orderly performance suggested that clinical assessment of patients was inadequate for determining the severity of diarrheal disease. Oral rehydration solution was widely recognized by aid post orderlies as a good treatment for diarrheal disease (Table 4) but prescribing patterns were determined less by the presence of dehydration than by the presence of supplies. Some aid post orderlies made up ORS incorrectly (Table 5). Few

Table 1

Percentage of aid post attendances for diarrheal disease among selected aid posts in three areas of the Southern Highlands Province, 1978-1987. Children and adolescents.

	Mendi Valley	Tari Basin	Nembi Valley
1978-80	6.0	7.8	8.5
Total attendances	463 (4)	1497 (?)*	960 (9)
1981-83	5.7	8.3	10.6
Total attendances	1872 (9)	1777 (9)	1728 (16)
1984-87	4.8	2.2	5.8
Total attendances	2437 (15)	1120 (8)	1146 (13)

1981-1983 vs 1984-1987, Tari Basin, $\chi^2 = 45.5$, $df = 1$, $p < 0.001$

1981-1983 vs 1984-1987, Nembi Valley, $\chi^2 = 19.7$, $df = 1$, $p < 0.001$

Note: data are incomplete for some years; Tari figures are based on 1979, 1983, 1987.

() total number of aidpost-months assessed to obtain attendances

* from Frankel (1980)

Table 2

Percentage of discharges for diarrheal disease at selected secondary care facilities in the Southern Highlands Province, 1978-1987. Children under five years.

	Mendi PH	Tari DH	Det HC
1978-80	18.5	22.0	14.7
Total discharges	4443	3529	3227
1981-83	15.8	17.0	16.3
Total discharges	4398	2074	2535
1984-87	11.7	15.5	17.2
Total discharges	3865	3511	1931

1978-80 vs 1981-83, Mendi, $\chi^2 = 11.7$, $df = 1$, $p < 0.001$

1978-80 vs 1981-83, Tari, $\chi^2 = 21.1$, $df = 1$, $p < 0.001$

1981-83 vs 1984-87, Mendi, $\chi^2 = 28.7$, $df = 1$, $p < 0.001$

Note: data are incomplete in some years

PH = provincial hospital

DH = district hospital

HC = health center

Table 3

Death rates from diarrheal disease and health service utilization by decedents within the Tari Research Unit surveillance area. Children under five years.

Diarrhea death rates per 1,000	Utilization of health services		
	Not Seen	Seen not admitted	Admitted
1978-80	13%	66%	20%
pyar 11217			
1981-83	14%	36%	50%
pyar 11588			
1984-87	14%	28%	58%
pyar 16389			

1978-80 vs 1981-83, $\chi^2 = 6.4$, $df = 1$, $p < 0.05$

1981-83 vs 1984-87, $\chi^2 = 10.1$, $df = 1$, $p < 0.01$

pyar = person years at risk estimated from the sum of the under-five mid year populations

aid post orderlies took time to explain the rationale of treatment to child-carers and little or no fluid was administered to children on the premises. Mothers brought empty bottles for the purpose of collecting their ORS (Tables 4, 5). Aid post orderlies consistently recommended that extra water should be given while diarrhea continued, but rarely im-

plied that a further visit to the aid post might be required. No health worker described the signs and symptoms of severe disease to child-carers (Tables 4, 5).

The supplies and equipment surveys showed that there have been operational constraints to the delivery of oral rehydration solution from aid

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Table 4

Percentage score assessment of knowledge of primary health care workers, 1980 and 1988.

	1980 % (n = 100)	1988 % (n = 21)
History taken and examination performed	9	33
Treatment selection		
Oralyte	41	76
Water	0	10
Drugs	14	10
ORS preparation, one packet in one liter of water	25	28
Advice		
Health education (not specified)	25	14
Recommend additional fluids	29	33
Recommend breast milk	3	14
Recommend food	23	10
Explain rationale	14	10
Come back next day	6	10
Describe home-based fluid	1	5
Hygiene	7	33

Table 5

Performance of primary health care workers in 1983 and 1988.

