

Original Article

Quality of care for severe acute malnutrition delivered by community health workers in southern Bangladesh

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Abstract

This study assessed the quality of care provided by community health workers (CHWs) in managing cases of severe acute malnutrition (SAM) according to a treatment algorithm. A mixed methods approach was employed to provide perspectives on different aspects of quality of care, including technical competence and acceptability to caretakers. CHWs screened children at community level using a mid-upper arm circumference measurement, and treated cases without medical complications. Fifty-five case management observations were conducted using a quality of care checklist, with 89.1% (95% confidence interval: 77.8–95.9%) of CHWs achieving 90% error-free case management or higher. Caretakers perceived CHWs' services as acceptable and valuable, with doorstep delivery of services promoting early presentation in this remote area of Bangladesh. Integration of the treatment of SAM into community-based health and nutrition programs appears to be feasible and effective. In this setting, well-trained and supervised CHWs were able to effectively manage cases of SAM. These findings suggest the feasibility of further decentralization of treatment from current delivery models for community-based management of acute malnutrition.

Keywords: community-based management of acute malnutrition, community health workers, child nutrition, severe acute malnutrition, quality of care, mixed methods.

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Introduction

Severe acute malnutrition (SAM), defined by severe wasting and/or nutritional oedema (WHO 1999), reflects recent illness and nutrient deficits and is the cause of 1–2 million preventable child deaths each year (Collins *et al.* 2006a). The South Asia region has among the highest burdens of SAM (Black *et al.* 2008), with Bangladesh experiencing a SAM preva-

lence of 3% (NIPORT *et al.* 2009). A prevalence of 1% has been indicated as a threshold for crisis because of high associated mortality (Mason 2002). Recent advances in the treatment of SAM have enabled children suffering from the condition to recover at home, rather than in crowded therapeutic feeding centres or under-resourced, overburdened health facilities (Collins *et al.* 2006b). Because of its promising performance in promoting recovery from

SAM, community-based management of acute malnutrition (CMAM) has been widely adopted as the most appropriate model of care for children with SAM; the United Nations supports its integration with other community-based health and nutrition activities in areas with a high burden of SAM (Collins *et al.* 2006a; WHO *et al.* 2007).

Until recently, outpatient treatment in CMAM has been delivered by trained health workers from primary care facilities. While this has improved coverage in many settings, there are still issues around community access and sensitization to CMAM programs, including distance to treatment sites and awareness of the program (Guerrero *et al.* 2010).

Community health workers (CHWs), defined as non-professional workers having limited education and coming from the communities they serve (WHO 1987), have direct access to some of the most underserved communities. Health services focused on preventive care commonly rely on CHWs, and their ubiquity at the community level makes them a viable candidate for performing simple, life-saving tasks. With the development of community-based strategies such as community case management (CCM) and community-based integrated management of childhood illness (C-IMCI), the role of the CHW has further expanded to include the provision of curative care (Marsh *et al.* 2008, 2009; CORE Group 2009), and the World Health Organization (WHO) has started to explore the possibility of incorporating treatment of SAM into its IMCI protocols (A. Briand 'unpublished observations').

There are challenges one can anticipate when further decentralizing the treatment of SAM into standard community-based protocols, such as ensuring both that sufficient capacity exists, and that community awareness and coverage are adequate to

ensure program quality (ENN 2011). However, developing an alternative service delivery strategy would also enable CMAM programs to address some of the current issues around community access and sensitization (Guerrero *et al.* 2010). Studies contributing research on models for best service delivery practices in this area are therefore timely.

However, there is limited evidence regarding quality of care outcomes when adding the treatment of SAM to existing community-based services, particularly when delivered by a cadre of CHWs with limited formal training and support. One study in Malawi compared outcomes for cases of acute malnutrition treated by medical professionals to cases handled by community health aids with no medical training. No differences in recovery rate were found between the two groups, with an average 89% recovery rate: an acceptable outcome by international standards (Linneman *et al.* 2007). Another study demonstrated good recovery rates (93.7%) in children with SAM during a famine in Malawi using a CMAM approach delivered by trained community health aids alone (Amthor *et al.* 2009).

Quality of care has different meanings, ranging from technical competence to the interpersonal dimensions of care, and the perceived importance of these dimensions often varies by context and stakeholder (Bruce 1990). Program beneficiaries' awareness of, and satisfaction with, a program are important components of quality of care, influencing participation, compliance and program effectiveness (Gilson *et al.* 1994; Guerrero *et al.* 2010). Therefore, it is crucial to understand the quality of care both from the perspective of care providers and recipients.

