



Assessment of the adherence of community health workers to dosing and referral guidelines for the management of fever in children under 5 years: a study in Dangme West District, Ghana

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Background: Community health workers (CHW) manage simple childhood illnesses in many developing countries. Information on CHWs' referral practices is limited. As part of a large cluster-randomised trial, this study assessed CHWs' adherence to dosing and referral guidelines.

Methods: Records of consultations of children aged 2–59 months with fever managed by CHWs were analysed. Appropriate use of drugs was defined as provision of the correct drug pack(s) for the child's age group. Symptoms requiring referral were categorised into danger signs, respiratory distress and symptoms indicating other illnesses. Multivariate logistic regression examined symptoms most likely to be noted as requiring referral and those associated with provision of a written referral.

Results: Most children (11 659/12 330; 94.6%) received the appropriate drug. Only 161 of 1758 (9.2%) children who, according to the guidelines required referral were provided with a written referral. Not drinking/breastfeeding, persistent vomiting, unconsciousness/lethargy, difficulty breathing, fast breathing, bloody stool, sunken eyes and pallor were symptoms significantly associated with being identified by CHWs as needing referral or receiving a written referral.

Conclusions: CHWs' adherence to dosing guidelines was high. Adherence to referral guidelines was inadequate. More effort needs to be put into strengthening referral practices of CHWs within comparable community programmes.

Keywords: Fever, Children, Community health worker, Guideline adherence, Referral, Ghana

Introduction

Childhood morbidity and mortality rates in Africa remain relatively high, and mortality is contributed to by diseases such as malaria (16%), pneumonia (18%) and diarrhoea (18%).¹ Many health systems have been unable to reach communities where childhood mortality occurs most. Therefore, as part of efforts to improve child survival, lay persons commonly called community health workers (CHW) with little or no previous education in health have been trained to manage these diseases within their own communities.^{2–4} CHW programmes have resulted in increased appropriate case management for diseases such as malaria and pneumonia,^{5–7} with a reduction in the severity of morbidity and a reduction in childhood mortality.^{6,8,9}

In general, care provided by CHWs has been limited to uncomplicated illnesses. Children assessed to have signs of severe illness or other diseases that CHWs have not been equipped to treat must be referred to appropriate health facilities. Few studies have reported on the adherence of CHWs to referral guidelines. Kelly et al. reported that 17% of severely ill children were not referred by CHWs.¹⁰ Yeboah-Antwi et al. reported a non-referral rate of 6.8% by CHWs.⁷ Ghana's experience with CHWs in recent years has been focused on uncomplicated illnesses, especially malaria, primarily because malaria is the leading cause of childhood morbidity and mortality after the neonatal period.^{11–13} These studies focused on the ability of CHWs to manage uncomplicated illness and provided little information on their ability to correctly identify symptoms requiring

referral or on the provision of written referrals. As part of a cluster-randomised trial, to be reported in detail elsewhere, lay persons (whom we called community-based agents but are hereafter referred to as CHWs) were trained to treat children aged 2–59 months with fever with either an antimalarial drug (artesunate/amodiaquine alone; AAQ arm) or together with the antibiotic drug amoxicillin (AAQ + AMX arm) within the home management of malaria strategy. The aim of the trial was to determine the added impact on childhood mortality of adding an antibiotic to an antimalarial in the treatment of fever among children. Here we report on the adherence of CHWs to the dosing and referral guidelines.

Methods

Study site

The trial was conducted between January 2006 and December 2009 in Dangme West District, a rural coastal district in Ghana. It is 1700 km² in size, has 376 communities and a total population of about 110 000. Inhabitants are made up mostly of farmers, fishermen and small-scale traders. There are a number of fish farms and crop farms. In 2006, there were four government health centres and six community clinics but no district hospital. Only one health centre had a functioning laboratory and none had radiography facilities. In 2009, this health centre was upgraded to a district hospital. Before 2009, malaria was treated presumptively and severely ill children were referred to hospitals in neighbouring districts. Private care was available through two private clinics, two maternity homes, two pharmacies and 42 drug retail shops. Under Ghana's national health insurance system, children under 5 years with acute illnesses are exempted from user fees. Currently, non-insured children pay Gh¢ 8.00–8.50 (US\$5.6–6.0) for consultation treatment with artesunate/amodiaquine or amoxicillin, respectively.