1983 (n = 10)	1988 (n = 6)
Histories taken quite well	Histories satisfactory
Examination neglected	Examination neglected
Prescribed Oralyte	Prescribed Oralyte or recommended water*
Preparation of ORS fine	Prepared hypertonic ORS
Patient sent home for hydration	Patient sent home for hydration
Advised to give extra water at home	Advised to give extra water at home
Non-specific warnings	Non-specific warnings

Note : adapted from Lehmann (1984) and Rogers *et al* (1991)

* 3 APOs had no Oralyte in stock

posts (Table 6). In 1988, 70% of aid post orderlies had Oralyte in stock, 66% had mixing jugs and 73% had a source of clean water (48% had all three) compared with 94%, 96% and 89% in 1982. Seventy percent of aid post orderlies in the 1988

survey said they had difficulty getting Oralyte, implying that supplies were intermittent.

In the 1988 survey of child-carers, 42% of respondents who recalled a consultation on behalf of a child with diarrhea came away from the health

Table 6

Percentage of aid posts with supplies and equipment for delivery or oral rehydration solution, 1980, 1982 and 1988.

	1980 % (n = 100)	1982 % (n = 124)	1988 % (n = 121)
ORT poster present	62	57	43
Jug available	73	96	66
ORS salts in stock	77	94	70
Difficult to get ORS	55	41	70
Clean water source	?	89	73
Functional water tank	?	76	54

facility without oral rehydration solution. Amongst those who were given oral rehydration solution 40% were not completely satisfied with it. However, mothers attributed changes in utilization of health services to failure of health workers to provide such treatment. Fifty-five percent of mothers interviewed said they would only use the health services if their child had severe diarrhea and 18% that they would manage the condition entirely alone. The predominant reason provided for non-use of health services was that mothers had been told, or expected to be told, implicitly or explicitly, that diarrhea was a condition to be managed at home (Table 7).

Information on mothers' knowledge of home-based management also appears in Table 7. Eighty-Six percent of women knew that children with diarrhea should be given extra water at home and 51% pointed out that continuation of breastfeeding was important. Twelve percent had heard of sugar-salt solutions. Twenty-three percent mentioned continued feeding as a component of home-based management. There were a variety of preferred foods, all of them perceived to have particular drying or binding properties.

DISCUSSION

Diarrheal disease control in the Southern Highlands Province

Home-based management of diarrheal disease is rooted in the philosophy of primary health-care and agencies such as the World Health Organiza-

tion and UNICEF are actively promoting ORT based on traditional home fluids which are physiologically safe and potentially effective. In 1980 the newly established National Diarrheal Diseases Control Committee for Papua New Guinea recommended that oral rehydration therapy should be home-based with referral of dehydrated cases for Oralte or IV fluids. After detailed discussion of alternatives the Southern Highlands Province elected to persist with a strategy based on delivery of oral rehydration solution by health-services to all cases of diarrhea. This strategy was maintained through 1981-83, but in subsequent years increasing emphasis has been given to the home-based management approach. Health-workers have been taught about home-based management during basic and in-service training, widely distributed standard management texts have reinforced the strategy and demonstration projects have promoted home-based management of diarrhea as a key community-based child survival intervention.

A previous evaluation of the diarrheal disease control program in the Southern Highlands Province cautioned that initial acceptance of oral rehydration therapy could be followed by growing disillusionment amongst the population served as conflicts between traditional practices and the new treatment became manifest. It was implied that program impact would not be sustained unless measures were taken to resolve certain difficulties inherent in the promotion of ORT (Frankel and Lehmann, 1984). Decreasing utilization of health services and increasing levels of mortality from diarrheal disease were observed during 1984-87. In 1988 the majority of mothers

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Table 7

Opinions and experiences of child carers interviewed in 1988 (n = 84).