This study, the first trial of its kind in Asia, assesses the quality of care provided by CHWs in the provision of CMAM protocols. It takes a mixed methods

Key messages

- CHWs can effectively manage cases of severe acute malnutrition according to a treatment algorithm in a timely manner, before they develop complications.
- Caretakers' trusting relationships with the CHW contributed to community participation in and compliance with the program.
- SAM case management appears to integrate well within the CCM package of services delivered by CHWs, including treatment of acute respiratory infection and diarrhoea.

approach to provide perspectives on different aspects of quality of care. The first objective of the study was to measure CHWs' technical competence in managing cases of SAM according to a treatment algorithm. The second objective was to examine the subjective aspects of quality of care, by assessing elements of CHW service delivery that were valued by caretakers. The results contribute evidence of the effectiveness of CHWs in the management of SAM, with implications for the further decentralization of treatment from current CMAM delivery models.

Methods

Description of the program

This study was conducted to assess an innovative service delivery model for CMAM implemented as part of a broader maternal and child health and nutrition (MCHN) initiative by Save the Children (US) (SCUS) in southern Bangladesh. Initial CHW selection was merit based, with SCUS program personnel ranking candidates on the basis of an exam score assessing basic literacy and numeracy and choosing the candidate with the highest score in her Expanded Program on Immunization (EPI) area. CHWs provided routine preventive care, including counselling and growth monitoring and promotion (GMP). In September 2007 they received an additional 3-day training to implement the CCM of acute respiratory infection (ARI) and diarrhoea, which included diagnosis of illness and treatment protocols that used antibiotics. In June 2009, all CHWs in one Upazila (the second lowest tier of regional administration) of Bhola district, Barisal division, participated in a 2-day

training in the CCM of SAM, which included the diagnosis of SAM and treatment protocols that used ready-to-use therapeutic foods (RUTF) (Valid International 2006). CHWs screened for cases of SAM in children less than 3 years by measuring mid-upper arm circumference (MUAC) during household visits and monthly GMP sessions.

Children identified as having SAM, defined by a MUAC measurement less than 110 mm and/or the presence of oedema (WHO *et al.* 2007), were classified into two groups. Those children suffering from SAM with complications (defined by absent or poor appetite and/or severe illness) received inpatient treatment at the Upazila health complex according to National Guidelines (IPHN *et al.* 2008). After complications were resolved, the child returned to the community for weekly outpatient treatment with RUTF provided by CHWs until recovered. Children suffering from SAM with no complications were monitored and provided RUTF each week by the CHW until recovery (defined by MUAC >110 mm, at least 15% weight gain, and resolution of any oedema for two consecutive weeks), according to study protocol.

Supervision and program attributes are outlined in Table 1. CHWs received support from their regular supervisors in addition to a team of Program Officers hired by SCUS specifically to provide technical guidance for CCM of SAM activities. All CHWs received routine supervision, monthly refresher trainings with a per diem of 200 taka (\$US2.94), and a monthly stipend of 800 taka (\$US11.80). Refresher trainings included a bimonthly 2-day intensive session on technical aspects of the MCHN program, providing a forum for CHWs to ask questions and receive feedback.

Table 1. Supervisory structure and workload

Program characteristic	
Number of CHWs per supervisor	25–40
Monthly supervision visits (excluding questions via phone)	1–2
Frequency of refresher trainings	1 per month
Proportion (hours) of refresher training spent on management of SAM	25% (2–4 h)
Number of households per CHW	150–225
Average household and population size per CHW catchment area	175 HH, 875 pop'n.
Average monthly SAM caseload*	1–2
Number of SAM cases per CHW identified over course of 1-year project	1–4

CHW, community health worker; SAM, severe acute malnutrition. *Includes new and follow-up cases.

Conceptual framework

The inquiry was guided by an adapted quality of care framework (Bruce 1990) incorporating caretaker satisfaction as a critical factor influencing program participation, compliance and effectiveness (Gilson *et al.* 1994; Guerrero *et al.* 2010). This framework, originating from the family planning literature, shares the focus of CMAM programs on alleviating factors constraining community participation in order to increase acceptability and utilization of services (Collins *et al.* 2006a; Guerrero *et al.* 2010). All elements in the framework represent dimensions of patient satisfaction that are commonly used to measure patients' perceived quality of care (van Campen *et al.* 1995). The framework was adapted to include factors related to CMAM programming, and to include impacts expected from achieving intermediate program outcomes such as caretaker awareness and satisfaction. This adapted framework provides a structure with which to describe both subjective and objective aspects of CHWs' quality of care. Figure 1 displays the adapted framework and the hypothesized connections between quality of program services received and program outcomes and impacts.