Study design

This study assessed the adherence of CHWs to dosing and referral guidelines. The study population comprised trained CHWs and children aged 2–59 months with fever as reported by the caregivers. Records of consultations of these children were included in this analysis. Consent to conduct the study was obtained from the Regional and District Health Administrations, and written informed consent was obtained from the caregivers with children aged 2–59 months old in the district.

Trial and intervention in brief

This was a cluster-randomised, stepped-wedge, controlled, open trial that measured the impact on childhood mortality of the use of an antimalarial versus an antimalarial plus an antibiotic for the treatment of fever among children aged 2–59 months (inclusive) within the home management of malaria strategy.¹⁴ Within this strategy, fever in children in areas where diagnostic facilities are lacking are considered as being due to malaria and are treated accordingly. All communities in the district, many of which were >5 km away from health facilities, were grouped into 114 clusters of approximately 100 children. Using stratified randomisation and cluster allocation performed in

Microsoft Excel 2007 (Microsoft Corp., Redmond, WA, USA), clusters were randomised in two phases to either the AAQ or AAQ + AMX arms. Trained CHWs dispensed AAQ or AAQ + AMX after assessing children taken to them by their caregivers. Information, education and communication messages and drama were developed during the first preparatory year of the trial together with social scientists with backgrounds in health education and medical anthropology. Information, education and communication targeted community leaders, community members and community caregivers. Health staff were trained in order to receive and record CHW referrals at the health facility.

Preparation

Existing national and Integrated Management of Childhood Illness (IMCI) guidelines were used to develop CHW reference material and data collection forms for recording the sick child encounter (SCE), referring the child and recording drugs.^{15,16} The SCE form was semipictorial in order for CHWs to easily identify appropriate fields for capturing symptoms presented by the sick child. SCEs were the source of data and CHWs were to use a new SCE form per consultation. Written referrals were provided in duplicate (two on one sheet); one to be retained by the CHW and one to be given to the caregiver to take to the health facility. Drugs, each pack containing a full treatment course, were pre-packaged and colour coded for different age groups. AAQ treatment was given once per day for 3 days, packaged in an orange drug pack for children aged 2–11 months and in a pink drug pack for children aged 12–59 months. Stickers with a crawling child and a pre-school child were put on the boxes to facilitate easy identification. Dispersible tablets of amoxicillin in three different aluminium foil blister packs were given twice per day, also for 3 days.^{17–19} The first dose was given under CHW supervision.

Training

Lay persons, all of whom had no training in formal health care, were selected from the communities they lived in, which were often >5 km away from a health facility. Of the 660 CHWs, 81 (12.3%) had been engaged in a community trial the year before, but none had previously dispensed artesunate/amodiaquine or amoxicillin. None had any formal education in health care.

Using treatment guidelines developed for this study, CHWs were given 3 days' training on assessing, treating and referring a child appropriately, counselling caregivers on how to give the drugs to their child, signs of worsening illness and when to return, and were taught to keep basic records. This was their main training; however trained field supervisors provided additional support, correcting CHWs but not forms during fortnightly supervisory visits. CHW participation in the trial was voluntary and without financial remuneration. CHWs received a T-shirt and blood pressure checks once and their transport fares were remunerated during review meetings. Training was conducted in commonly spoken local dialects for CHWs from clusters randomised to the same intervention arm.

Assessment of the children

Table 1 outlines the CHWs' responsibilities and expected actions to be carried out at the CHW's home during the client-provider

Table 1. Key actions in the assessment of children to be undertaken by all community health workers related to referral

Category	Symptom	How information was to be obtained	Action
Danger signs	Not drinking	Offer water/observe breastfeeding	Refer
	Persistent vomiting	Ask caregiver	Refer
	Convulsion	Ask caregiver	Refer
	Lethargic/unconscious	Observe child/ask caregiver; clap near child's ears	Refer
Respiratory distress	Difficulty in breathing	Observe child/ask caregiver	Refer
	Fast breathing	Count respiration rate for 1 min: ≥50 breaths/min in children aged 2–11 months; ≥40 breaths/min in children aged 12–59 months	Refer
	Chest indrawing	Observe under ribs for indentation on inhalation	Refer
Other illnesses	Stridor	Listen to child's chest for noisy breathing	Refer
	Diarrhoea	>5 days	Refer
	Bloody stool	Ask if blood in stool	Refer
	Sunken eyes	Observe child and ask	Refer
	Skin pinch	Pinch abdomen/observe skin recoil	Refer
	Weight loss	Observe and ask	Refer
	Palmar pallor	Observe child's palm	Refer
	Swollen feet	Indent feet with thumbs	Refer

