

Improving the hospital management of malnourished children by participatory research

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Abstract

Objective: To improve the clinical management of severely malnourished children in rural hospitals in South Africa.

Study design: A pre- and post-intervention descriptive study in three stages: assessment of the clinical management of severely malnourished children, planning and implementing an action plan to improve quality of care, and monitoring and evaluating targeted activities. A participatory approach was used to involve district and hospital nutrition teams in all stages of the research.

Setting: Two rural first-referral level hospitals (Mary Theresa and Sipetu) in Mount Frere District, Eastern Cape Province.

Main measures. A retrospective record review of all admissions for severe malnutrition to obtain patient characteristics and case fatality rates, a detailed review of randomly selected cases to illustrate general case management, structured observations in the paediatric wards to assess adequacy of resources for care of malnourished children, and in-depth interviews and focus group discussions with nursing and medical staff to identify barriers to improved quality of care.

Results. Before the study, case fatality rates were 50% and 28% in Mary Theresa and Sipetu hospitals, respectively. Information from case studies, observations, interviews, and focus group discussions revealed many inadequacies in knowledge, resources, and practices. The hospital nutrition team developed and implemented an action plan to improve the quality of care and developed tools for monitoring its implementation and evaluating its impact. In the 12-month period immediately after implementation, case fatality rates fell by -25% in both hospitals.

Conclusion: Participatory research led to the formation of a hospital nutrition team, which identified shortcomings in the clinical management of severely malnourished children and took action to improve quality of care. These actions were associated with a reduction in case fatality rates.

Keywords: case fatality rates, in-patient treatment, malnourished children, malnutrition, participatory research, quality of care

Under the new government, the health sector in South Africa is undergoing radical reorganization. Health services based on the primary health care approach are being decentralized within District Health Systems (DHS). Consequently, there has been a shift of resources from the tertiary level to secondary and primary levels. The challenge remains, however, to improve the quality of care within the DHS at secondary and primary levels.

Severe malnutrition is a major cause of morbidity and mortality among young children in Africa. It contributes to ~54% of deaths in children under 5 years of age [1]. Hospital management of severe malnutrition is an important component of a comprehensive approach to the problem of undernutrition. A review of case management worldwide has revealed a median case fatality rate of ~25%, with rates in some hospitals as high as 50% [2]. Many of these deaths are avoidable and are due to outdated procedures and protocols, and unfamiliarity with modern practices of management. Centres that improved their treatment of malnutrition have successfully reduced the death rate to <10% [3,4]. This suggests the need to motivate health practitioners to review current practices in the management of severely malnourished children in paediatric wards, and to adopt practices that will improve the quality of care.

This paper reports on a process that has led directly to an improvement in the quality of care, as undertaken by a hospital nutrition team consisting of personnel responsible for paediatric in-patient care. The process comprised three stages: assessment of clinical management, planning and implementing an action plan, and monitoring and evaluating activities. Each of these stages is described below.

Background

The Mount Frere district serves an estimated rural population of 280000 and is the poorest health district in the Eastern Cape Province of South Africa. In 1997, a household survey of maternal and child health showed poor health coverage, with only 54% of deliveries occurring in health facilities [5]. The tuberculosis BCG vaccination at birth had been given to 95% of children, but only 64% had received the measles vaccination by the age of 1 year. The majority of the population still does not have access to clean water or sanitation. Under-nutrition is a major cause of childhood illness and death in this district [6].

Two hospitals serve the Mount Frere health district: Sipetu and Mary Theresa, with 150 and 170 beds, respectively. Staffing levels are low, and at the time of the study each had two medical officers who were responsible for both in- and outpatients. On the paediatric wards there were typically one or two senior nurses and two to four junior nurses or auxiliaries per shift for 20-60 children. Both hospitals share a set of 17 satellite clinics, which refer cases that require hospital care.

Mount Frere health district is one of several districts in the country supported by the Initiative for Sub-District Support (ISDS). The ISDS is a national project set up by the Health Systems Trust and the Department of Health to help develop approaches aimed at improving the quality of district health services. Currently the ISDS, in collaboration with the Public Health Programme at the University of the Western Cape (UWC), is implementing a model district Integrated Nutrition Programme (TNP) in Mount Frere. Before this programme in-service training was rudimentary, with little emphasis on problem solving.