Service quality is conceptualized as having five interrelated elements that are of importance to care recipients. *Appropriate array of nutrition services* refers to all activities undertaken by the CHW to prevent malnutrition and to manage cases of SAM at

community level. This includes monthly weight measurement at GMP sessions, screening for SAM and diagnosis with a MUAC measurement, provision of antibiotic and folic acid for cases of SAM, and delivery of RUTF until child's recovery from SAM. *Information given* refers both to preventive and curative nutrition counselling with caretakers, and the CHWs' ability to answer caretakers' questions. *Technical competence* refers both to an objective assessment of CHWs' ability to manage cases of SAM using a quality of care checklist, and caretakers' impressions of CHWs' ability to manage cases of SAM. *Interpersonal skills* encompass the caretakers' trust and willingness to listen to the CHW. *Follow-up mechanisms* include points of interaction with CHWs and caretakers to follow up on the child's nutrition status, including household visits and GMP sessions. All five elements were evaluated in this analysis.

Quantitative methods

Trained surveyors assessed CHWs' performance with a quality of care checklist during observation of management of a case of SAM.

Sample description

A total of 197 CHWs were randomly selected out of a total population of 261. Because of low SAM preva-

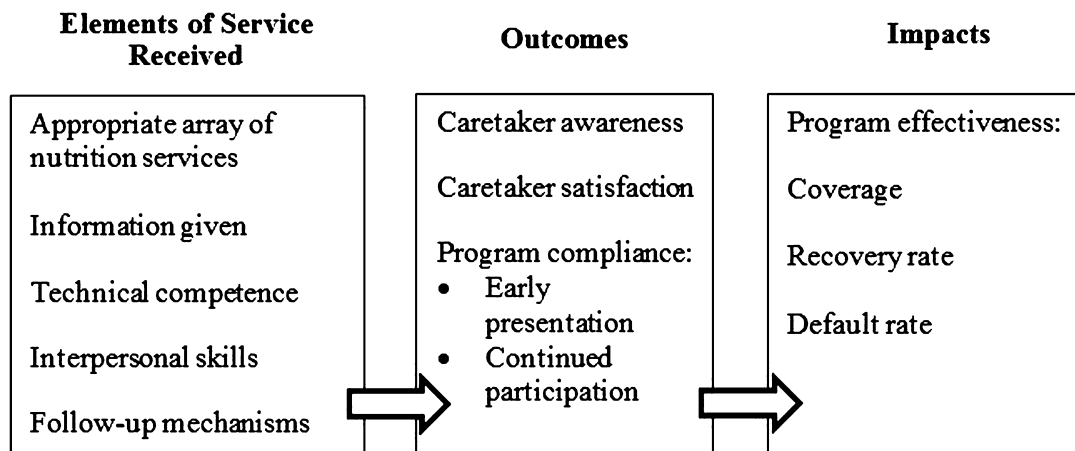


Fig. 1. The quality of service experience and its outcomes and impacts. Adapted from Bruce (1990).

lence during the months of data collection, it was not possible to conduct a case management observation with every CHW in this sample. Efforts were made to observe all CHWs who had a child with SAM in their catchment area during this time. In total, 55 CHWs were assessed. As these 55 CHWs were not randomly selected, but rather represent a subsample of randomly selected CHWs implementing the CCM of SAM, the possibility that their personal characteristics influenced their score outcomes was explored during data analysis.

Data collection

A cross-sectional survey of CHWs and case management observations were conducted between February and April 2010. The survey contained questions regarding CHWs' demographic and professional characteristics. The case management observation used a quality of care checklist based on a CMAM classification algorithm and treatment protocols adapted to this program (Collins 2004). Each checklist item had a categorical score ('correct' or 'incorrect') with an option to mark 'not applicable' if an item did not apply to a particular case. Informed consent was obtained from all CHWs participating in the study.