encounter. A history was taken focusing on the presence and duration of fever and other symptoms. In line with the main objective of the trial, children reported by caregivers, eligible to receive study drugs, were provided AAQ or AAQ + AMX on account of the fever. Both in the AAQ and AAQ + AMX arms, children with symptoms of severe illness (danger signs) required immediate referral; and children with fast breathing (≥ 50 breaths/min for children < 12 months old and ≥ 40 breaths/min for children 12–59 months old) or who had symptoms of other childhood illnesses that would need additional attention at a health facility were to be noted on the form as requiring referral. Figure 1 shows the flowchart of these actions. All actions were to be taken by CHWs, except drugs that were dispensed per intervention arm. The drug pack(s) provided were to be indicated on the SCE form and caregivers of referred children were to be provided with a written referral and counselled to go to the health centre. CHWs were not to refer verbally but to fill forms in duplicate, one to be attached to the child's SCE form and another to be given to the caregiver to show to staff at the health facility. Health facilities were not required to provide feedback to CHWs as this was deemed extra work but they were asked to retain the referral form for later collection. Children reaching health facilities were treated or referred to neighbouring district hospitals as per national guidelines.

Monitoring and supervision

Community meetings held after CHWs received their training announced the commencement of the intervention. Community members were informed that drugs were provided at no cost and were urged to comply with all CHW instructions. CHWs received a box with relevant forms and drugs. Completed SCE forms and referral forms were kept in a file in the box. CHWs were visited fortnightly by field supervisors who replenished drugs and forms. They used a standardised checklist to assess

completed forms and, if needed, CHWs were advised and corrected (but not the forms). CHWs who consistently made errors in filling forms were visited by a member of the study team and were re-trained on the specific issue noted. Public health facilities within the district were visited fortnightly and the study referral forms were retrieved. Review meetings held yearly for trained CHWs were used to re-train CHWs in assessing and referring children and in dealing with other issues pertaining to the trial.

Analysis

Data from completed SCE forms were entered into Epi Data (CDC, Atlanta, GA, USA) and were analysed using SPSS 16 for Windows (SPSS Inc., Chicago, IL, USA). Adherence to the dosing regimen was determined by comparing the child's age with the drug pack(s) dispensed. Adherence to referrals was assessed by determining the proportion of cases for whom CHWs had indicated on the form appropriately when a symptom for referral was present and those who had provided written referrals. Indications for referral were also grouped into: (i) IMCI-defined danger signs (unable to drink or breastfeed, persistent vomiting, convulsions, lethargy/coma); (ii) respiratory distress symptoms (fast breathing, difficult breathing, chest indrawing, stridor/wheeze); and (iii) symptoms of other illnesses requiring a referral (diarrhoea for > 5 days, bloody stool, sunken eye, slow return on skin pinch, gross weight loss, palmar pallor and swollen feet) (Table 1). A χ^2 test for two-sided p-values at the 0.05 level was used for determining statistical significance. Logistic regression models were used to identify characteristics that enhanced CHW adherence to referral instructions. Covariates included CHW age, gender, education, occupation, training phase and intervention arm, and symptoms. Clustering at the level of the CHW was accounted for by applying random-effects modelling methods, resulting in robust standard errors.