The first step in the development of a district INP in Mount Frere was the formation of a multisectoral district nutrition team, consisting of: nurses from satellite clinics and paediatric wards; health promotion officers; representatives from environmental health, agriculture, and education; and nutrition officers. The team was given information about basic nutrition concepts, data collection methods, and fieldwork strategies to enable them to conduct a situational analysis of nutrition-related activities in their district. One of the activities evaluated during this training was the management of severely malnourished

children at Mary Theresa hospital. On the first visit of the team, which included UWC/ISDS facilitators, a myriad of problems in the management of malnourished children were identified. Going through the ward register, case fatality from malnutrition was found to be >50%. The gravity of the situation, which this process revealed, was immediately recognized by the senior paediatric nurse who said 'I was aware that many children admitted with malnutrition do not survive, but I was not aware that the numbers are so high'.

Methods

The study comprised three phases: (i) formation of a hospital nutrition team to assess the clinical management of severe malnutrition; (ii) development and implementation of action plans to improve quality of care; and (iii) monitoring and evaluation of activities.

Formation of the hospital nutrition team to assess clinical management

The hospital nutrition team consisted of six staff (one doctor and the two most senior nurses from the paediatric ward of each hospital) and UWC/ISDS facilitators. Two of the four nurses were also part of the district nutrition team. The task of the hospital nutrition team was to investigate the reasons for the high mortality among severely malnourished children during treatment and to suggest actions. They gave feedback to the district nutrition team at monthly meetings.

Using a summary of the World Health Organization (WHO) draft guidelines [7] for the management of severe malnutrition [8,9], the hospital nutrition team developed checklists and other instruments for data collection. Data were collected during March and April 1998. A retrospective record review of all malnutrition admissions (kwashiorkor, marasmus, or marasmic–kwashiorkor) to both hospitals between 1 March 1997 and 31 March 1998 was completed to obtain the following data: age, diagnosis, presence of oedema, weight on admission, lowest weight during admission, treatment prescribed, mean length of stay, and mean rate of weight gain (g/kg/day). Case fatality rates were calculated from the admission/death registers. A detailed review of six randomly selected cases was conducted to illustrate the general management of children with severe malnutrition.

Structured observations were undertaken in the paediatric wards regarding cleanliness, adequacy of toilet and bathing facilities, ward infrastructure, and availability of resources needed for the care of malnourished children.

In-depth interviews were conducted with two senior nurses and two doctors from each hospital to identify barriers to the management of malnourished children. An open-ended exploratory question—'What problems do you encounter in the management of malnourished children in your hospital?'—was posed during the course of the interview, and clarifying questions and reflective summaries were used. Focus group discussions were held with eight paediatric staff to explore further those areas of case management that needed improvement and ways in which the barriers could be overcome. The interviews and focus group discussions were tape-recorded and transcribed, and the information was summarized and categorized into major themes and concepts. Data analysis was completed during June 1998.

Development and implementation of action plans

After completion of the data analysis, the hospital nutrition team and facilitators met for 2 days in August 1998 to review the research findings and formulate a plan for improving the

management of severe malnutrition. The provincial coordinator of the INP and the provincial and regional personnel responsible for maternal and child health were invited as a demonstration of their interest and support, and to initiate action at the provincial level, if needed. Paediatric ward doctors from other regions of the Eastern Cape were also invited to experience the process in readiness for similar activities planned for other districts.

Before presentation of the results of the assessment, participants received information about the background to the INP and the place of facility-based care within the INP. The multiple causes of malnutrition were explained as outlined in UNICEF's conceptual framework [10], and the 'triple A' approach to planning interventions [11] was described, namely the process of assessing the problem, analysing its causes, and taking action based on this analysis and actual or potential resources. In addition, research from other countries of the impact on case fatality of improving hospital management of malnourished children was highlighted. Participants were reassured that the meeting was not aimed at criticizing their practices, and that comparable case fatality rates have been reported internationally.

Presentation of the research findings stimulated a very productive discussion among the participants concerning lack of knowledge, motivation, and availability of resources for the care of malnourished children in hospitals in the province. Doctors and nursing staff from the two hospitals expressed appreciation of the research process, and nursing staff stated that their involvement in the process had already led to modification of some of their practices. For example, there had been some improvement in the frequency of weighing of children, and in one hospital malnourished children were being nursed separately from children admitted with other conditions, the pharmacist had been contacted to ensure a reliable supply of medicines, and more space to accommodate malnourished children was provided. They felt ready to improve the quality of care further.