Data were collected by 19 surveyors who were also CHW supervisors. They were chosen for their existing relationship with CHWs, and were expected to put CHWs at ease compared with an unfamiliar third party observing their work. Standardization training was conducted prior to data collection with role plays and discussion around 'good' vs. poor practice for each checklist item. Training included a discussion around the importance of 'negative' outcomes in research, to assure surveyors that negative scores from CHWs would not reflect poorly on their own job performance.

Qualitative methods

Focus group discussions (FGDs) with caretakers were used to contextualize CHWs' performance by assessing aspects of service delivery that were valued by caretakers.

Sample description

FGDs were conducted with caretakers of children accessing SAM treatment. Each FGD included between six and eight caretakers (Krueger & Casey 2008) resulting in a total of 29 caretakers. CHWs or supervisors selected between one and three caretakers per CHW catchment area using convenience sampling. Caretakers living near the community site where the FGD was held were favoured because transportation costs were not reimbursed. The sample represents caretakers receiving services from a variety of CHWs. No identifying or socio-demographic information was collected from caretakers; however, many were illiterate, and were believed to have low education and income levels.

Data collection

Caretakers developed their own indicators of quality of care and ranked them according to perceived importance. The researcher and a study assistant facilitated discussions using a semi-structured questionnaire. Each session was tape-recorded, and notes were taken. Caretakers were informed that the research team was not affiliated with SCUS, that all comments would be kept anonymous, and that the purpose of the research was for a general interest in their views. Informed consent was obtained from all caretakers participating in the study.

Data analysis

Quality of care checklist scoring

Based on their performance on the checklist, a maximum possible score was calculated for each CHW as total correct responses divided by total applicable items. 'Good quality' was defined as achieving at least 90% error-free case management, a standard used in other CCM quality of care analyses (Degefe *et al.* 2009). Oedema and SAM with complications was rare; therefore, checklist items assessing CHWs' competency in measuring oedema grades and referring complicated cases were not included in final score calculations. Given the high overall performance of CHWs on all checklist items including

oedema assessments, excluding these items did not strongly influence the average score.

Statistical analysis

Descriptive statistics were calculated for CHWs' demographic and professional characteristics. Significance tests were conducted to determine whether there were statistical differences in these variables between assessed and non-assessed CHWs that could bias the findings. A Wilcoxon signed-rank test was used to assess the difference between median checklist score and the standard quality score of 90%. A binomial test was used to calculate a 95% confidence interval (CI) for the proportion of subjects scoring 90% or better on the checklist. The statistical software 'R' was used for binomial tests (R Development Core Team 2010). Stata statistical software version 11.0 was used for significance tests (StataCorp 2009).

Qualitative analysis

Results from FGDs were coded and themes were compiled into a comprehensive matrix in Microsoft Word (Microsoft 2010) to observe patterns related to caretakers' perceptions of CHW service delivery (Miles & Huberman 1994). Similarly, findings from ranking exercises were compiled into a matrix and then simplified by including only those indicators mentioned in two or more FGDs and sorting indicators by median rank. Finally, results were organized by, and described according to, the elements in the quality of care framework (Fig. 1).

Results

Sample characteristics

Table 2 presents demographic and socio-economic characteristics of the overall sample, and compares CHWs who were assessed with the quality of care checklist and those who were not. On average, CHWs were 28.5 years old, married and had completed at least eighth grade education. One quarter attended madrasa schools. Their households had five to six members, including two children. Less than one

quarter of these women did other work for pay; those who did were mainly engaged in semi-skilled labour such as poultry rearing and tailoring. One-half of the sample had electricity in their homes, while nearly all had a rudimentary tin roof.

Because of low SAM prevalence during the months of data collection, not all randomly selected CHWs could be assessed while managing a case of SAM. There were few significant demographic differences between assessed and non-assessed CHWs. Occupation patterns differed between groups, with a higher percentage of assessed CHWs engaged in paid work outside the home. Differences in husbands' occupation were significant, with spouses of non-assessed CHWs engaged in more professional and technical work than spouses of assessed CHWs who undertook more unskilled and semi-skilled labour. These findings suggest that the assessed CHWs in this analysis may come from poorer households than their non-assessed counterparts. Further, assessed and non-assessed CHWs did not differ significantly in their perceptions of work support and other professional characteristics (data not shown). In summation, assessed and non-assessed CHW groups may be different from one another; however, these differences do not suggest that assessed CHWs were more skilled.

