

Emerging Problems in Infectious Diseases

Determinants of quality in home-based management of malaria by community health volunteers in rural Kenya

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Abstract

Introduction: Kenya adopted the World Health Organization's recommendation of community case management of malaria (CCMM) in 2012. Trained community health volunteers (CHVs) provide CCMM but information on quality of services is limited. This study aimed to establish determinants of quality of service of CCMM conducted by CHVs.

Methodology: A cross-sectional survey was conducted in November 2016 in Bungoma County, Kenya. Data were collected through observing CHVs perform routine CCMM and through interviews of CHVs using structured questionnaires. A $\geq 75\%$ score was considered as quality provision. Descriptive statistics were performed to describe basic characteristics of the study, followed by Chi-Square test and binary logistic regression to examine the differences and associations between the categorical variables.

Results: A total of 147 CHVs participated; 62% of CHVs offered quality services. There was a direct association between quality of services and stock-outs of artemether-lumefantrine (AL), stock-outs of malaria rapid diagnostic tests (RDT) and support supervision. CHVs who were supervised during the year preceding the assessment were four times more likely to perform better than those not supervised (uOR 4.2, 95% CI: 1.38-12.85). CHVs with reliable supplies of AL and RDT kits performed three times better than those who experienced stock outs (uOR = 3.2, 95% CI: 1.03-10.03 and 3.3, 95% CI: 1.63-6.59 respectively). Biosafety and documentation were the most poorly performed.

Conclusions: The majority of CHVs offered quality CCMM services despite safety gaps. Safety, continuous supplies of RDT, AL and supervision are essential for quality performance by CHV in delivering CCMM.

Key words: Community case management of malaria; community health volunteers; quality service.

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Introduction

In Kenya, malaria is responsible for 30% of outpatient consultations, 19% of hospital admissions and 3–5% of inpatient deaths [1]. Seventy percent of Kenya's population live in malaria transmission areas while 29% live in malaria endemic zones, where children and women bear the brunt of the disease [1]. In Kenya, more than 50% of the population has limited access to government health services. According to a study conducted by the World Health Organization (WHO) and Ministry of Health (MoH) using the Service Availability Mapping tool, in 2007 there were nine health facilities per 100,000 of population in western Kenya where malaria is endemic [1]. Barriers to access health services include inability to pay for healthcare, distance and social-cultural factors. In addition, health facilities are inadequately staffed with high rates of provider absenteeism, shortages of drugs and poor quality of care [2, 3]. Given these constraints, self-treatment of suspected malaria is common using

over-the-counter drugs, which may not be effective [3,4].

Community case management of malaria (CCMM) was introduced by WHO in 2005 to address the high burden of malaria and lack of access to healthcare for rural populations in malaria endemic areas [1]. In Kenya, CCMM was integrated into existing community healthcare services which are guided by the Community Health Strategy (CHS). The community healthcare structure is the first level of care and comprises community units (CU) serving a population of approximately 5,000 people within a functional unit such as a village or sub-location linked to an established health facility. Community health volunteers (CHV) provide mainly preventive healthcare services to about 100 households, approximately 500 people, within each CU. CHVs in Kenya are lay community members selected by their communities and receive 3 weeks' formal training but are generally not remunerated and therefore work on a voluntary basis [5]. CHVs are

supported and supervised by Community Health Extension Workers (CHEW) who are trained health care workers, nurses or public health staff, based at the link health facility. CHEWs serve as the secretary to a CU and oversee recruitment and management of CHVs with the support of village and facility health committees. One CU therefore comprises about 10 CHVs and 2 CHEWs[6]. CCMM was started in 2012 in 10 counties in western Kenya and so far over 7,500 CHVs have been trained on CCMM. To undertake CCMM, CHVs were further trained on how to identify suspected malaria cases, test them using malaria rapid diagnostic tests (RDTs), and treat confirmed uncomplicated cases with artemether lumefantrine (AL). CHVs were also trained to recognise and refer severe malaria cases, negative malaria test cases and all pregnant women, and to promote malaria prevention activities. Concerns of adherence to protocols, quality of care and sustainability have been raised with respect to delivery of CCMM [7,8]. CCMM has been successfully implemented in rural settings in other malaria endemic countries [9-11] and has also been implemented in selected urban settings in Africa [11,12]. This study was conducted to identify determinants of quality of care in malaria management at community level to inform the quality of services in diagnosing and treating malaria by CHVs. There was need to develop a knowledge base of information gaps and practice related to malaria case management at community level, as well as to provide an overview of factors necessary to enhance national decision-making around the introduction of malaria case management at community level thereby making sound improvements and sustainability choices. With such knowledge base, it is anticipated that malaria will be better managed resulting in reduced malaria morbidity and mortality. With reduced health burden, the communities will contribute to improved social economic status of the country leading to achieving Kenya's vision 2030. The achievements so far gained in the fight against malaria must be sustained and improved. The remarkable progress and gains are still delicate hence require more effort. The world needs innovative tools and technologies, as well as new strategic approaches (such as CCMM) to sustain and accelerate progress in the fight against malaria [13]. However, there is need to ensure such strategic approaches and innovations are closely monitored to ensure quality results that address gaps in malaria management.

Methodology

Study site

The study was carried out in Bungoma County, western Kenya bordering the Republic of Uganda to the west. The county was randomly selected from the ten counties participating in CCMM. Bungoma County has a total population of 1,630,934, a population density of 453.5 people per square kilometre [14], and 102 CUs with 1,020 CHVs. The malaria prevalence in Bungoma County in 2015 was 27% as compared to 5% countrywide [14].

