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Perceived Quality of Care of Community Health Worker and Facility-Based Health Worker Management of Pneumonia in Children Under 5 Years in Western Kenya: A Cross-Sectional Multidimensional Study

Brian I. Shaw,* Elijah Asadhi, Kevin Owuor, Peter Okoth, Mohammed Abdi, Craig R. Cohen, and Maricianah Onono

School of Medicine, University of California, San Francisco, San Francisco, California; Kenya Medical Research Institute, Nairobi, Kenya; United Nations International Children's Emergency Fund, New York, New York; Department of Obstetrics, Gynecology and Reproductive Sciences, University of California, San Francisco, California

Abstract. Integrated community case management (iCCM) programs that train lay community health workers (CHWs) in the diagnosis and treatment of diarrhea, malaria, and pneumonia have been increasingly adopted throughout sub-Saharan Africa to provide services in areas where accessibility to formal public sector health services is low. One important aspect of successful iCCM programs is the acceptability and utilization of services provided by CHWs. To understand community perceptions of the quality of care in an iCCM intervention in western Kenya, we used the Primary Care Assessment Survey to compare caregiver attitudes about the diagnosis and treatment of childhood pneumonia as provided by CHWs and facility-based health workers (FBHWs). Overall, caregivers rated CHWs more highly than FBHWs across a set of 10 domains that capture multiple dimensions of the care process. Caregivers perceived CHWs to provide higher quality care in terms of accessibility and patient relationship and equal quality care on clinical aspects. These results argue for the continued implementation and scale-up of iCCM programs as an acceptable intervention for increasing access to treatment of childhood pneumonia.

INTRODUCTION

Global under-five mortality has greatly declined over the last two decades. To accelerate progress in reducing under-five child mortality, the World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) have recommended the adoption of integrated community case management (iCCM) programs targeting the three major infectious killers of children under 5 years—diarrhea, malaria, and pneumonia—to decrease mortality by 70%, 60%, and 90%, respectively, for these conditions.[1–3] Though traditionally community health workers (CHWs) have been used to deliver a variety of services including health education, maternal health counseling, and medication monitoring (e.g., directly observed therapy),[4] there has been an increasing emphasis on expanding the role of CHWs to address health workforce deficiencies. iCCM trains lay CHWs to assess, classify, and treat uncomplicated cases of diarrhea, malaria, and pneumonia and refer complicated or severe cases in areas that lack access to prompt and effective treatment due to patient level barriers such as lack of affordable transportation to the health facility, and health system level barriers including both direct and indirect costs.[3]

The implementation of iCCM has yielded mixed results in its impact on child pneumonia mortality. Early reports of the efficacy of community management of pneumonia in resource-limited settings were promising with a meta-analysis from 1992 (and subsequent reanalysis using primary data in 2003) showing a statistically significant 30% decrease in total under-five mortality in studies mostly from Asia.[5,6] Later studies have validated that many iCCM programs incorporating pneumonia care performed well on process measures[7–11] and outcomes[12] in the sub-Saharan African context. However, other research has shown that many iCCM programs have not achieved decreases in mortality and fail to perform on intermediate outcomes.[13–16] Especially, troubling is the result of a study in which adding pneumonia management to an existing program of diarrhea and malaria community management led to no statistically significant reduction in mortality in a well-controlled randomized controlled trial.[15] Therefore, it is imperative to perform research that assesses the efficacy and acceptability of iCCM programs.

African policy makers have been hesitant to integrate pneumonia care into the CHW repertoire. In 2014, only 27 of 42 sub-Saharan African countries surveyed were providing "complete" iCCM compared with 35 providing CCM for diarrhea and 32 for malaria.[17] A recent meta-analysis showed that one of the most important aspects of scalable interventions with CHWs is community acceptance.[18] Although some studies have demonstrated that iCCM interventions are acceptable to the community,[19,20] others have shown that programs are resisted if CHWs do not provide services of value.[21] This is important because iCCM programs, which have low utilization and likely low acceptance of services are the least cost-effective, do not lead to decreases in mortality, and may decrease demand for biomedical health care, leading the most marginalized to seek care from ineffective providers.[1,22] In the current study, we sought to determine the level of community acceptance of CHWs capacity to diagnose and treat sick children with pneumonia at the community level when compared with facility-based health-care workers in western Kenya. Building on the work of other groups in East Africa,[23] we used an adapted version of the Primary Care Assessment Survey (PCAS)[24] to evaluate perceptions of caregivers who sought medical attention for their children with pneumonia.