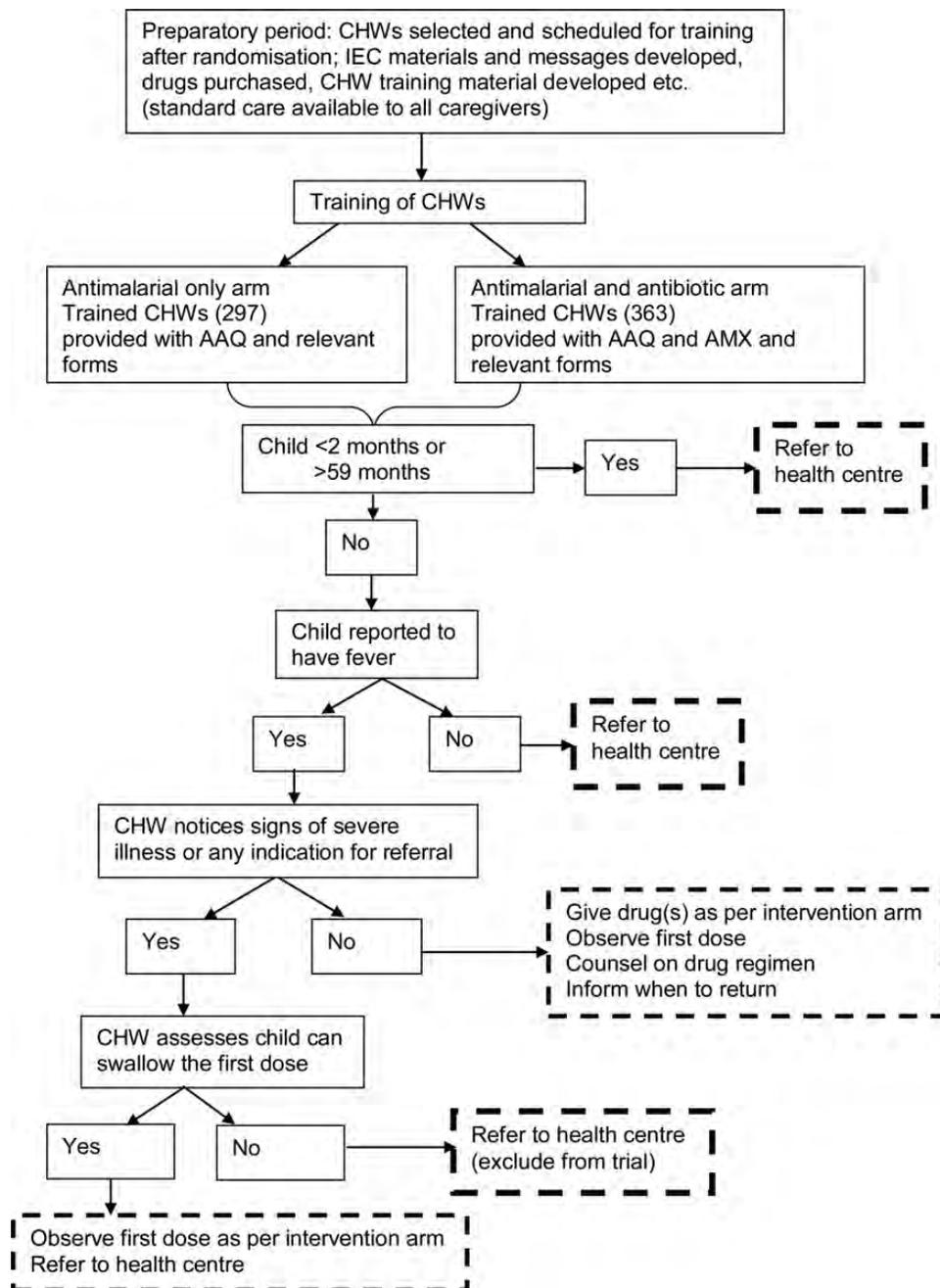


Figure 1. Flowchart of community health workers' (CHW) guide for assessing, treating and referring a child. AAQ: artesunate/amodiaquine; AMX: amoxicillin; IEC: information, education and communication.

Results

There were 660 trained CHWs, 297 in the AAQ arm and 363 in the AAQ + AMX arm; 348 (52.7%) were men and 312 (47.3%) were women, with ages varying from 15 years to 83 years (median age 30 years, IQR = 18 years). From April 2007, when CHWs began attending to children, there were 13 451 sick child consultations, with a male:female ratio of children of 52.7:47.3; and the median age was 25 months (IQR = 25 months). In this analysis, 643 consultations (4.8%) were excluded because of missing

data on age ($n = 424$), over or under age ($n = 90$), no evidence of fever ($n = 87$) and poorly filled forms ($n = 42$). Of the remaining 12 808 febrile episodes (95.2%), 5990 (46.8%) occurred in the AAQ arm and 6818 (53.2%) in the AAQ + AMX arm. Other demographic characteristics of the CHWs are shown in Table 2.

