Case Management of Kwashiorkor: An Intervention Project at 7 Nutrition Rehabilitation Centres in Malawi

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INTRODUCTION

There are enormous regional disparities in the prevalence of kwashiorkor, and in regions where it is the predominant form of childhood malnutrition, it tends to be the final common pathway for nutritional insults such as food insecurity, a monotonous staple diet, chronic infections (TB or HIV), persistent diarrhoea and even cerebral palsy. As the most common f orm of severe malnutrition in Malawi, kwashiorkor (including marasmic kwashiorkor) accounts for 75% of all admissions to Nutrition Rehabilitation Centres (NRCS) in the southern region. It has a high case-fatality rate at large hospital-based NRCS, which has changed little over recent decades despite an overall fall in under-five childhood mortality.

Recently, nutritionists and paediatricians have been accused of malpractice by Berg of the World Bank for failing to improve nutrition in the developing world despite considerable research advances in nutritional science (1). The proposed solution to this deplorable situation was the use of nutrition 'engineers' but it is still unclear how to address the problem and there is a lack of relevant operational research. This project was an attempt to record prospectively the results of case management of kwashiorkor at different levels of NRCS, and to try to improve the outcomes. The NRCs were typical of treatment centres for kwashiorkor in Malawi, so they were not transformed research units with a specialised level of practice. The project standardised treatment protocols for kwashiorkor at these NRCS, provided paediatric supervision through regular visits, supplied a micronutrient supplement (Nutriset), and evaluated the results from both clinical impressions and data collection.

Methods

The project was carried out in the southern region of Malawi at NRCs based at 2 central hospitals (Blantyre and Zomba), 2 district hospitals (Mwanza, Ntcheu) and 3 rural clinics (Mpemba, Namitambo and Chikwawa). The centres were selected on the basis of feasibility, willingness to participate, and to represent typical NRCs at each level in the region. These NRCs were not just feeding centres, but in-patient facilities for the treatment of sick children. All participating NRCs used the same standard treatment protocol, except for tube-feeding and a milk-free diet as explained below. Initial routine medications were cotrimoxazole and albendazole, with chloramphenicol for clinically suspected sepsis.

TABLE 1

BASELINE ADMISSION DATA OF NRC PATIENTS BY FACILITY TYPE

Parameter	CENTRAL Hospitals		DISTRICT Hospitals		RURAL Clinics		p-value†
Number of cases (n=1625)	901		351		373		
Male sex	477	(52.9)	168	(48.0)	182	(48.8)	0. 19‡
Household members (CI)	4.9	(4.8-5.0)	5.0	(4.8-5.2)	4.9	(4.7-5.1)	0.53
Father died	62	(7.3)	33	(10.4)	38	(10.7)	0.08‡
Mother died	61	(7.1)	2.1	(6.6)	24	(6.7)	0.93‡
Chron. ill parent(%)	121	(13.7)	49	(14.9)	35	(9.7)	0.09‡
Prev. child death (%)	334	(39.7)	145	(46.0)	166	(46.3)	0.04‡
>2 child deaths (%)	128	(15.2)	78	(24.8)	62	(17.3)	0.001‡
Prev. malnutrition (%)	166	(18.5)	86	(25.4)	60	(16.9)	0.008‡
Age (months)*	26.7	(25.8-27.6)	29.0	(27.3-30.7)	29.4	(27.9-31.1)	0.003
Socio-economic score*	17.5	(16.7-18.5)	13.6	(12.4-14.9)	15.2	(14.3-16.2)	0.00001
Hosp. travel time in min (CI)	69	(66-73)	130	(116-146)	102	(43-113)	0.000001
Water collection-min/day (CI)	33	(31-36)	51	(46-57)	62	(57-67)	0.000001
Access to tapwater (%)	463	(55.5)	67	(21.2)	80	(22.5)	0.000001‡
Days diarrhoea PTA (CI)	5.9	(5.4-6.4)	4.6	(4.0-5.3)	3.1	(2.7-3.6)	0.000001
Days oedema PTA (CI)	11.1	(10.4-11.8)	12.6	(11.4-14.0)	8.3	(7.5-9.1)	0.000001
Father's yrs schooling (CI)	6.5	(6.3-6.7)	3.9	(3,5-4.3)	4.6	(4.2-5.0)	0.000001
Mother's yrs schooling (CI)	4.0	(3.8-4.2)	2.1	(1.8-2.4)	2.4	(2.1-2.7)	0.000001