Quantitative results

CHWs' management of cases of SAM without complications according to algorithm was of high quality, with 58.2% of the sample (32 out of 55 CHWs) achieving 100% error-free case management. The median score of 100% was significantly different from the standard high quality score of 90% (Wilcoxon signed-rank: $z = 5.56$, $P < 0.001$). A majority of assessed CHWs (89.09%; 95% CI for proportion: 77.75–95.89) achieved scores above 90% on the checklist. Results are summarized in Table 3.

CHWs assessed MUAC accurately, and delivered the correct education messages to caretakers of children with SAM. Small numbers of CHWs did not administer antibiotics and folic acid when they should have; similarly, some forgot education messages such as reminding to breastfeed before giving RUTF.

Table 2. Demographic and socio-economic characteristics of CHWs

Characteristic	Overall	Assessed	Non-assessed
	<i>n</i> = 197	<i>n</i> = 55	<i>n</i> = 142
	100%	27.9%	72.1%
Background			
Age – mean ± SD	28.5 ± 6.0	28.4 ± 5.8	28.5 ± 6.1
Marital status:			
Married	96.4%	96.4%	96.5%
Widowed	2.5%	1.8%	2.8%
Divorced	0.5%	0	0.7%
Separated	0.5%	1.8%	0
Highest completed education:			
Primary (0–5)	0.5%	0	0.7%
Lower secondary (6–8)	54.3%	67.3%	49.3%
Secondary (8–10)	36.0%	29.1%	38.7%
High secondary (11, 12)	7.6%	3.6%	9.2%
Graduate (Bachelors)	1.5%	0	2.1%
Education system:			
General	71.1%	63.6%	73.9%
Madrassa	28.9%	36.4%	26.1%
Household size – mean ± SD	5.4 ± 2.4	5.7 ± 3.1	5.3 ± 2.1
No. of children – mean ± SD	2.0 ± 0.9	2.1 ± 1.0	1.9 ± 1.0
No. of male children – mean ± SD	1.0 ± 0.8	0.9 ± 0.8	1.0 ± 0.8
Socio-economic status			
CHW does other work for pay*	(<i>n</i> = 195)	(<i>n</i> = 55)	(<i>n</i> = 140)
No other paid work	83.6%	72.7%	87.9%
Skilled/semi-skilled work	13.3%	20.0%	10.7%
Professional work	3.1%	7.3%	1.4%
Husband's occupation level***	(<i>n</i> = 144)	(<i>n</i> = 43)	(<i>n</i> = 101)
Does not work for money	5.6%	4.7%	5.9%
Unskilled work	10.4%	23.3%	5.0%
Semi-skilled/skilled work	68.8%	72.1%	67.3%
Professional/technical work	15.3%	0	21.8%
Homestead has electricity	(<i>n</i> = 196)	(<i>n</i> = 55)	(<i>n</i> = 141)
Homestead has rudimentary roof (tin)	48.0%	50.9%	46.8%
	99.5%	100%	99.3%

CHW, community health worker; SD, standard deviation. * $P < 0.05$, *** $P < 0.001$; for significance of difference between CHW groups (Wilcoxon Mann–Whitney test, Pearson's chi square, Fisher's exact test or *t*-test for independent samples as appropriate).

Qualitative results

Indicator ranking matrix

Table 4 summarizes the aspects of CHW services that were valued by caretakers, ranked according to their perceived importance, with 1 being very important and 8 being less important. Items prioritized by caretakers reflect several elements of service provision from the quality of care framework (Fig. 1). The provision of RUTF was ranked first in all but one FGD, suggesting that caretakers found the nutritional treatment provided by the CHW to be appropriate. Other ranked indicators representing nutrition services and

follow-up mechanisms included monthly weighing sessions and check-up activities during household visits for sick children. Caretakers appreciated CHWs' friendly, inclusive demeanour, indicating a value placed on interpersonal skills. They also valued information given by the CHW in terms of both general counselling and specific feedback on feeding and hygiene practices.