AAQ and AAQ + AMX were correctly dispensed in most instances: 5543/5622 (98.6%) and 6116/6515 (93.9%), respectively. Table 3 shows details of drugs dispensed by age categorisation and by intervention arm. There were some differences in

Table 2. Demographic characteristics of trained community health workers (CHW) by intervention arm

Demographic characteristic	AAQ arm	AAQ + AMX arm	Total
Total number of CHWs	297	363	660
Age range (years)	15–76	15–83	15–83
CHWs with no education	4/288 (1.4)	4/353 (1.1)	8/641 (1.2)
Primary education	10/288 (3.5)	15/353 (4.2)	25/641 (3.9)
Secondary education	268/288 (93.1)	322/353 (91.2)	590/641 (92.0)
Tertiary education	6/288 (2.1)	12/353 (3.4)	18/641 (2.8)
Unemployed	25/293 (8.5)	39/355 (11.0)	64/648 (9.9)
Self-employed	230/293 (78.5)	267/355 (75.2)	497/648 (76.7)
Professional/clerical work	21/293 (7.2)	31/355 (8.7)	52/648 (8.0)
Student	17/293 (5.8)	18/355 (5.1)	35/648 (5.4)
No. of children attended to by a CHW (range)	1–179	1–291	1–291

Data are number (%), unless otherwise indicated.

AAQ: artesunate/amodiaquine alone; AAQ + AMX: artesunate/amodiaquine + amoxicillin.

Table 3. Appropriateness of drug(s) given by community health workers (CHW) by child age group and intervention arm

Arm	Drug	Age group (months)	Adherence of drugs by intervention arm			Logistic regression ^a	
			Appropriate drug(s) for age [n (%)]	Inappropriate drug(s) for age [n (%)]	Total (N)	OR (95% CI)	p-value
AAQ	Artesunate/amodiaquine	2–11	1069 (96.7)	37 (3.3)	1106	1	
		12–59	4474 (99.1)	42 (0.9)	4516	3.75 (1.08–6.58)	<0.001
AAQ + AMX	Artesunate/amodiaquine ^b	2–11	1180 (98.9)	13 (1.1)	1193	1	
		12–59	5257 (98.8)	65 (1.2)	5322	0.89 (0.42–1.88)	NS
	Amoxicillin ^c	2–11	1223 (99.0)	12 (1.0)	1235	1	
		12–35	3370 (92.9)	256 (7.1)	3626	0.13 (0.07–0.23)	<0.001
AAQ + AMX	Artesunate/amodiaquine and amoxicillin together	36–59	1863 (95.2)	94 (4.8)	1957	0.19 (0.11–0.34)	<0.001
		2–11	1178 (98.7)	15 (1.3)	1193	1	
		12–35	3153 (91.6)	289 (8.4)	3442	0.14 (0.08–0.24)	<0.001
		36–59	1785 (94.9)	95 (5.1)	1880	0.24 (0.14–0.41)	<0.001

NS: not significant.

^aBivariate logistic regression adjusted for clustering at level of CHW.

^bDosing adherence to artesunate/amodiaquine.

^cDosing adherence to amoxicillin.

adherence by age group and drug type. Significantly more children in the AAQ arm (5543/5622; 98.6%) received the right drug for age group compared with the AAQ + AMX arm (6116/6594; 92.8%) (adjusted $p < 0.001$). Overall, in 11 659/12 330 (94.6%) febrile episodes the study drugs were correctly dispensed.

Identification of symptoms requiring referral and provision of a written referral

Table 4 shows the various symptoms in children that required referral and the proportions for which referrals were noted and

written referrals were provided. Table 5 shows the number of referral symptoms a child had, the proportion of cases for whom CHWs identified and indicated correctly on their forms as requiring a referral, and the proportion for whom a written referral was provided. Often CHWs did not recognise when a symptom required referral, thus more symptoms were present on the forms than written referrals provided. Of the 1758 (13.7%) febrile episodes in which children had one indication for referral, only 161/1758 (9.2%) were provided a written referral, with no significant difference by intervention arm adjusted for clustering at the level of CHW ($p = 0.246$). Provision of written referrals was

Table 4. Children who presented with symptoms requiring referral, who were identified correctly for referral and who received a written referral