* geometric means (95% confidence intervals-CI) PTA - prior to admission
† p-values are ANOVA for quantitative measurements, and corrected Chi squared‡ for categorical measures

Micronutrient, mineral and vitamin supplements were not available initially (except for potassium at Mwanza and Blantyre), but the project provided these as Nutriset, which is a powder supplement for milk specifically designed for the treatment of severe malnutrition in the developing world(2). When added to high energy milk, nutriset contains supplemental potassium, calcium, magnesium, zinc, manganese, selenium, iodine, copper and multivitamins. It was started at NRCs in July (mid-project, when it arrived in Malawi from France), so we compared results before and after its use. The milk-based diet was made from a premix of dried skim milk powder, vegetable oil and sugar supplied by the World Food Programme. The premix was made into a phase 1 milk for initiation of cure. On recommended intakes, this meant a daily intake per kilogram of body weight of approximately 332 KJ (79 kcal) and 1.2g of protein. Once the oedema, appetite and mental status had improved, children were advanced to a phase 2 diet, generally in the second week of treatment. On recommended intakes of 150 ml/kg/day, this diet provided a daily intake of 712 KJ (170 kcal) and 5.8 g of protein per kilogram. Since routine tube-feeding (by intermittent rather than continuous feeding) was only done

TABLE 2

CLINICAL FINDINGS ON ADMISSION BY FACILITY

Clinical Features	CENTRAL Hospitals	DISTRICT Hospitals	RURAL Clinics	p-value†
No kwash. rash(%)	315 (35.4)	126 (38.0)	206 (56.7)	0.0000001
Severe kwash. rash (%)	266 (29.9)	119 (35.8)	69 (19.9)	0.000001
Hair changes (%)	641 (72.2)	263 (79.5)	272 (74.3)	0.04
Hepatomegaly (%)	226 (25.7)	36 (11.2)	47 (13.5)	0.0000001 -
Spienomegaly (%)	84 (9.6)	33 (10.2)	40 (11.5)	0.60
Oral thrush (%)	236 (26.8)	70 (21.7)	41 (11.8)	0.0000001
Irritability (%)	759 (87.0)	193 (60.5)	211 (60.7)	0.00000001
Cough (%)	497 (56.3)	141 (41.6)	163 (44.3)	0.0000007
Severe oedema (%)	328 (36.5)	89 (26.2)	61 (16.5)	0.000000001
Diarrhoea (%)	459 (51.1)	228 (66.3)	191 (51.5)	0.000004
Diarrhoea >3/day (%)	315 (38.8)	171 (55.0)	122 (35.7)	0.0000003
Fever (%)	407 (46.1)	167 (49.3)	193 (52.4)	0.12
Wasting z-score (±sem)	-2.092 (0.04)	-2.125 (0.06)	-1.697 (0.06)	0.000005‡
Stunting z-score (±sem)	-3.577 (0.05)	-3.415 (0.08)	-3.276 (0.08)	0.003‡

† p-values are Chi square for categorical measures and ANOVA‡ for quantitative measurements

TABLE 3

CLINICAL OUTCOMES BY FACILITY

Clinical Features	CENTRAL Hospitals	DISTRICT Hospitals	RURAL Clinics	p-value†
Number of deaths	275 (30.5)	90 (25.8)	28 (7.5)	0.00000001‡
0-5 days (%)	170 (61.8)	43 (47.8)	8 (28.6)	
6-10 days (%)	55 (20.0)	19 (21.1)	6 (21.4)	0.0004‡
>10 days (%)	50 (18.2)	28 (31.1)	14 (50.0)	
mean days* (CI)	5.8 (5.2-6.4)	10.2 (7.6-12.8)	14.9 (9.1-20.7)	0.00001
Left NRC before discharge (%)	139 (15.4)	21 (6.0)	38 (10.1)	0.00001‡
Transfer to other facility (%)	0	2 (0.6)	43 (11.5)	0.00000001‡
Clinical sepsis (%)	420 (46.8)	83 (26.1)	76 (21.3)	0.00000001‡
Days of diarrhoea at NRC* (CI)	2.6 (2.5-2.7)	2.6 (2.4-2.9)	2.0 (1.9-2.2)	0.0000001
Days for oedema to resolve* (CI)	6.9 (6.5-7.2)	8.1 (7.5-8.8)	9.9 (g.2-10.6)	0.0000001
% Weight loss of oedema (CI)	11.2 (10.5-11.9)	9.8 (8.7-10.9)	8.7 (7.7-9.7)	0.0008
HIV prevalence (%)	235 (26.1)	32 (14.2)	86 (17.2)	0.000008‡
Gained weight in hospital (%)	553 (64.5)	230 (75.4)	252 (77.3)	0.000005‡
Weight gain in g/kgday* (CI)	11.2 (10.4-12.0)	7.1 (6.4-7.9)	6.4 (5.8-7.2)	0.0000001
Length of stay in days* (CI)	11.2 (10.6-11.8)	20.2 (18.5-21.9)	19.0 (17.6-20.4)	0.0000001