MATERIALS AND METHODS

Study design. The current study was a cross-sectional survey of caregivers of children aged 2–59 months visiting CHWs and facility-based health workers (FBHWs) for management of pneumonia (fast breathing and lower chest in-drawing). It was nested within an implementation science project occurring

*Address correspondence to Brian I. Shaw, School of Medicine, University of California, San Francisco, 513 Parnassus Avenue, S-245, San Francisco, CA 94143. E-mail: brian.shaw@ucsf.edu

in Homabay County, Kenya, in which CHWs were trained to administer oral rehydration salts and zinc for diarrhea, artemisinin combination therapy for malaria, and oral amoxicillin for pneumonia (fast breathing and chest in-drawing). This parent study was commissioned by the Kenya Ministry of Health, supported by the WHO and UNICEF, and registered as ACTRN12614000208606.

Setting. The study was conducted between June and August 2014 in Homabay County in western Kenya. Homabay County has six administrative subcounties: Homa Bay, Ndhiwa, Mbita, Suba, South Rachuonyo, and North Rachuonyo. It is a rural county with a population of approximately one million. Children under 5 years account for 16% of the population.[25] Under-five mortality in Homabay is 130/1,000 compared with the Nyanza average of 91/1,000.[26] The most serious barriers to the availability of child health services in Homabay are related to inadequate human resources. These include prolonged waiting times, poor communication between staff and patients, and negative previous experiences.[27] Despite an adequate number of health facilities, Homabay county suffers from inequities in health worker distribution. Even though there are an average of four doctors and 51 nurses per 100,000 populations, 58% of residents have to travel at least 5 km to the nearest health facility.[28–30] To address the inequitable provision of services and the high under-five mortality, Homabay was selected to receive an iCCM intervention. Homabay has implemented the community strategy for primary care with full coverage of community health units including over 2,600 CHWs and 200 community health extension workers (CHEWs) who have been trained in iCCM. Each CHW covers 50–100 households while 10–20 CHWs are supervised by one CHEW.[29]

Participants. Study participants were caregivers whose children, aged 2–59 months, had received treatment of pneumonia from a CHW or FBHW in the past 8 weeks. To identify caregivers of children treated by CHWs, we used an online registry that tracked all CHW diagnosis, care, and treatment of children. For FBHW treated children, facility-based registers were reviewed. Caregivers were then traced by trained research assistants who also administered surveys.

Sample size. Estimates of the attainable sample size and power calculations for this study were based on historical data from the iCCM program with a pneumonia prevalence of 8.6% and a monthly incidence of 2.0%. Approximately 130 children with pneumonia are seen in the community per month per subcounty in this program. The estimated sample size was 392 caregivers whose children were treated by CHWs and FBHWs with an equal number (196) in each category. This sample size gave us 80% power to be able to detect a 15% difference between perceived quality of care between CHWs and FBHWs.

Sampling. Eligible caregivers from both the online and facility-based registers were purposively sampled and asked to participate in a one-on-one quantitative interview. Facilities were matched to community units from which caregivers who sought treatment at CHWs were sampled.

Data collection. We used the PCAS instrument to collect data. The PCAS is a validated tool comprised of Likert-scale questions designed to assess the attitudes of patients and caregivers of patients towards primary care practitioners in a number of domains.[24] Trained research assistants administered the surveys in the preferred language of the caregiver (either Dholuo, Kiswahili, or English). To minimize bias, the same research assistant administered both the CHW and FBHW surveys when possible.