	No.	%
Experience of health services		
Utilization of health services		
Usually present diarrhoea to health services	23	27
Only present diarrhoea if child severely ill	46	55
Do not present diarrhoea to health services	15	18
Of those recalling a consultation for diarrhoea		
Recall being given ORS for diarrhoea	22	58
Recall attending for diarrhoea, no ORS given	16	42
Of those given ORS		
Satisfied	4	18
Not satisfied	9	41
Uncertain	9	41
Of those not usually presenting to health services		
Told/expected to be told no treatment, or manage at home, or given water only	24	39
ORS makes the child vomit	1	2
Afraid of drip	2	3
Uncertain	34	56
Home-based management		
Recommended fluids		
Water	72	86
Sugar, salt or sugar-salt solutions	10	12
Soups	11	13
Feeding		
Continue breast feeding	43	51
Continue feeding	19	23
Foods, possible drying agents		
Sweet potato	25	30
Taro	21	25
Dry biscuit	19	23
Banana	18	21
Foods, possible binding agents		
Greens	33	39
Other		
Ash or charcoal	1	1
Keep warm	2	2
Keep cool	12	14
Prayer meeting	1	1

we interviewed reported that they managed diarrheal disease without assistance from the health services or else consulted only for severe disease. The predominant explanation for such behavior was not dissatisfaction with ORS, but that health personnel had encouraged them to manage diarrheal disease at home. Any failure to recognize cultural norms by the program must be seen in the context of a broader range of issues that relate to the promotion of home-based management of diarrheal disease.

Effective delivery of oral rehydration therapy as recommended by the National Diarrheal Diseases Control Committee for Papua New Guinea requires identification and appropriate treatment of dehydrated children by health workers and the promotion of effective home-based therapy for children with mild disease. We found that aid post orderlies rarely looked for signs of dehydration in their patients, and were not adept at recognizing these signs when they occurred. They might administer fluids on site, but usually this amounted to a trial of treatment and never to replacement of fluids lost. On some occasions ORS was incorrectly prepared.

Although supplies of Oralyte were maintained, by 1988 less than 50% of aid post orderlies had Oralyte, clean water and a jug at hand. In practice, ability to deliver ORS remains a fundamental determinant of distribution practices. Oral rehydration is widely accepted by health workers as the best available treatment for diarrheal disease, but its use is not rationalized according to the state of hydration of the patient.

It was evident from the reports of women interviewed in 1988 that promotion of home-based management has been given increased emphasis in recent years. Almost 90% of women recognized that they should provide additional fluids to children with diarrhea, and continued breast-feeding was advocated by over half. Seventy-three percent of women initially managed diarrhea at home and 40% of these recalled doing so because they had been told, or expected to be told to do so by health workers.

Effective home therapy of diarrheal disease will be dependent on timely oral rehydration therapy using correctly prepared fluids in sufficient volume, continued feeding of appropriate foods in adequate quantities, and knowledge of signs that

indicate need for treatment outside of the home. In our studies little or no explanation, instruction or demonstration was offered by health-workers to women expected to rehydrate their children at home. There are still acceptability issues surrounding the promotion of ORT in this population, and we must remain open to the suggestion that commitment to ORT may be low. Of equal relevance to the current situation, health workers have successfully communicated the idea that diarrhea is a condition that can be managed at home, but have failed to teach the skills necessary to carry this out effectively. Our thesis is that home-based management has been advocated, but with quite inadequate preparation of the target population for their therapeutic role. Poor early treatment of diarrhea, late presentation of severely dehydrated children, and increasing mortality from diarrheal disease are the result of an ill conceived home-based management strategy.

Implications for the National Diarrheal Disease Control Program

In the Southern Highlands Province, a diarrheal diseases control program that was based on the delivery of oral rehydration solution from health facilities has devolved to a program that more nearly resembles that proposed as national policy.

A comprehensive review of the control of diarrheal disease based on three provinces in Papua New Guinea became available in 1988 (Papua New Guinea Department of Health, 1988). As in our study an assessment of aid post orderlies managing diarrhea cases was carried out. Clinical performance was satisfactory, but the level of advice to mothers was often poor. In a household survey more than 80% of mothers professed knowledge and use of "home fluids" and 50% gave fluids at home as the first measure in diarrhea. However, the "perception of dehydration by mothers was probably very low". Twenty-five percent of mothers said they did not know how to decide whether a child with diarrhea needed to be taken to a health facility.