Caretaker perceptions of service delivery

Several themes emerged during discussions with caretakers related to their perceptions of the quality of

Table 3. Management of cases of SAM without complications

Checklist item	N [†] , % correct
Overall % error-free case management: N, median (range)	55, 100%*** (66.7–100)
<i>1. Type of child:</i>	
a) New SAM case	32, 58.2
b) Follow-up SAM case	23, 41.8
<i>2. MUAC measurement</i>	
a) Keep work at eye level.	55, 100
b) Remove clothing covering arm.	55, 100
c) Find approximate midpoint of child's arm.	55, 100
d) Make sure arm is relaxed at child's side and wrap tape around arm.	55, 100
e) Make sure tape is flat and not too tight or loose.	55, 96.4
f) Read measurement number on MUAC strip.	55, 96.4
<i>3. Oedema check (in sick children only):</i>	
a) Press firmly on top of child's feet for 3 s.	24, 100
b) Release, and feel pressed spot for indentation.	24, 95.8
<i>4. SAM diagnosis:</i>	
a) MUAC <110.	55, 98.2
b) Presence of oedema.	45, 100
c) Check for SAM with or without complications according to algorithm.	
1. Check for danger signs.	55, 100
2. Check for chest in drawing.	55, 100
3. Count respiratory rate according to protocol.	55, 100
4. Take temperature.	55, 98.2
5. Examine for dehydration.	55, 92.7
<i>5. Check appetite:</i> Give packet of RUTF to child.	55, 98.2
<i>6. If SAM without complications identified:</i>	
• Antibiotic given according to protocol	55, 89.1
• Folic acid given according to protocol	55, 92.7
• RUTF given and amount calculated according to protocol	55, 96.4
<i>7. Delivery of education messages:</i>	
a) RUTF should replace the regular diet (except for breast milk)	55, 92.7
b) RUTF should not be shared with siblings or other children.	55, 96.4
c) Give frequent feedings with small amount of RUTF (up to eight times per day)	55, 98.2
d) Any child 6-12 months who is breastfed should receive breast milk first then RUTF.	54, 87.3
e) Give adequate amounts of safe water with RUTF.	55, 96.4
f) Do not mix water in the RUTF packet.	55, 92.7
g) Give the medicine provided by your CHW two times per day for 5 days.	55, 92.7
h) Seek immediate advice from the CHW if your child experiences any allergic reactions after consuming RUTF.	55, 92.7

CHW, community health worker; MUAC, mid-upper arm circumference; RUTF, ready-to-use therapeutic food; SAM, severe acute malnutrition. *** $P < 0.001$; for significance of difference between reported median score and a hypothesized median score of 90% (Wilcoxon signed-rank test). [†]Because some items were designated 'not applicable' for a particular case, not every CHW implemented every measure on this checklist and for some items $N < 55$.

services received, many of which support findings detailed by the indicator ranking exercise above.

Interpersonal skills and technical competence

CHWs came from the same community, and caretakers felt they were 'very close to us mentally'. But being literate, CHWs could also 'read papers' and subsequently 'know many systems'. This combination of familiarity and learnedness inspired the community's

trust. The CHW gave 'good answers' to questions about the unfamiliar treatment their children received. Caretakers expressed their appreciation through actions like saying prayers for CHWs at mosque.

Information given and follow-up mechanisms

Caretakers regularly praised CHWs' dedication to sharing their knowledge. This indicated a trusting

Table 4. CHW services indicator ranking matrix

Indicators of CHW services	Median rank (range)	# FGDs reporting
Brings RUTF for child	1 (1–2)	4
Gives us advice for our children*	1.5 (1–2)	2
Treats everyone nicely	3 (2–4)	2
Comes to our house and takes care of our children	3 (2–7)	4
Checks for problems in child (temperature, breathing count, oedema)	4 (4–6)	4
Helps us understand how to feed child using the Promise Sheet [†]	5 (3–7)	3
Taught us to wash hands before feeding child	5.5 (5–6)	2
Weighs child monthly at GMP session	7.5 (7–8)	2
Tells us to give oil and khichuri to child	8 (6–8)	3

CHW, community health worker; FGD, focus group discussion; GMP, growth monitoring and promotion; RUTF, ready-to-use therapeutic food. Number of FGDs = 4. Each group listed 7–9 indicators for ranking. Only those indicators mentioned in two or more FGDs were included. *This represents general advice, not specifically related to feeding. [†]A communication tool regarding feeding practices developed for CHWs by Save the Children (US).

relationship with the CHW, developed over the 5-year program. The CHW gave information about feeding and hygiene that was ‘new’ and ‘different’ from that which they had heard from their families, and explained the health benefits of these practices. She provided practical demonstrations, and helped husbands and other family members to understand the advice. CHWs made regular household visits to share this advice and follow up on questions: ‘*sometimes she came two times per day to our houses to help us. Our children are well now.*’

Appropriate array of nutrition services

In general, caretakers had no trouble understanding and applying the CHW’s advice. Their children found RUTF to be acceptable and enjoyable, eating it more easily than their regular food. However, they found it difficult to spend the amount of time with their child that the CHW recommended, especially for responsive feeding. ‘*Sometimes we cannot follow apa’s advice because we forget it, and we have lack of time to follow it.*’ Further, for those complicated cases of SAM that the CHW referred to the health facility for treatment, caretakers said they ‘*feel pleasure*’ if they can avoid going to the hospital.