Participants then divided into small groups and drew upon the WHO guidelines to develop a specific action plan for each hospital. Participants identified practices needing improvement, and constraints, for each of the 10 treatment steps. Strategies to overcome the constraints were formed in order to operationalize practices sooner. Staff felt that some of the 10 steps could be implemented immediately. For areas that could not be modified without further consultation with the provincial department, one person was given responsibility to negotiate with the relevant provincial personnel, and a time frame for completion was chosen. These areas included provision of an electrolyte/mineral solution and special feeds (starter and catch-up formulas). To sustain the enthusiasm generated during the 2 days, and to provide support to the staff, a further workshop was arranged to review progress.

In October 1998 a 2-day workshop was held with the hospital nutrition team to review progress in the implementation of the 10 steps and to provide further training. The managers for provincial and district maternal and child health and nutrition also attended. Staff from both hospitals shared their achievements. They reported that children were now being treated with broad-spectrum antibiotics, iron was no longer given in the initial phase of treatment, diuretics were no longer prescribed, and mothers were now allowed to sleep in the wards to keep children warm and to help feed and care for them. In one hospital, two additional feeds were being given. Resources had also improved: dextrostix were now available to test for hypoglycaemia and, although the available scales were still not reliable, children were now being weighed daily. Staff in one hospital reported they had obtained a refrigerator for the paediatric ward.

Staff also shared the constraints they faced with respect to implementing some of the steps. Wards were small and often overcrowded, and they lacked certain supplies, especially electrolyte/mineral solution. In one hospital, there were only four nurses on duty at night to cover all the wards including the emergency cases. In such situations, staff reported that the feeding of children was sacrificed.

Through problem-solving and further training, a treatment protocol considered to be feasible and appropriate for the local conditions was agreed. A time line was formed for the issues that needed action at the hospitals, and at the regional and provincial levels. These included follow-up with the provincial pharmacist on the possibility of making the electrolyte/mineral mixture centrally for all the regional hospitals, and with the regional maternal and child health coordinator regarding the ordering of proper scales, storage containers, and measuring equipment for children's feeds. The staff were very eager to improve the quality of care of malnourished children further.

Monitoring and evaluating activities

From November 1998 to March 1999, monthly follow-up visits by facilitators provided additional support to the team. During these visits, meetings were held with the paediatric staff and they reported the changes they had introduced.

A checklist of performance indicators to monitor the implementation of the 10 steps was developed. The indicators were frequency of feeding and weighing the children, correct antibiotic treatment, and completeness of records. Also included in this checklist were monthly impact indicators, namely case fatality rates and average weight gain during the rehabilitation phase. The senior ward nurse from each hospital developed a schedule for monitoring the activities. The process included checks of sampled patient records to ensure that procedures were completed and recorded, and observation of ward procedures to ensure quality of care. Oral feedback was given to the ward staff on a regular basis. The monitoring process identified areas that needed further training, which facilitators provided.

Results

The retrospective review revealed 98 admissions with a diagnosis of severe malnutrition and a wide age range (6 weeks to 4 years), with 41% aged 18-24 months. Most children had a clinical diagnosis of kwashiorkor. Mean length of stay was 15 days and the rate of weight gain in the 'catch-up' phase was poor (mean 2 g/kg/day), but could only be calculated for 23% of children due to incomplete records. Results of the assessment are given in Table 1. None of the recommended 10 treatment steps was practised adequately. Inadequate knowledge and lack of resources were the most common perceived barriers. Table 1 also shows the actions taken to improve care and the changes achieved. The most significant improvements were in relation to prevention of hypoglycaemia and hypothermia through frequent feeding and keeping warm, prevention of cardiac failure by avoiding intravenous rehydration fluids, correction of electrolyte imbalance by giving potassium supplements and not giving diuretics to treat oedema, timely treatment of infections and micronutrient deficiencies, and provision of special feeds (starter and catch-up). Actions not achieved were provision of structured play sessions and an effective system of community follow-up.

Impact evaluation for the 12-month period March 1999 to February 2000 showed a reduction in case fatality from 50% to 39% in Mary Theresa, and from 28% to 21% in Sipetu hospital.