* geometric means (95% confidence intervals-CI)

† p-values are ANOVA for quantitative measurements and Chi square‡ for categorical measures

in Zomba, this represents the volumes given to the mothers rather than actual intakes. The protein and energy densities of these diets are similar to standard treatment protocols for the developing world (3).

The other component of the project was regular paediatric visits to supervise the NRCs every 2-4 weeks. All children with nutritional oedema (kwashiorkor, including marasmic-kwashiorkor) admitted to project NRCs from mid-January to mid-December 1995 were included, but cases of oedema of non-nutritional origin (e.g. nephrosis or severe anaemia) and marasmus without oedema were excluded. Efforts were made to include all kwashiorkor cases, including those absconding or dying soon after admission, on whom we had incomplete data. A questionnaire about household water supply, sanitation, hygiene practices, health and socio economic status was administered to the parents or guardians of children in the project. The questionnaire had been field tested and modified before use. A numeric score for socioeconomic status was developed from it based on parents education and employment, household attributes and possessions, water supply and sanitation characteristics and previous child deaths. This score was distributed symmetrically in a bell-shape about a median of 20 with a range of 5-41. Children in the project were weighed and measured on admission and at least twice weekly. Weights and recumbent lengths of subjects were measured by trained nurses using standard techniques on a Salter hanging scale and locally-made stadiometer. WHZ was calculated on the lowest weight recorded in hospital after oedema had resolved, but no correction was made for children who died with oedema. Wasting and stunting were defined conventionally as below 2 standard deviations for WHZ and HAZ, respectively, using NCHS standards. A reliable WHZ was only available for 1442 admissions (88.7%), due mainly to missing lengths, particularly from fatal and/or brief admissions. This was due to the effort made to record all kwashiorkor admissions. The constraints of working in this environment means that observations and measurements such as weight, length, oral intake, dirrhoea frequency and vital signs were not as accurate as in a research ward, so internal validity was sacrificed for high external validity. Reliable microbiology and biochemistry tests were not available. Doctors were not available to look after malnutrition cases at district and rural NRCS, so other than the paediatric visits, they were cared for by a nurse with minimal support from a clinical officer or medical assistant. Clinical data were collected on admission and on the twice-weekly round by nurses at rural clinics, by clinical officers at hospitals and by the authors in Blantyre. The ELISA test for HIV infection was only done in 354 children (21.8%) in the study, because only those with strong clinical indications (other than malnutrition) were tested and only after pre-counselling. There were no significant differences in clinical variables between HIV cases diagnosed clinically and by ELISA test. The clinical protocol diagnosed another 164 untested children, which combined with the 189 positive ELISA tests (53.4%) was consistent with an HIV infection rate in project patients of 21.7%.

Data were entered into Epi Info version 6 (World Health Organization/Centres for Disease Control, USA) on a portable computer with anthropometric z-scores calculated by Eqinut within Epi Info. Variables which were not normally distributed, such as age and length of stays, were log transformed for analyses and are presented as geometric means and 95% confidence intervals (CI). Hyphenated values in parenthesis (e.g. 3.4-5.6) are CI unless otherwise specified. For normally distributed quantitative variables with homogeneity of variance (Barlett's test), means were compared by ANOVA. Categorical variables were compared by Chi suare (Yates corrected X2) . Multiple linear and logistic regressions were analysed using Epi Info Analysis and EGRET (Statistics & Epidemiology Research Corporation, Sattle, USA), respectively.