Caretakers were pleased about their children’s fast recovery from SAM. Previously ‘*attacked*’ by illness, their thin children were ‘*corrected quickly*’ and ‘*became round*’ after treatment. However, for many it was a challenge to maintain the child’s weight gain

after discharge. Children ‘*still want RUTF, but not other food*’, and families could not ‘*give other food to their mouths*’. According to caretakers, after discharge their children ‘*became thin*’ ‘*like earlier*’ due in part to a return to regular household food, lack of time for responsive feeding and exposure to infection.

Discussion

This study demonstrates that in this context, well-supervised and trained CHWs were able to deliver CMAM with high quality of care, and were trusted by the community. This community acceptance promoted early case-finding, likely reducing the number of cases of SAM with complications needing medical treatment. The high-quality service provision and community satisfaction and demand cohere with effectiveness outcomes from a linked analysis of outcome data for this program, including high coverage (89%), low default (7.5%), high recovery (92%) and low mortality rates (0.1%) (Sadler *et al.* 2011).

CHW technical competence

CHWs managed cases of SAM without complications according to algorithm with high quality of care. A majority of CHWs (89.09%, 77.75–95.89) achieved 90% or higher error-free case management. This finding is in line with those from other studies suggesting that community-level workers can successfully manage SAM (Linneman *et al.* 2007; Amthor

et al. 2009). Field trials have also found CHWs to be capable of effectively diagnosing and treating neonatal sepsis according to a clinical algorithm, and treating severe disease in neonates with a lower case fatality rate than other available treatment options (Bang *et al.* 2005; Baqui *et al.* 2009). Village health workers in India correctly diagnosed 89% of neonatal sepsis cases, and correctly treated 81% (Bang *et al.* 2005). One study in Bangladesh validating CHWs' ability to correctly identify sick neonates and manage certain illnesses according to a clinical algorithm showed strong agreement between CHWs' and physicians' classifications (Darmstadt *et al.* 2009). In Nepal, community members trained in the antimicrobial treatment of pneumonia achieved significant reductions (28%) in child mortality due not only to pneumonia but also to diarrhoea and measles (Pandey *et al.* 1991).

Caretaker perceptions of service delivery

High scores on the quality of care checklist demonstrate the strong technical competence of CHWs; positive caretaker perceptions of quality of care support these results. Several aspects of quality were particularly important to caretakers. Their prioritization of CHWs' provision of RUTF in ranking exercises suggests that communities saw the need for this treatment and recognized that RUTF was appropriate for the condition. This was due in part to the rapid recovery of children with SAM, which has been found in other studies to influence positive community perceptions of CMAM programs and to enhance participation (Collins *et al.* 2006b). Further, services were delivered to the doorstep, an important factor given women's limited mobility in these areas. These elements supported awareness of and access to the program, which have been found to be key determinants of community participation (Rosato *et al.* 2008), and therefore program utilization and coverage, in other studies (George *et al.* 2009; Guerrero *et al.* 2010).

One complaint was linked to caretakers' perceived inability to maintain their child's weight after program exit, although re-admission to the program occurred in only 2.5% of admissions (Sadler *et al.* 2011). While their children may not have relapsed

into SAM, some caretakers were displeased that they could not maintain their discharge weight. This finding points to the utility of delivering care for SAM within a broader package of community-based MCHN interventions, all aiming to prevent malnutrition and sustain good nutritional status, thereby complementing efforts to treat acute malnutrition in those few children for whom this is necessary.