Main outcome variables. The main outcome of this study is perceived quality of care as measured by the PCAS. Previous studies have shown that a high perceived quality of care is associated with an increased utilization of services and therefore acceptability.[31] The PCAS measures caregivers' perceptions of the quality of primary care through 10 different domains, including detailed measurement of the provider-patient relationship (communication quality, patient trust, provider knowledge of patient, interpersonal treatment, and relationship duration). For this study, we have grouped these 10 domains into three general categories of accessibility, clinical care, and patient relationships (Table 1). The category of accessibility includes the domains of organizational access, financial access, visit-based continuity, and longitudinal continuity. The category of clinical care includes the domains of preventive counseling (measured by number of health messages delivered) and physical examination. The category of patient relationship includes the domains of interpersonal treatment, communication, trust, and patient knowledge. In addition, two summary scale variables were assessed: the self-reported satisfaction of the caregiver and a domain summary that is an average of all domains excluding longitudinal continuity due to heterogeneity of this variable due to surveyor error.

Statistical methods. PCAS domain raw scores were calculated, missing scores imputed, and scaled scores calculated using guidelines from the original PCAS study.[24] Missing

TABLE 1
PCAS domain score definitions

Category	Domain scale	Content
Accessibility	Organizational access	Availability of staff and services and convenience of location of health services
	Financial access	Measure of the amount of money spent on treatment
	Longitudinal continuity	Duration of contact between health provider and client
	Visit-based continuity	Ongoing care for the same period of illness
Clinical care	Preventive counseling	Discussion of preventive measures with client
	Physical examination	Thoroughness of physical examination
Patient relationship	Communication	Ability to probe for symptoms, give feedback and assist in making treatment decisions
	Interpersonal treatment	Patience, friendliness, respect of patient, and giving quality time to a patient
	Trust	Integrity and role of provider as patient's agent
	Patient knowledge	Provider knowledge of patient
Summary scores	Self-reported satisfaction	Caregivers overall satisfaction with the visit
	Domain summary	Average score across all domains

PACS = Primary Care Assessment Survey.

scores were imputed for all domains where at least 50% of their total component questions were answered. The mean score of the completed questions was assumed for the missing components and an imputed score was calculated. Sociodemographic variables were analyzed by performing statistical tests for all variables between the CHW and FBHW groups. Principle component analysis based on assets was used to compute the socioeconomic status (SES) of the surveyed respondents as previously described.[32]

Comparisons of PCAS domain-scaled scores were performed using Wilcoxon–Mann–Whitney test to compare medians between CHW and FBHW provided care. A model was constructed to examine difference in domain ratings between CHW and FBHW provided care while controlling for possible confounders. The factors of time since last visit, SES, caregiver education, caregiver sex, and geographic location were determined as covariates a priori to include in this analysis. Domain scores were dichotomized using a median split and a modified Poisson regression with robust error variance was used to determine incidence rate ratios (IRRs) for receiving "high" domain scores given CHW care. IRRs greater than one suggest CHW superiority, values equal to one suggest equivalence between CHWs and FBHWs, and values less than one suggest FBHW superiority. This method was preferred over logistic regression as the outcomes were, by definition, nonrare.[33]

Ethical clearance. The study protocol was reviewed and approved by the Kenya Medical Research Institute National Ethical Review Committee, as well as the University of California, San Francisco Committee for Health Research. Written consent in the preferred local language was obtained from caregivers of children prior to any study procedure.

RESULTS

Caregivers selected from all six subcounties of Homabay participated in the study with 194 receiving care from a CHW and 174 receiving care from an FBHW. Two surveys from the CHW and six in the FBHW group and were excluded due to incomplete data caused by a communication error with our survey software. In addition, one survey in the FBHW group was excluded due to the child being older than 59 months. This yielded a total of 192 surveys in the CHW group and 167 in the FBHW group that were analyzed. Of the overall sample, 157/192 (82%) of the CHW group and 101/167 (61%) of the FBHW group contained data for all domain score variables. In both groups, incomplete data were mostly due to missing data for the longitudinal continuity domain with 35 missing in the CHW and 56 missing in the FBHW groups. Data were imputed for domain scores in 22/192 (12%) of the CHW group and 34/167 (20%) of the FBHW group. This difference was statistically significant by χ^2 test ($P < 0.02$).

Sociodemographic characteristics and access indicators. As shown in Table 2, characteristics of caregivers and children were similar across both groups in terms of caregiver sex, caregiver age, caregiver education, SES, child sex, and child age. Differences were seen in the relationship of the caregiver to the child ($P < 0.004$), caregiver religion ($P < 0.002$), and father's occupation ($P < 0.022$) by χ^2 tests.