Results

There were 1625 consecutive cases of kwashiorkor treated at the 7 NRCs during the study period, including 901 (55.4%) at central hospitals, 351 (21.6%) at district hospitals and 373 (23.0%) at rural clinics. It was obvious both clinically and from the data in tables 1 and 2 that the children treated at the three kinds of facilities differed in some important respects. On average, central hospital patients were younger, sicker, had a longer history of illnesses and were from families of higher socioeconomic status than those from rural clinics. This is reflected in case-fatality rates, which were 30.5% at central hospitals, 25.8% at district hospitals and 7.5% at rural clinics. The proportions of late deaths after 5 days treatment at NRCs (table 3), as an indicator of the quality of case management, were 71% (rural), 52% (district) and 35% at central NRCs (p=0.006). The proportion of patients diagnosed clinically as sepsis and treated with an antibiotic other than routine cotrimoxazole was much higher in central hospital patients (table 3).

Routine tube - feeding was associated with better weight gain but with no reduction in mortality

There were no differences in WHZ, HAZ, socioeconomic status score, age or sepsis incidence between those with and without weight gain. However, the group without weight gain vs those who did gain weight had a longer mean duration of diarrhoea in hospital (4.1 vs 3.5 days, ANOVA p=0.01), a shorter length of stay (13.9 vs 18.6 days, p=0.000001), a higher rate of HIV infection (26.4% (91/345) vs 18.7% (189/1011, X^2 p=0.003) and a higher case-fatality (35.1% (121/345) vs 8.0% (81/1011), P=0.000000001).

The central hospital NRC in Zomba used routine nasogastric tube feeding of all kwashiorkor admissions, but otherwise used the same case management protocal as other NRCs.

The introduction of a micronutrient of supplement was associated with improved weight gain and lower mortality

Tube feeding was not used elsewhere. It was important to evaluate this difference in feeding regimes, since it might be considered unethical as a randomised study design. Table 4 shows that although there was little difference in mortality, tube-fed cases had significantly (ANOVA p=0.000001) greater weight gain in hospital

than the Blantyre NRC (8.24 vs 4.51 g/kg/day). This improved weight gain with tube-feeding was most evident during the wet season (8.5 vs 3.8 g/kg/day) but also occurred in the dry season (7.8 vs 5.5 g/kg/day, p,0.006).

infection (including clinically diagnosed cases) had a higher case fatality rate (37.4%, 132/353) than presumed negative cases (20.5%, 261/1272), for an odds ratio of 2.3 (1.8-3.0). HIV infection was also associated with significantly more wasting (-2.3 vs -1.9 z-

TABLE:.4

COMPARISON OF ROUTINE TUBE-FEEDING VS NONE AT CENTRAL HOSPITALS

Feature n =	Blantyre NRC 748	Zomba NRC 153	p-value†
NASOGASTRIC TUBE-FEEDING	nil	routine	
Baseline:			
Age (months)*	26.7 (25.8–27.7)	26.5 (24.2-29.1)	0.87
Socio-economic score*	22.2 (21.8–22.7)	19.8 (19.0-20.6)	**0.003**
Weight/height z-score	–2.06 (–1.97,-2.13)	–2.28 (–2.06,–2.50)	**0.04**
Height/age z-score	–3.56 (–3.45,-3.67)	–3.67 (–3.55,–3.79)	0.59
Diarrhoea on admission (%)	387 (51.9)	72 (47.1)	0.31‡
Breastfed (%)	43 (5.9)	12 (7.8)	0.46‡
Days of oedema PTA	15.3 (14.2-16.4)	21.4 (17.8-25.0)	**0.0002**
Days of diarrhoea PTA	12.3 (11.1-13.5)	10.4 (8.0-12.8)	0.19
Results:			
Death (%)	227 (30.3)	48 (31.4)	0.88‡
Length of stay in hospital (days)	10.6 (10.1-11.2)	14.1 (12.2-16.0)	**0.005**
Days of diarrhoea in hospital	3.36 (1.1-13.5)	3.19 (2.7-3.7)	0.57
Days for oedema resolution	5.0 (4.6-5.5)	5.5 (4.8-6.2)	**0.66**
Day of lowest weight	5.8 (5.4-6.2)	6.0 (4.7-7.2)	0.73
Given antibiotic for clinical sepsis (%)	365 (48.8)	55 (36.7)	**0.009‡**
Weight gain (g/kg/day)*	4.51 (4.09-4.93)	8.24 (6.63-9.86)	**0.000001**