Discussions of CHW competence often referred to their trusting relationship with caretakers. Other studies have also found that care recipients are most comfortable with health workers with whom they share common attributes (Bruce 1990; Bang *et al.* 1994; Rosato *et al.* 2008), and that care recipients place greater importance on care providers' attitudes and length of contact time than on more traditional elements of quality care such as technical skills (Sung 1977; Bruce 1990; Gilson *et al.* 1994; George *et al.* 2009). Further, CHWs visited the houses of children with SAM once a week or more. These regular follow-up visits, a common factor in community perception of high quality care (Bruce 1990), may also be particularly important for SAM treatment in that they provide a continued mechanism to raise awareness about the importance of proper care and treatment (Guerrero *et al.* 2010).

Generalizability

Several contextual factors promoted the successful results seen in this program, and may influence generalizability to other settings. This intervention was built on the skills of a cadre of CHWs with more than 3 years of experience in the MCHN program, and 2 years of experience implementing CCM of ARI and diarrhoea. They had encountered severely malnourished children via monthly weighing sessions, and knew that these children did not always recover with counselling alone. Training them in the CCM of SAM expanded their understanding of malnutrition and provided an option for effectively treating these children.

CHW motivation is a complex phenomenon, resulting from many contributing intrinsic and extrinsic factors including training, payment, socio-economic status and a supportive work environment (Bhatta-

charyya *et al.* 2001). This program supported CHW technical competence via training and supervisory mechanisms. Further, CHWs received remuneration, and were respected by their communities. Taken together, these factors contributed to a motivated and mobilized cadre of workers, a critical factor for promoting community participation and program effectiveness (Rosato *et al.* 2008).

The level of support required by CHWs went through two distinct phases. In the first 2–3 months of implementation, they required more supervision. During this period, they received regular supervisory visits, and were further encouraged to call supervisors for assistance if needed when managing a case of SAM. Additionally, technical issues were discussed during monthly refresher trainings. After this initial phase, according to discussions with program management, CHWs were technically sound and confident, and support shifted more to administrative aspects like record keeping. During discussions, program managers suggested that quality of care could be maintained with fewer supervisors, if tasks such as data entry were shifted from supervisor's workloads, allowing them more time for direct CHW supervision. Supervisory ratios in this program were below optimal levels, at 1:25–40 (Table 1) compared to 1:10–20 (Mason *et al.* 2006). Further research could determine optimal levels of CHW support, including workloads (both for CHWs and their supervisors), training frequency, and level and type of incentive (whether financial or non-financial), to maintain quality of care at reasonable costs.

This study has several limitations. First, data were collected during a dry season with low SAM prevalence. It is possible that increases in caseload during the rainy season may impact quality of care, although individual CHWs experienced low SAM caseloads on average over the course of the year (Table 1). The presence of researchers during FGDs may have introduced some observer bias into the qualitative data collection process (Campbell *et al.* 1995). However, discussions were structured in such a way as to evoke honest responses, with opinions elicited from all caretakers and any differences in opinion discussed. Additionally, it is possible that the observation of case management sessions by supervisors may have

affected CHWs' quality of care outcomes (Rowe *et al.* 2002, 2006). However, CHWs in this program were accustomed to supervisory observation during household visits. Further, given a lack of variability in quality of care outcomes in this analysis, we were unable to statistically analyse factors related to quality. Future studies could employ a longitudinal study design in order to provide further information on the context of quality service delivery by CHWs. Finally, this work was enabled by CHWs' ability to prescribe antibiotics, an important component of the medical protocol to treat SAM (Valid International 2006) without which effectiveness and therefore quality might suffer, although this is currently under debate (Trehan *et al.* 2010; Lazzarini & Tickell 2011). These findings can thus be generalized to those contexts where CHWs can prescribe antibiotics.

Conclusions and future directions

Integration into the CCM package of services appears to support high quality of care for cases of SAM, and therefore to promote program effectiveness. CHWs achieved good quality of care while managing cases of SAM without complications according to a treatment algorithm. A high level of trust for CHWs among caretakers contributed to community participation and compliance with the program. This suggests that well-trained and supervised CHWs can effectively manage SAM, and that policy change such as enabling CHWs with training and resources that supports this intervention should be promoted.

CHWs could provide a mechanism for delivery of high-quality treatment to large numbers of children in countries like Bangladesh where prevalence of SAM is high but access to health facilities is low. The integration of CHWs into the recently developed 5-year national plan for the health, nutrition and population sector in Bangladesh should be considered by policy makers.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

CP, JC, HA and KS designed the research; CP and KS conducted the research; CP, JC, HA and KS analysed the data; CP, JC, HA and KS wrote the paper; and CP had the primary responsibility for the final content. All authors read and approved the final manuscript.

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