Caregivers whose children received care from CHWs showed statistically significant improved access to care from their health professional across a number of indicators (Table 3) including travel time ($P < 0.001$), operating hours ($P < 0.001$), waiting time ($P < 0.001$), expense of the visit ($P < 0.002$), and expense of the drugs ($P < 0.001$).

TABLE 2
Sociodemographic characteristics of caregivers and children

Characteristic	CHW care, *n* (%)	FBHW care, *n* (%)	*P* value
Caregiver sex			0.827
Female	176 (92)	152 (91)	
Male	16 (8)	15 (9)	
Total	192	167	
Caregiver age mean (SD)	29 (8.2)	29.3 (9.1)	0.924
Total	191	167	
Caregiver relation			0.004
Mother	173 (90)	132 (79)	
Father	12 (6)	14 (8)	
Other	7 (4)	21 (13)	
Total	192	167	
Caregiver religion			0.002
Christian	159 (83)	155 (93)	
Traditional	21 (11)	7 (4)	
Religion			
Muslim	3 (1)	0 (0)	
Other	9 (5)	5 (3)	
Total	192	167	
Socioeconomic status			0.250
Lower 1/3	67 (36)	47 (31)	
Middle 1/3	65 (35)	48 (31)	
Upper 1/3	55 (29)	58 (38)	
Total	187	153	
Caregiver education			0.374
Some primary	136 (71)	110 (66)	
Secondary	48 (25)	45 (26)	
University/ College	2 (1)	6 (4)	
Other	6 (3)	6 (4)	
Total	192	167	
Father's occupation			0.022
Day laborer	32 (17)	23 (14)	
Farmer	68 (35)	37 (22)	
Fisherman	14 (7)	15 (9)	
Institutional Employee	8 (4)	8 (5)	
Small Businessman	28 (15)	31 (19)	
Unemployed	17 (9)	33 (19)	
Other	25 (13)	20 (12)	
Total	192	167	
Child sex			0.714
Female	94 (49)	85 (51)	
Male	98 (51)	82 (49)	
Total	192	167	
Child age (months)			0.207
2–12	58 (31)	37 (23)	
13–36	90 (48)	81 (50)	
36–60	40 (21)	43 (26)	
Total	188	161	
Child symptoms			N/A
Cough	192 (100)	162 (97)	
Fever	153 (80)	141 (84)	
Fast breathing	124 (65)	135 (81)	
Watery stools	27 (14)	15 (9)	
Other	9 (5)	22 (13)	

CHW = community health worker; FBHW = facility-based health worker; NA = not applicable; SD = standard deviation.

Bivariate analysis: differences in perceived quality of care between CHW and FBHW care. Differences in all domains were statistically significant in all cases ($P < 0.001$ for all comparisons) with CHWs being rated more highly than FBHWs. Larger differences in means were seen in variables related to

TABLE 3
Access indicators

Characteristic	CHW, *n* (%)	FBHW, *n* (%)	*P* value
Travel time			< 0.001
< 30 minutes	163 (85)	44 (26)	
0.5–1 hours	27 (14)	91 (55)	
1–2 hours	2 (1)	28 (17)	
> 2 hours	0 (0)	4 (2)	
Total	192	167	
More operating hours needed			
No	131 (71)	44 (27)	< 0.001
Yes	54 (29)	116 (73)	
Total	185	160	
Waiting time			< 0.001
None	120 (63)	6 (4)	
< 5 minutes	59 (31)	14 (8)	
6–30 minutes	13 (7)	112 (68)	
> 30 minutes	0 (0)	34 (20)	
Total	192	166	
Visit expensive?			0.002
No	174 (91)	127 (80)	
Yes	17 (9)	33 (20)	
Total	191	160	
Drugs skipped due to cost?			< 0.001
No	191 (99)	142 (85)	
Yes	1 (1)	24 (15)	
Total	192	167	

CHW = community health worker; FBHW = facility-based health worker.

access to care and patient relationships than in clinical care (Table 4).