Although there may be historic reasons for some of the weaknesses identified in the Southern Highlands' program, our observations have implications for the control of diarrheal disease elsewhere in Papua New Guinea. Since we provide

data indicating the impact of oral rehydration therapy under different conditions of use, our study provides an important perspective on control efforts. Our data affirm that oral rehydration therapy can save lives from diarrheal disease in Papua New Guinea, but suggest that under current conditions of use the potential of oral rehydration therapy is not being met. We have identified problems within the referral system, but focus on ill-conceived promotion of home-based management as of particular concern.

Further training and better supervision of health-workers are required and adequate supply and distribution systems must be maintained in order to consolidate the status of the referral system. The details of national policy must be reinforced at all levels of the health services. Communication issues must be given increasing attention. Better knowledge of target audiences is required and training of health workers in communication skills. Communications networks outside the health-services should be investigated, materials developed and delivered, and activities evaluated. Programs in number of countries have indicated the potential value of communications activities in the promotion of effective home-based management (World Health Organization, 1987). A concerted effort is required to ensure that Papua New Guinea's diarrheal disease program moves into this new and exciting phase of program development.

Limitations of study design

Aid post attendance data and discharge data presented in this paper were collected routinely on behalf of the provincial health authorities. They contain omissions, and probably recording errors. Since they are utilization data the population base is unknown, and might not be static. We have standardized our outcome measure to diarrhea (principal complaint) and have counted first attendances only. By examining trends for all cases of diarrhea, and for diarrhea and dysentery combined, we were able to exclude diagnostic transfers as an explanation for patterns observed. By demonstrating changes in the percentage of diarrhea cases as well as changes in the absolute number of diarrhea cases utilizing services we have overcome possible objections that changes in catchment populations, or changes in other major causes of utilization, could have explained chang-

ing trends. The consistency of results between areas validates our procedures and gives us confidence in our conclusions.

Monthly returns from notifying centers showed decreasing numbers of outpatient and inpatient cases of diarrheal disease during 1985-87. This was a limited series, but further supported our analyses based on selected aid-posts and inpatient facilities.

There have been no notable environmental improvements that could have reduced the incidence of diarrheal disease during the period under review and hygiene promotion activities have been insignificant. Nevertheless, measles vaccination coverage has increased (Alto and Cutts, 1989). EPINT notifications for diarrheal disease have increased gradually from under 350 per notifying center per year in 1978-80 to close to 1,000 per center per year in 1984-87, but subcenter data have been progressively included in the system. In an independent analysis of EPINT data based on attenders at child health clinics during 1982-86 there were wide variations in notifications from year to year, but no significant increase in incidence during the period (Alto and Cutts, 1989).

Our mortality data related to a known population base, but from a more localized area than the data referred to so far. Corroboration of the findings at Tari was sought by examination of death certificates held at the provincial health office. Amongst the 918 records located an increasing proportion of registered childhood deaths during 1985-1987 were for diarrheal disease.

The observational study of aid post orderlies and the survey of child-carers were also carried out at Tari. Further studies in other parts of the province were not feasible given prevailing resource constraints. However, our proposition that diarrhea is being treated inadequately in the home should be investigated in more detail. This will require a combination of methodological approaches, some epidemiological and some anthropological. Studies of appropriate utilization of ORT frequently address over-use of ORT, or ORT use during the last episode of diarrheal disease. Sometimes the ability to make a recommended home solution is observed. The proposed study should address the more difficult concepts of whether ORT is started early in an episode of diarrhea, whether it is maintained throughout and whether it is given in ade-

quate quantities. The study could be usefully extended to investigate feeding practices during diarrhea, and to document the likely feasibility, acceptability and safety of various fluids for rehydration in the home.

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