Table 1 Comparison of recommended and actual practices in Mary Theresa and Sipetu hospitals, perceived barriers to quality of care, and actions taken to improve care of malnourished children

Assessment of practices			Implementation	
Recommended practice	Practice prior to intervention	Perceived barriers to quality care	Programme intervention	Changes reported at follow up visits
Step 1: Treat/prevent hypoglycaemia				
Feed every 2 hours during the day and night. Start straight away.	Children were left waiting in the queue in the outpatient department and during admission procedures.	Lack of knowledge about risks of hypoglycaemia.	Training to explain why malnourished children are at increased risk.	Malnourished children fed straightaway and 3 hourly during the day and night.
	In the wards, they were not fed for at least 11 hours at night.	Lack of knowledge about how to prevent it.	Training on how to prevent and treat hypoglycaemia.	
		Shortage of staff, especially during the night.	Motivated District health managers for more night staff in paediatric wards.	The number of night staff was increased.
	Hypoglycaemia not diagnosed.	No Dextrostix for testing for hypoglycaemia.	Motivated the Department of Health to provide resources (10% glucose and Dextrostix).	Dextrostix and 10% glucose obtained.
Step 2: Treat/prevent hypothermia:				
Feed every 2 hours during the day and night, keep warm, and avoid exposure.	Children were not kept warm.	Frequent power loss and dependence on electrical heaters.	Training on proper ways to diagnose hypothermia. Training on prevention of hypothermia.	Malnourished children fed straightaway and 3 hourly during the day and night. Mothers sleep with children at night to keep them warmer.
	Mothers were not admitted with children.	No beds, no space for mothers. Cost of feeding mothers during hospital stay.	Mothers given mattresses to sleep under children's beds.	Mothers help with feeds during the night. A generator is used during power failure.

continued

Table I *continued*

Assessment of practices			Implementation	
Recommended practice	Practice prior to intervention	Perceived barriers to quality care	Programme intervention	Changes reported at follow up visits
Step 3: Treat/prevent dehydration:				
Rehydrate orally (except in shock).	Children with diarrhoea were rehydrated intravenously.	Lack of knowledge about dangers of intravenous therapy in malnourished children.	Training on the dangers of intravenous fluids.	Most children are now rehydrated orally.
Rehydrate more slowly than for well-nourished children and monitor for signs of overhydration.	Children were rarely monitored.	One ward sister commented that intravenous therapy was used because of staff shortages: 'if we don't put up intravenous therapy, who will feed that child?'. Lack of knowledge about dangers of overhydration.	Encouraged staff to rehydrate children orally and taught how much to give. Training on the importance of monitoring vital signs to prevent overhydration.	.
Step 4: Correct electrolyte imbalance				
Give extra potassium and magnesium.	In one hospital, potassium was given routinely as slow-K, but not magnesium. In the other hospital, neither potassium nor magnesium was given.	Lack of knowledge that severely malnourished children have severely disordered electrolyte balance.	Explained that all severely malnourished children have too little potassium and magnesium in their bodies, and too much sodium, and that this increases the risk of heart failure.	Children are given extra potassium and sometimes magnesium daily in the form of a mineral electrolyte mixture.
Never treat oedema with diuretics. Give a low sodium diet.	Most oedematous children were treated with diuretics. Children were fed food containing salt.	Lack of knowledge.		Diuretics are no longer prescribed. Children are fed low sodium, specially-prepared feeds.

Table I *continued*

Assessment of practices			Implementation	
Recommended practice	Practice prior to intervention	Perceived barriers to quality care	Programme intervention	Changes reported at follow up visits
Step 5: Treat infection				
Give broad-spectrum antibiotics routinely as the usual signs of infection may not be present in severe malnutrition.	In neither hospital were children treated with broad-spectrum antibiotics routinely.	Lack of knowledge about the presence of hidden infection in malnourished children.	Training about the need for antibiotics straightaway and what to prescribe.	All children are treated with broad-spectrum antibiotics.
	Wards were overcrowded, hygiene in the wards was poor, exposing children to risk of cross infection.	Lack of resources. Beds were insufficient. No running water or soap to wash hands.	Encouraged staff to take special care to avoid cross-infection.	Wash basins, soap, and towels are provided for staff and mothers.
Step 6: Correct micronutrient deficiencies				
Give zinc, copper, folic acid, and multivitamins. Give high dose of vitamin A on day 1.	Neither hospital gave zinc or copper supplements, or multivitamins.	Lack of knowledge that severely malnourished children have multiple deficiencies. Lack of resources (zinc and copper). Intermittent supplies of multivitamins and vitamin A.	Training about the need for micronutrient supplements (prevent blindness, repair damaged gut and cells, restore normal body function).	Multivitamins, vitamin A, and sometimes mineral electrolyte mixture are given.
Do not give iron in the initial phase.	Both hospitals gave iron in the initial phase of treatment.		Explained risk of giving iron too soon (pathogen replication and oxidative damage to cell membranes).	Iron is withheld during the initial phase of treatment.
Step 7: Feed cautiously initially				
Give frequent small feeds of a milk-based starter formula and continue breastfeeding. Aim for 100 kcal/kg/day and 1–1.5 g protein/kg/day	Older malnourished children were given the same meals as for adults, but smaller portions.	Lack of knowledge about the special needs of malnourished children.	Explained the importance of giving small amounts of starter formula during the initial stabilization period to allow damaged organs and cells to get back into working order.	All children are fed a specially prepared starter formula that just meets their basic energy and protein needs during the stabilization phase.
	Younger infants were given full-strength milk.			