* geometric means (with 95% confidence intervals)
† p-values are ANOVA for quantitative measurements and Chi square‡ for categorical measures.
PTA - *prior to admission* *Statistically significant p-values are in bold*

Diarrhoea was present on admission in 54% (878/1625) of children, of whom 429 (48.9%) had a history of persistent diarrhoea (>14 days). The mean duration of diarrhoea during hospitalisation was only 2.5 days (2.4-2.6), which did not affect late mortality (after 5 days) or weight gain on nutritional rehabilitation. However, prolonged diarrhoea in hospital was associated with greater initial weight loss, early death,

The extent of seasonal variation makes the impact of such interventions as improved supervision or supplementation with micronutrients difficult to calculate.

HIV infection and wasting, when controlled for facility type, admission diarrhoea and length of stay.

Wasting was present in 52.1% (751/1442) of admissions after resolution of oedema. It was more common at central and district hospitals, in younger children and during the rainy season. Cases of marasmic-kwashiorkor had a higher mortality, greater weight gain, less oedema on admission and longer length of stay. HIV

scores, ANOVA p=0.00006) and stunting (-3.8 vs -3.4, p=0.0002) and less weight gain in hospital (4.29 vs 5.18g/kg/day, p=0.009) than non-HIV cases of kwashiorkor. Kwashiorkor was diagnosed in 121 breastfed children in this series with a mean age of 15.6 months (14.5-16.8). The ELISA test for HIV was positive in 38 children (14 infants) out of 55 tested and another 55 were diagnosed clinically as HIV infection, giving an odds ratio of 15.9 (10.0-15.7) for HIV infection in breastfed kwashiorkor cases.

The extent of seasonal variation in admissions is indicated in table 5 in order to illustrate its importance in this data. The dry season months (July-Dec) had fewer admissions, a longer length of stay and a lower mortality, whereas diarrhoea and wasting were worse in the wet season (Jan-June). The introduction of Nutriset was associated with improved weight gain (6.06 vs 4.66 g/kg/day) and a lower mortality 20.8% (110/529) vs 25.8% (283/1059) which remained significant despite controlling for confounders such as season.

Discussion

This paper presents descriptive clinical data on a large number of kwashiorkor patients studied prospectively in hospital in an attempt to apply nutritional knowledge to improve

hospital outcomes. The statistical methods used to present the data are only intended to clarify possible associations of clinical significance. The variables selected are well-recognised clinical outcomes such as death, length of stay, duration of diarrhoea and anthropometric indices. Indeed, the data need to be interpreted with caution because of the marked seasonal variations presented in table 5.

We must advance from protocols to actual practice

The differences between the 3 levels of NRC facilities (central, district and rural) presented in tables 1 to 3 indicate that central hospital patients tended to be sicker, have higher socioeconomic status and give a longer history of illness than rural clinic patients.

The lower mortality at rural clinics reflects both less severe disease and transfer of sicker cases to larger NRCS. The rural NRCs tend become feeding centres due to less pressure on beds, with longer stays of less severe kwashiorkor cases than at district or central NRCS. In addition to less severe disease, the lower rate of clinical sepsis at district and rural facilities may be related to under-diagnosis because of less clinical supervision, since cough and fever on admission were equally common at each facility (table 2). Ascertainment bias may also apply to differences in hepatosplenomegaly.

The best predictors of weight gain in hospital on nutritional rehabilitation were prompt oedema loss, more severe wasting and treatment with nasogastric tube-feeding. Although tube-feeding improved weight gain, it is associated with an increased risk of aspiration pneumonia when nursing care is limited. This may have contributed to the high mortality in Zomba (31.4%), since we expected a lower mortality than in Blantyre.