Categorisation	Symptom	Total (all clusters)		
		No. identified (A) [A/N (%)]	No. noted for referral (B) [B/A (%)]	No. given written referral (C) [C/B (%)]
Danger signs	Unable to drink/breastfeed	881/12 808 (6.9)	68/881 (7.7)	39/68 (57.4)
	Persistent vomiting	461/12 808 (3.6)	140/461 (30.4)	68/140 (48.6)
	Convulsion	142/12 808 (1.1)	52/142 (36.6)	28/52 (53.8)
	Lethargic/coma	237/12 808 (1.9)	89/237 (37.6)	46/89 (51.7)
Respiratory distress symptoms	Fast breathing (2–11 years)	55/2407 (2.3)	21/55 (38.2)	14/21 (66.7)
	Fast breathing (12–59 years)	858/10 401 (8.2)	231/858 (26.9)	120/231 (51.9)
	Difficult breathing	398/12 808 (3.1)	155/398 (38.9)	74/155 (47.7)
	Chest indrawing	55/12 808 (0.4)	21/55 (38.2)	9/21 (42.9)
	Stridor/wheeze	113/12 808 (0.9)	49/113 (43.4)	24/49 (49.0)
Other signs requiring referral	Diarrhoea >5 days ^a	46/1634 (2.8)	12/46 (26.1)	7/12 (58.3)
	Bloody stool	95/12 808 (0.7)	35/95 (36.8)	17/35 (48.6)
	Sunken eyes	170/12 808 (1.3)	76/170 (44.7)	30/76 (39.5)
	Skin pinch	52/12 808 (0.4)	21/52 (40.4)	12/21 (57.1)
	Weight loss	227/12 808 (1.8)	72/227 (31.7)	33/72 (45.8)
	Palmar pallor	302/12 808 (2.4)	142/302 (47.0)	82/142 (57.7)
	Swollen feet	35/12 808 (0.3)	17/35 (48.6)	7/17 (41.2)
	Total (at least one symptom)	2716/12 808 (21.2)	642/2716 (23.6)	308/642 (48.0)

^aThis assessment was done only for children who presented with diarrhoea.

Table 5. Number of referral symptoms children requiring referral had, the proportion for whom referrals were noted and the proportion for whom written referrals were provided

No. of symptoms in a child requiring a referral	No. noted for referral (A) [A/N (%)]	No. provided written referral (B) [B/A (%)]
1	219/1758 (12.5)	82/219 (37.4)
2	176/497 (35.4)	94/176 (53.4)
3	134/254 (52.8)	80/134 (59.7)
4	54/99 (54.5)	24/54 (44.4)
5	28/51 (54.9)	9/28 (32.1)
6	7/22 (31.8)	4/7 (57.1)
7	10/12 (83.3)	7/10 (70.0)
8	8/13 (61.5)	5/8 (62.5)
9	5/7 (71.4)	3/5 (60.0)
12	0/2	
15	1/1 (100.0)	0/1

analysed as per categorisation of the child's condition developed during analysis. Of 1423 children with at least one danger sign, 217 (15.2%) were provided a written referral with no differences by intervention arm (adjusted $p=0.101$). Of the 1337 children

with at least one symptom categorised as respiratory distress, 307 (23.0%) were provided a written referral, however CHWs in the AAQ + AMX arm were less likely to provide written referrals compared with CHWs in the AAQ arm (adjusted $p=0.035$). Of the 544 children with at least one symptom indicating other illnesses, 139 (25.6%) were provided a written referral with no differences by intervention arm (adjusted $p=0.076$).

Review by community health workers

In 7554 of 12 808 (59.0%) febrile episodes, children were brought back to the CHW after 2 days for review, during which caregivers were asked whether the child had recovered or was still unwell. Most of these children (6352/7554; 84.1%) taken to the CHW for review after 2 days were well, but 128/7554 (1.7%) were still unwell. The need for referral was appropriately noted in 52/128 (40.6%) of these children, but few (43/128; 33.6%) were provided a written referral. Significantly more written referrals were provided in AAQ arm (27/75; 36.0%) than in AAQ + AMX arm (16/53; 30.2%) (adjusted $p < 0.001$). Of all children with an indication for referral who returned to the CHW, 963/1022 (94.2%) were well.

Yearly assessment of written referrals

Between 2007 and 2009, CHWs' provision of written referrals to relevant children reduced significantly from 108/495 (21.8%) to 50/332 (15.1%), for children with at least one danger sign

(adjusted $p < 0.043$); from 156/494 (31.6%) to 65/318 (20.4%), respectively, for children with respiratory distress (adjusted $p = 0.007$); but from 54/160 (33.8%) to 39/137 (28.5%) (adjusted $p = 0.420$) for children with other indicators for referral (not significant).