continued

Table 1 *continued*

Assessment of practices			Implementation	
Recommended practice	Practice prior to intervention	Perceived barriers to quality care	Programme intervention	Changes reported at follow up visits
Step 7: (continued)	Actual intakes were unknown. The nursing staff often recorded 'feeding well', 'refused', etc. No nasogastric feeding of anorexic children.	Lack of knowledge about the importance of recording intake, and the need for tube feeding when anorexic.	Explained the importance of recording feeds including leftovers to assess the child's progress.	All feeds including leftovers are now recorded.
Step 8: Rebuild wasted tissues (catch-up growth)				
Make a gradual transition from the starter to a catch-up formula	Children were given the same diet throughout their hospital stay. No modification was made to achieve catch-up growth.	Lack of knowledge about nutritional requirements to achieve catch-up growth.	Trained about the importance of feeding children as much as they can eat to rebuild wasted tissues and to achieve rapid weight gain.	During the rehabilitation phase children are given catch-up formula as much as they can eat, 7 times a day. Family meals are served in addition.
Feed unlimited amounts frequently, aiming for an intake of 150–220 kcal/kg/day and 4–6 g protein/kg/day.	Food intakes were not monitored.			
Weigh children daily.	Children were weighed infrequently.	Negative attitudes towards malnourished children. One nurse said 'We know that children should be weighed daily, but who will pick up a poor Kwashi and put it on the scale, unless very committed?'. Lack of resources: scales were either not available or not in working condition.	Explained the need to monitor the progress of children by rate of weight gain. Negotiated with the Department of Health to purchase scales.	Children are now weighed daily. Reliable scales obtained.

Table I *continued*

Assessment of practices			Implementation	
Recommended practice	Practice prior to intervention	Perceived barriers to quality care	Programme intervention	Changes reported at follow up visits
Step 9: Provide stimulation, play, and loving care				
Give emotional support and playful stimulation.	There was no organized play. Children were left to lie in bed without any stimulation.	Lack of knowledge of the importance of stimulation and tender loving care. ‘We never knew that stimulation is part of the management.’ ‘No one would like to play with a miserable child. We call them ‘Miserere’.’	Explained that as children become malnourished they become less active and stop developing mentally as well as physically, and that loving care and playful interaction should form part of caring for malnourished children in hospital.	
		Lack of resources (no toys or books for children. No educational materials for mothers).	Gave guidance on how to use available resources to make toys for children.	Plastic containers donated by staff are used to create toys.
Step 10: Prepare for follow-up after discharge				
Involve parents and caretakers in the feeding and care of children and teach them how to continue at home. Follow-up each child regularly to check progress.	There was no adequate training of mothers on ways to prepare foods that will meet basic energy requirements.	Lack of knowledge of the importance of energy intake for growth in children.	Training of paediatric staff to obtain social and economic history and to educate caregivers/mothers on appropriate feeding practices.	Paediatric staff are working with clinic supervisors and community liaison officers to develop a system to follow-up children after discharge.
	Neither hospital had an adequate system of continuity of care after discharge.	Lack of resources (personnel and transport) to follow children to the community after discharge.	Explained the importance of involvement of mothers in the care of malnourished children during admission so that they may continue at home.	