Poisson regression model: differences in perceived quality of care between CHW and FBHW care. Our multivariate analysis using a more stringent modified Poisson regression (Table 5) showed that CHWs still outperformed FHBWs in most areas with IRRs greater than one, indicating a higher perceived quality of care for CHWs. CHWs were rated more highly in terms of financial access (IRR: 7.15, 95% confidence interval [CI]: 4.65–11.00, $P < 0.001$), organizational access (IRR: 4.92, 95% CI: 3.55–6.80, $P < 0.001$), self-reported satisfaction (IRR: 1.62, 95% CI: 1.34–1.97, $P < 0.001$), and the domain summary (IRR: 1.50, 95% CI: 1.43–1.59, $P < 0.001$). However, the outcomes related to the provision of clinical care—preventive counseling (IRR: 1.33, 95% CI: 0.96–1.83, $P = 0.081$) and physical examination (IRR: 1.18, 95% CI: 0.93–1.50, $P = 0.170$)—showed no statistically significant difference between groups.

DISCUSSION

The data presented here allows for a robust examination of community perception of quality of pneumonia home case management in western Kenya. Overall, caregivers rated the quality of CHW provided home-based management for childhood pneumonia higher than FBHW provided care.

Caregivers rated CHWs higher in regards to ease of access. This is likely because of both the spatial distribution of CHWs, as they live in the community and therefore are closer to clients, and the fact that CHWs do not charge user fees for care or medications. Studies have found that utilization of health-care services decreases with increasing travel time and cost of services.[34,35] Though Kenya has implemented a policy to decrease user fees,[36] especially for the poorest Kenyans, there is a lack of adherence to this policy.[37] And there are still many indirect costs associated with seeking care from a health facility such as the cost of transportation, food, and foregone work.[35] Home case management by well-trained well-supplied CHWs may be one way to expand access to care to this population. Though we found no difference in SES between the caregivers who used CHWs and FBHWs to access care, CHWs were rated highly in accessibility across all income levels (data not shown) arguing that economically vulnerable populations consider them accessible.

CHWs were rated more highly than FBHWs in their ability to communicate with caregivers and instill trust. Patients answered positively when asked about the integrity, friendliness, and support in decision-making by CHWs. The ability to enter a therapeutic relationship with the patient is important as both fear of stigma and perception of poor quality care were associated with decreased utilization of iCCM in Ethiopia.[38] This high satisfaction with CHWs is consistent with task shifting literature in human immunodeficiency virus (HIV), which has found that clients receiving treatment from less trained staff are highly satisfied with their care as they feel more supported by providers that are more relatable.[39] In addition, more trust in providers is associated with better adherence to medication for chronic conditions such as hypertension.[40] Therefore, CHWs may play an important role in ensuring that caregivers follow recommendations for medical treatment of their children. This is consistent with a recent study in Ethiopia that found adherence rates of 84% for trimethoprim/sulfamethoxazole prescriptions dispensed by CHWs.[41] Antibiotic resistance is a concern both in the in

TABLE 4
Bivariate analysis: differences in perceived quality of care between CHW and FBHW care

Characteristic	CHW, mean (SD)	CHW, median (IQR)	FBHW, mean (SD)	FBHW, median (IQR)	*P* value*
Financial access	90 (11)	100 (80–100)	44 (25)	40 (20–60)	< 0.001
Organizational access	82 (13)	80 (73–93)	46 (24)	40 (27–60)	< 0.001
Visit-based continuity	97 (10)	100 (100–100)	75 (25)	80 (60–100)	< 0.001
Longitudinal continuity	75 (25)	75 (50–100)	54 (24)	50 (50–75)	< 0.001
Patient knowledge	77 (13)	77 (69–85)	64 (23)	64 (44–77)	< 0.001
Preventive counseling	87 (18)	100 (67–100)	75 (31)	100 (67–100)	< 0.001
Physical examination	79 (14)	80 (60–80)	68 (23)	60 (60–80)	< 0.001
Communication	81 (12)	81 (75–90)	67 (20)	63 (52–83)	< 0.001
Interpersonal treatment	83 (10)	80 (80–88)	65 (21)	60 (48–80)	< 0.001
Trust	77 (10)	75 (71–82)	73 (12)	71 (64–82)	< 0.001
Domain summary	84 (7)	83 (79–88)	65 (16)	65 (54–75)	< 0.001
Self-reported satisfaction	88 (12)	80 (80–100)	78 (19)	80 (60–100)	< 0.001

CHW = community health worker; FBHW = facility-based health worker; IQR = interquartile range; SD = standard deviation.
*All *P* values are based on the Wilcoxon–Mann–Whitney comparison of medians.