Factors contributing to community health worker adherence

In the multivariate logistic regression model in which clustering was adjusted for at the level of the CHW, adherence to dosing guidelines was associated with the intervention arm to which the CHWs belonged. CHWs in the AAQ clusters were more compliant with the dosing regimen than those in AAQ + AMX clusters (adjusted $p < 0.001$). In similar multivariate models that adjusted for clustering at the CHW level, not breastfeeding, persistent vomiting, unconsciousness/lethargy, difficult breathing, bloody stool, sunken eyes and pallor were symptoms and signs that CHWs significantly identified as requiring referral to a health facility. Apart from sunken eyes, these symptoms were also significantly associated with CHWs providing a written referral (Table 6). Age, gender, education and the phase in which CHWs received training did not emerge as predictors of the provision of written referral (data not shown).

Discussion

Here we report on the adherence of CHWs involved in a trial on the management of fever among children aged 2–59 months in Ghana. CHWs used the SCE form to take a history, examine,

treat or refer a child, and record results. Symptoms were assessed based on what the CHWs recorded on the SCE forms. It was not possible to assess their accuracy in recording symptoms. Examination of several children by CHWs was observed at the start of their functioning, but it was not possible to regularly check later on due to limitations of staff and finances. We acknowledge that this is a limitation and agree that intensive supervision of CHW is very important. Based on ages recorded, CHWs performed well in providing the appropriate drug and dose according to age group, and this was probably enhanced by the use of pre-packaging, colour coding, labelling with stickers and instructive inserts, factors known to improve drug prescribing.^{20,21} Performance regarding referral was inadequate both with respect to recognising the need for referral and providing a referral, despite instructions on when and how to refer and a supply of referral forms.

Community health programmes (CHP) on the management of illness of children vary in several aspects. They may address single diseases, e.g. malaria^{8,9,22,23} or pneumonia,^{6,24} or have a broader approach on fever, respiratory infections, diarrhoea and malnutrition.^{7,10} They vary in activities expected from the CHWs (drug distribution only, health education, collecting information, or diagnosis and treatment). The involved persons vary from trained healthcare workers to trained volunteers and mothers. They may be employed or receive some or no remuneration⁶ (Bangladesh Rural Advancement Committee [BRAC], 2001, unpublished). There are differences in the duration of programmes, sustainability, supervision and quality control. Some CHPs are local, others regional or even national. These variations make the results of CHPs as reported in the literature often difficult to compare and not generalisable, yet lessons can be learnt

Table 6. Multivariate analysis showing symptoms more likely to be noted as requiring a referral and those more likely to receive a written referral from community health workers

	Identified as requiring referral		Provision of written referral	
	Adjusted OR	95% CI for OR	Adjusted OR	95% CI for OR
Unable to drink or breastfeed	0.437	0.307–0.622 ^a	1.493	1.063–2.096 ^a
Persistent vomiting	1.766	1.250–2.495 ^a	3.456	2.256–5.294 ^a
Convulsion	0.731	0.397–1.344	1.353	0.601–3.042
Unconscious/lethargy	1.834	1.246–2.701 ^a	1.834	1.046–3.214 ^a
Difficult breathing	2.532	1.869–3.432 ^a	2.860	1.893–4.320 ^a
Fast breathing	1.286	0.920–1.798	4.058	2.987–5.513 ^a
Chest indrawing	0.980	0.423–2.274	0.740	0.185–2.956
Stridor	1.407	0.804–2.463	2.109	0.954–4.664
Diarrhoea >5 days	1.475	0.786–2.765	16.646	6.791–40.803 ^a
Bloody stool	1.622	0.932–2.823	2.699	1.275–5.713 ^a
Sunken eye	1.956	1.037–3.691 ^a	1.122	0.498–2.528
Skin pinch	1.506	0.502–4.518	1.255	0.180–8.733
Weight loss	0.864	0.462–1.616	1.360	0.478–3.869
Pallor	2.724	1.720–4.315 ^a	5.308	2.901–9.709 ^a
Swollen feet	1.011	0.368–2.776	0.421	0.077–2.299

Reference point = symptom in question not reported.