Discussion

This research actively involved the hospital nutrition team in identifying shortcomings in the management of malnourished children, and in the process of exploring changes to be introduced, availability of resources, and difficulties to be dealt with in implementing improved care. Involving the team in all stages of the research (initiation, design, data collection, data analysis, and presentation of the findings) encouraged them to reflect on their own practices, to plan and implement changes for better quality of care [12,13], and to develop a protocol to suit their needs and available resources. This experience strengthened their self-confidence to change the situation themselves, despite working in difficult circumstances, and to motivate and train other staff, leading to a commitment to improved performance. The process also built the research skills of the team and created ownership of the project: in one paediatric ward, staff prepared and displayed a poster reading: 'Please feed me 3-hourly, and weigh me daily'. In the other hospital, staff composed '10 kwashy messages' based on '10 steps' (see Table 2). These messages are displayed as a poster on the wall of the paediatric ward. The process also helped develop awareness among others who were indirectly involved in the care of malnourished children of the need to introduce changes.

Senior nursing staff on the paediatric ward were especially targeted because treatment is primarily nurse-led in these hospitals and they are strategically placed to identify incorrect or incomplete activities and take timely action where needed. They were critical in leading the project in their hospitals and in overseeing agreed tasks and time frames. Feedback to other ward staff helped to motivate them to keep up the good work.

The role of external facilitators was important to the process. They provided technical expertise and training, and offered support and encouragement to the paediatric staff, listening to issues raised and helping them to explore the implications of introducing changes. In many instances, facilitators encouraged critical thinking and offered alternative ways of viewing the situation, which assisted problem solving. The development of a trusting relationship between the staff and facilitators was critical. Because of the sensitivity of exposing unsatisfactory conditions, the external facilitators on the team took responsibility for observation of the paediatric wards.

Another important factor was the involvement of relevant hospital, provincial, and district management personnel. For example: the hospital manager made a policy change so as to allow mothers to stay with their

children; the preparation of feeds and the frequency of feeding was planned with the district dietician; the lack of reliable scales was discussed with the provincial coordinator of the INP; and negotiations were undertaken with the district health manager about increasing the number of night staff in the hospital and overhauling the generator. The involvement of stakeholders was not simply a courtesy or for outward show, but was a vital part of the process as not all problems could be overcome by ward staff. Their involvement was also important for sustaining quality of care.

Following the experience in these two hospitals, the process has been scaled-up within the province and staff at a further 23 hospitals have been trained. For sustainability and to avoid reliance on external facilitators, training is now organized by the provincial Department of Health and nurses now comprise the training team. They use a detailed training guide [14]. There are, however, a number of constraints to sustainability. Typical of many rural hospitals in South Africa, doctor turnover is high. Most are expatriates on short contracts or are newly graduated community service doctors on 1-year contracts, and there is no satisfactory induction or supportive supervision for them. Their undergraduate training does not equip them for the reality of treating severely malnourished children in under-resourced rural hospitals, thus compromising quality of care. There is also increasing absence or loss of nursing staff due to HIV/AIDS and migration, and in-service training for rotated staff becomes an additional burden. Due to the previous educational system in South Africa, many nurses lack certain numeracy skills and they have difficulty calculating the impact indicators (rates of weight gain and case fatality rates). The monitoring tool was not as successful as hoped, as poorly performed tasks went unnoticed. Nevertheless, in some hospitals case fatality rates of 40–50% have fallen to 10–15% and have been sustained. The best case fatality rates achieved by Mary Theresa and Sipetu since the initiation of the project have been 21% in both hospitals.

Improving the capacity of health workers to perform simple rapid assessment in order to improve the quality of health care will be critical to the success of the new decentralized health system in South Africa. This paper shows how such a process can lead to significant improvements, even in the context of limited resources and amongst staff whose competence has been negatively affected by the apartheid system. While it is too soon to judge the long-term impact, the short term has seen changes in the knowledge, skills, and attitudes of staff, and their achievements have improved their morale and commitment. Recognition by health personnel

of inadequacies in their performance is a crucial first step towards improving it.
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Conclusions

We have demonstrated that, even in remote rural district hospitals, staff can be motivated to design and perform simple health research which can highlight important shortcomings in clinical management and lead to actions to improve quality of care.

Acknowledgements

The authors would like to thank the paediatric staff and matrons of both hospitals. We also thank the District Health Management Team, the Eastern Cape Provincial Coordinator of the INP, and the Regional Nutrition Coordinator for their support for our work in this district. We would also like to thank the SANA (Sustainable Approaches to Nutrition in Africa) Regional Advisor, Academy for Educational Development (Washington DC and Nairobi). This project was funded by the Initiative for Sub-District Support, Health Systems Trust.

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