TABLE 5
Poisson regression model: differences in perceived quality of care between CHW and FBHW care

Characteristic	Unadjusted IRR* (CI)	*P* value	Adjusted IRR (CI)	*P* value
Financial access	7.73 (4.90–12.20)	< 0.001	7.15 (4.65–11.00)	< 0.001
Organizational access	5.09 (3.61–7.18)	< 0.001	4.92 (3.55–6.80)	< 0.001
Visit-based continuity	2.04 (1.44–2.90)	< 0.001	2.31 (1.63–3.29)	< 0.001
Longitudinal continuity	2.38 (1.63–3.46)	< 0.001	2.30 (1.57–3.36)	< 0.001
Patient knowledge	2.26 (1.76–2.91)	< 0.001	2.44 (1.95−3.05)	< 0.001
Preventive counseling	1.23 (0.88–1.72)	0.218	1.33 (0.96–1.83)	0.081
Physical examination	1.20 (0.93–1.56)	0.153	1.18 (0.93–1.50)	0.170
Communication	1.98 (1.57–2.50)	< 0.001	1.91 (1.53–2.38)	< 0.001
Interpersonal treatment	2.21 (1.69–2.90)	< 0.001	2.10 (1.63–2.71)	< 0.001
Trust	1.30 (1.05–1.62)	0.015	1.32 (1.07−1.63)	0.010
Domain summary	1.49 (1.41–1.59)	< 0.001	1.50 (1.43–1.59)	< 0.001
Self-reported satisfaction	1.63 (1.34–1.99)	< 0.001	1.62 (1.34–1.97)	< 0.001

CHW = community health worker; CI = confidence interval; FBHW = facility-based health worker; IRR = incidence rate ratio.
*IRR is the probability of being in the top 50% of all scores given seeking care from a CHW. Therefore, IRRs above one suggest CHW superiority, IRRs at one suggest equivalence between CHWs and FBHWs, and IRRs below one suggest FBHW superiority. The adjusted model controls for time since last visit, socioeconomic status, caregiver education, caregiver sex, and geographic location.

setting of home-based treatment of pneumonia as well as clinic prescribed therapy.[42] However, resistance levels will be lower if all courses of antibiotics are completed due to high adherence rates.[43]

In the present study, CHWs delivered a similar number of counseling messages compared with FBHWs. Studies in other areas, such as sex education, have established the role of peers in helping to set norms even when they are less expert on an issue.[44] The idea of a trusted CHW peer being the most appropriate conveyor of health education and counseling messages is not new.[4] However, continued study of the effect of increasing professionalization of CHWs on their ability to relate to community members and provide effective peer counseling will be necessary moving forward.

Even in regards to clinical skills, the area in which FBHWs have a clear advantage, caregivers rated CHWs and FBHWs equally. Though a lack of clinical skill is one of the main reasons cited by professional health workers not to support task shifting,[45,46] caregivers did not perceive such a decrease in care quality. One explanation could be that CHWs simply spend more time with the patients and are therefore able to perform a more thorough evaluation. In the environment of a busy clinic, trained health professionals often spend very little time with the patient. One study of a health center in Kenya showed that of a 2 hour 25 minute total clinic visit (including wait time, check in and time with the clinician), less than 10 minutes was actually spent with a clinician.[47] From a patient's perspective, this would stand in stark contrast to a visit with a CHW, where the entirety of the time was spent with the provider. In addition, it has been shown that FBHWs often do not adhere to the Integrated Management of Childhood Illness (IMCI) guidelines (which parallel iCCM guidelines) due to either a lack of belief in their validity or "cognitive overload" due to time pressure.[48] Mature iCCM programs have achieved a consistency with guidelines of approximately 70%, whereas studies of IMCI in a variety of facilities have only demonstrated a maximum of 30% consistency.[48–50] Therefore, caregiver faith in CHW ability may be well placed.