^aSignificant at 0.05 level.

from the experiences of others. Three studies^{10,23,25} specifically evaluated referral practices of CHWs, whilst others reported other aspects of referral by CHWs.^{26–28} From these studies, the following reasons for suboptimal performance of CHWs relating to referral practices emerge:

- algorithms and guidelines were too complicated
- symptoms and signs on which to refer were ambiguous
- CHWs may be unconvinced about the need for referral themselves
- health staff criticise frequent referrals by CHWs
- caregivers protest against referral; therefore, CHW does not refer
- CHWs, aware of high costs related to hospital care, avoid referrals, or if referrals are given, caregivers may not comply
- knowledge about low satisfaction with care at the referral centre may be a threshold for CHWs to refer.

In the study of performance of CHWs in the management of acute respiratory infection, diarrhoea and malaria in western Kenya by Kelly et al.,¹⁰ CHWs adequately treated 90.5% of malaria cases but often made mistakes assessing symptoms. The complexity of guidelines was an important reason for deficiencies. The authors give a series of simple guidelines and instructions for referral. In Uganda, referral practices were assessed within a home-based management of fever programme aimed at treating malaria.²³ The referral rate was low (8%), but referral completion reached 87%, although 30% of urgent referrals delayed >24 h. Only 50% of patients with pneumonia were urgently referred. Lack of money and waiting for the effect of the malaria drugs to show were the main reasons for delay. They concluded that home-based management needs to include pneumonia and also that lack of regular supervision may contribute to suboptimal performance. In Mali, verbal referral was twice as frequent as notification in the referral book, probably because the CHWs felt that the family would not comply.²⁶ In Sierra Leone, CHWs referred clients with indications for referral (rapid diagnostic test [RDT]-negative or RDT-positive with signs of severe illness, or other illnesses) as directed, however referral completion for children was very low (33/2024; 1.6%) but was much higher (15/17; 88.2%) when signs of severe malaria were present.²⁵

In this study, the recruited CHWs had limited or no experience in health care and were given 3-days training. About 90% had secondary (the equivalent of junior high school) education, 1% had no education and almost 3% had tertiary education. The average duration of CHWs' service was 24.7 months. We did not evaluate actual consultations by CHWs and, although they were supervised fortnightly by trained staff, the quality of their supervision was not assessed quantitatively. Guidelines and instructions were in English but training was in the dominant local languages. During review meetings, problems about the guidelines did not come forward. When asked about poor referral practice, CHWs said caregivers resisted being referred. CHWs might have become complacent with time about referring as a result of perceived efficacy of the study drugs, as 84% of the children who reported back (50% of the total) were well. It is unlikely that shortage of forms played a significant role as CHWs were re-stocked with the same number of referral forms as SCE forms and few CHWs needed to refer more children than they

had SCE forms for. Of the 161 written referrals provided, 140 (87.0%) were retrieved from the health facilities. Caregiver compliance with referral advice will be presented elsewhere.²⁴ The formal health sector receiving referred patients did not consistently retain notes and did not report back and unfortunately personnel and finances did not allow us to redress this. In Mali, a referral system that enabled feedback from the referral centre to CHWs worked well.²⁶

Although only a small percentage of children had an indication for referral, it is still important that CHWs properly identify and refer children with indications for referral in order to prevent illnesses from becoming worse and ultimately childhood mortality. To enhance management of patients with fever within CHPs, diagnostic tools of RDTs for malaria (probably in the future for other diseases) have been introduced in WHO guidelines.²⁹ Carefully designed teaching instructions and regular supervision of CHWs and also of actual consultations as well as strategies to improve referral are required.

Conclusion

Adherence of CHWs to dosing regimen by age group was 94.6%. Only 13% of consultations involved children with symptoms and signs that required referral, but CHW did not consistently note that these symptoms required a referral and the provision of written referrals was inadequate. CHPs need to develop strategies that enhance adherence to guidelines and instructions for referral. Socio-anthropological studies on deficiencies are needed.

Authors' contributions: MAC, JOG, MG and PAK conceived the study; all authors contributed to the design of the study; JA, SAA and MAC analysed the data; PAK, JA, SAA and MAC interpreted the data; MAC, JOG and MG drafted the manuscript; PAK, MA, JN, PA, DK, JA, SAA and MAC critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. JOG and PAK are guarantors of the paper.

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