HIV-infected cases of marasmic-kwashiorkor had a higher mortality, more stunting, less oedema, higher socioeconomic status and lower weight gain than non-HIV cases. The better socioeconomic status at central hospitals is partly related to the higher rate of HIV infection (26.1% vs 16.3%, table 3), which is a more likely cause of malnutrition in better off families than in those living in dire poverty. Kwashiorkor is normally a disease of the weaning period and is uncommon in breastfed children, so it is notable that we recorded it in 121 children (7.4%) in this project, including 44 infants. The association of still breastfeeding with HIV infection was striking. Evaluation of the micronutrient supplement (Nutriset) in this setting was complicated by methodological constraints. Although these supplements were not available before the project, we felt uncomfortable about using a placebo preparation in view of the known benefits of potassium and zinc. The introduction of the supplement during the project was also complicated by seasonal variation, although we tried to control for this on regression. But we wish to stress that this was an intervention project, so we wanted to observe the effect of introducting the Nutriset supplement in this setting. Anecdotally, there was a striking improvement in the anorexia and irritability of kwashiorkor cases with the introduction of Nutriset. We suspect that this was mainly related to zinc supplementation, since its introduction alone (40 mg/day) in Blantyre, just before Nutriset arrived, had a clinically obvious effect. Other studies in Malawi have shown zinc to be a limiting factor in the maize-based diets of children due to its high phytate content[4,5].

There was a significant fall (X2 p=0.03) in deaths after introducing the Nutriset with case-fatality rates of 25.8% (283/1096) before its use compared to 20.8% (110/529) after. This effect of Nutriset on mortality occurred despite controlling for seasonal factors on logistic regression. The apparent effect of Nutriset on weight gain was particularly striking (ANOVA p=0.00003) for Blantyre and Ntcheu with 3.73g/kg/day (3.3-4.1) before vs 5.4 (4.8-6.0) after its introduction. The effect was less obvious at NRCs with routine tube-feeding (Zomba), good nursing care (Mwanza, because

TABLE 5

SEASONAL VARIATIONS IN ADMISSIONS

Season	Jan-Mar (wet)	Apr-Jun	Jul-Sep (dry)	Oct-Dec
n =	578	519	311	218
Mortality	168 (29.1)	115 (22.2)	46 (14.8)	64 (29.4)
Diarrhoea on admission	353 (61.5)	223 (43.5)	167 (54.2)	135 (61.9)
Days diarrhoea in hospital*	3.1 ±0.2	2.8 ±0.2	4.1 ±0.2	3.5 0.2
Length of stay*	13.3 ±0.5	15.7 ±0.5	17.5 ±0.7	14.1 0.7
WHZ at lowest weight*	-2.21 ±0.05	-2.00 ±0.05	-1.61 ±0.07	-2.09 0.08
WHZ on discharge*	-1.78 ±0.05	-1.42 ±0.06	-0.80 ±0.07	-1.35 0.09
mean z-score increase/day	0.032	0.037	**0.046**	**0.052**
Wt gain (g/kg/day)*	4.11 ±0.27	4.85 ±0.29	5.49 ±0.30	5.57 0.09
Days to lowest weight*	5.6 ±0.25	6.9 ±0.36	6.7 ±0.36	6.2 0.40
Oedema resolution (days)*	8.4 ±0.29	9.5 ±0.30	9.0 ±0,36	7.0 0.36

*±sem, WHZ - weight for height z-score

Notable differences are in bold

of expatriate nursing support) or erratic milk supply (Namitambo). This suggests that an important impact of the micronutrient supplement was on anorexia, which could be attributed to the known effect of zinc supplementation on appetite, but especially at centres with less supervised feeding where appetite determined intake.

An important component of this project was paediatric visits and supervision of NRCS. As expected, it was very difficult to isolate this effect from the other factors affecting outcomes in our data. We have to report that our clinical impressions of the impact of the project on case management and mortality are disapponting. This is not to deny that there were undocumented benefits, such as fewer referrals to central hospitals and less isolation of district and rural health workers.

In conclusion, we make the following recommendations to improve case management of kwashiorkor. A micronutrient supplement such as Nutriset should be provided to all NRCs along with the milk powder and vegetable oil. Additional potassium, however, is needed for phase 1 milk (initiation of cure) in order to provide 8 mmol/kg/day (6). Routine tube-feeding of milk-based diets should be considered for all children with wasting and anorexia. This requires good nursing care to prevent aspiration pneumonia, so should only be instituted at central or district level. In view of the limited health resources, perhaps it would be better to reduce the number of NRCs managing kwashiorkor, but provide adequate resources and supervision to those at central and district level. There are no easy solutions, but improved case management of kwashiorkor will not occur without better motivation and supervision of health workers. The level of supervision needed was greater than we could provide by visits in this project. The emphasis must shift from new protocol development to how to actually implement feasible protocols which improve outcomes at NRCS. We must advance from protocols to actual practice.

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