In terms of overall satisfaction, CHWs were preferred to FBHWs when examining either a self-reported satisfaction score (a component of the PCAS) or a summary score that was calculated as the mean across all PCAS domains indicating acceptability. This is in line with many other studies that have shown the acceptability of community case management of disease starting with diarrhea and malaria[51–53] and more recent research on iCCM including pneumonia care.[19,20] This is likely because the CHWs in this program have been providing services which are considered valuable to the community.[21] Previous work has demonstrated the availability of drugs as an exceedingly important component of iCCM interventions. If CHWs are not adequately supplied, the community sees them as useless.[14] In addition, conflicts can arise between health facilities and CHWs if they are receiving drugs from a common source, with the result often being that CHWs are forced to go without.[54] In the current study, the supply of amoxicillin was highly prioritized (with sufficient stock given to both facilities and CHWs) to limit stockouts and may have contributed to the perceived utility of these CHWs—they were able to perform the duties expected of them by the community.

Finally, individuals who sought care with CHWs were more likely to practice African traditional religion. This is noteworthy as previous work has shown that members of this group are less likely to access care for a variety of conditions.[55,56] This may be because some African traditional religions place stigma on seeking biomedical health care.[55] The ability to discreetly seek care from a CHW may ameliorate this barrier as it can be seen as simply talking to a neighbor rather than receiving biomedical treatment. This is analogous to previous efforts to encourage exclusive breast-feeding for HIV-positive women as a means to prevent vertical transmission so that they are able to be more circumspect about revealing their status.[57] Therefore, CHWs may be an effective way to increase the provision of biomedical care to individuals otherwise wary of it.

The strength of this study was the evaluation of specifically community case management of pneumonia in a population of CHWs implementing community case management of malaria and diarrhea. Limitations to this study include an inability to qualitatively describe differences in ratings between CHW and FBHW provided care. A mixed methods approach may have yielded more robust data. In addition, cross sectional studies have an inherent tendency to exhibit bias because of systematic differences between groups. However, we attempted to mitigate this by matching our data both spatially and temporally. The data from this study were collected by program research assistants and therefore may have suffered from

desirability bias. However, because the same individuals administered both the CHW and FBHW surveys this potential bias should be equally distributed. Though all cases of pneumonia treated by CHWs met previously defined iCCM diagnostic criteria, the cases treated by FBHWs were identified solely by facility register review. This could mean there were clinical differences between the two groups. However, there were no serious adverse events (such as death) in either group, and children's symptoms were similar in both group (Table 2). In addition, the purpose of the study was only to determine caregiver satisfaction, therefore the effect of this difference in case identification on outcomes of interest was likely small. Finally, caregivers were only asked to participate in the study if their children had received care in the past 8 weeks to reduce recall bias.

Overall, this study presents a strong case for the implementation and scale-up of the treatment of pneumonia as part of iCCM. Caregivers of children under 5 years find CHW provided care for pneumonia both readily accessible and of high quality. By increasing access to lifesaving pneumonia care in a culturally sensitive way in the most under-resourced settings, large impacts on under-five mortality may be achieved.

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Authors' addresses: Brian I. Shaw, School of Medicine, University of California, San Francisco, San Francisco, CA, E-mail: brian.shaw@ucsf.edu. Elijah Asadhi and Kevin Owuor, Center for Microbiology Research, Kenya Medical Research Institute, Nairobi, Kenya, E-mails: easadhi@kemri-ucsf.org and kevinowuor1@gmail.com. Peter Okoth, Child Health, United Nations International Children's Emergency Fund, New York, NY, E-mail: pokoth@unicef.org. Mohamed Abdi, Center for Microbiology Research, Kenya Medical Research Institute, Nairobi, Kenya, E-mail: mohasmail33@gmail.com. Craig R. Cohen, Department of Obstetrics, Gynecology and Reproductive Sciences, University of California, San Francisco, San Francisco, CA, E-mail: criag.cohen@ucsf.edu. Maricianah Onono, Center for Microbiology Research, Kenya Medical Research Institute, Nairobi, Kenya, E-mail: maricianah@yahoo.com.

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