Sample size and sampling design

A cross-sectional study design was used. Assuming that 50% (to maximise sample size) of patients would receive quality services, an intra-class coefficient (ICC) of 0.3, a cluster size of 3 and an expected response rate of 90%, the study required a sample size of 405 patients to estimate the expected proportion of CHVs providing quality care with 6.5% absolute precision and 95% confidence. This translated to $405/3 = 135$ minimum CHVs to be observed. A sample of 25 CUs was first selected at random from a list of all functional CUs in Bungoma County. Then CHVs were selected using systematic sampling, stratified by sampled CUs. Within each sampled CU, a sample of 6 out of 10 CCMM-trained CHVs was randomly selected to participate in the study. The sampling frame was based on the list of CCMM trained CHVs. The study was designed such that each selected CHV would be observed attending to at least three clients. Sampled CHVs were asked to perform routine CCMM every day over a one week period during which research teams visited CHVs in their community settings. No additional efforts were made to mobilize patients for the purpose of the study.

Patient/case enrolment

The inclusion criteria for assessment of a case included: a) the adult or child was sick; b) the adult or child presented with a new problem; and c) the adult or child did not require urgent referral for a severe, life-threatening problem or pregnant. Patients who met the inclusion criteria and gave written informed consent were included in the study and underwent direct observation, re-examination and an exit interview. Patients who did not provide informed consent, under one year, pregnant women and severely ill patients were managed by the CHVs according to their usual practice; the research team facilitated referral of severely ill patients to the appropriate level of health care, in collaboration with the county health authorities.

Data collection

Data were collected over a period of one month during November 2016. Ten experienced research assistants (CHV supervisors from outside Bungoma County) were trained for four days prior to the study start.

Data collection tools were:

- i. *Direct observation checklist* to observe each CHV attending to at least 3 community members with signs and symptoms of malaria. The checklist addressed correct use of job aids, classification of the illness, decision to refer or treat at home, treatment and communication to the patient or caretaker. The observation checklist utilised three levels of scoring: satisfactory (scoring 2), unsatisfactory (scoring 1) and not done (scoring 0). The scores were then summed for each CHV. To describe CHV performance in managing malaria, scores for case management were converted to percentages and then categorized into satisfactory (75–100%), not satisfactory (50–74%) and not done (0–49%).
- ii. *A structured questionnaire* administered by research assistants to each selected CHV through a face-to-face interview. The questionnaire was designed to examine experiences with commodity stock outs, safety procedures during CCMM, referrals and support supervision from CHEWs.
- iii. *Equipment and supplies checklist* administered by research assistants on the availability of supplies and equipment required for performing CCMM. These included paracetamol, salter scale, digital thermometers, first aid kit, back pack, bicycle, reporting tools (household register, Daily Activity Register (DAR), referral booklet, AL/RDT register, tracking register), RDTs and ALs.

To ensure completeness of data quality tools and quality of the data collection process, tools were pre-tested by the research assistants for 20 observations over two days in areas not under study.

Data analysis

Data were analysed and presented using frequency distribution tables and charts. Associations between categorical variables were tested using the Chi-square (χ^2) test. Binary logistic regression was used to compute unadjusted odds ratios and their respective confidence intervals. Statistical results were regarded as significant at $p < 0.05$. The Statistical Package for Social Sciences

(SPSS) version 20 was used for statistical analysis and Microsoft Excel for graphical presentation of data.

Ethical considerations

Ethical clearance was obtained from Amref Health Africa's Ethics and Scientific Review Committee (ESRC) before the study start. Voluntary participation through informed consent, confidentiality of data through use of unique study codes for each participant, and respect for each person's dignity were upheld in accordance with research ethics.

Results

Data were collected over a period of one month during November 2016. A total of 452 direct observation checklists (at least three observations per CHV), 147 structured questionnaires and 147 equipment and supplies checklists were filled.

Sociodemographic characteristics of CHV

The majority of CHV 89(60.5%) were female. The mean (SD) age of CHV was 40 years. All CHV had completed formal education with the majority (89.0%) having attained secondary and tertiary education, and 17(11.0%) primary level of education. Most CHVs had been in practice for 12 years; less than one quarter had less than one year of experience. A high proportion of

Table 1. Socio-demographics of CHV.

Characteristic	n (%)
Gender of CHVs (N = 147)	
Male	58 (39.5)
Female	89 (60.5)
Age groups of CHVs (n=145)	
< 30 years	19 (13.1)
30-39 years	53 (36.5)
40-49 years	50 (34.5)
> = 50 years	23 (15.9)
Age (Mean (SD))	40 (8.8)
Duration in practice (N = 137)	
< 1 year	31 (22.6)
1-2 Years	66 (48.2)
> = 2 Years	40 (29.2)
Education level (n=146)	
Primary	16 (11)
Secondary education	125 (85.6)
Tertiary/college	5 (3.4)
Religion (n=147)	
Christian	145 (98.6)
Muslim	2 (1.4)
Other	0 (0)
Marital status of CHV (n=147)	
Not Married Currently	10 (6.8)
Currently Married	137 (93.2)

CHVs were married (93.2%) and 98.6% were Christians. Sociodemographic characteristics are summarized in Table 1.

Overall level of quality of services

For quality management of malaria cases, 280 (62%) of observations, the CHVs scored above 75%.

Malaria testing by CHV

Most (98%) observations showed good rapport and 84.7% of observations showed good patient engagement. CHV failed to check patients' temperatures in 66.6% of observations. Where temperatures were taken, only 94 (20.8%) were

performed correctly. In 28(6.3%) of observations, CHVs failed to explain the need for malaria tests to patients when required. In nearly one third of patients (29.9%) no weight measurements or age were recorded. In 181 (40%) observations, CHVs did not adequately prepare the RDT (assembling the necessary items, checking the expiry date of the kit and for any damage to the kit, and recording the lot and batch number of the kit). CHVs labelled test kits for 382 (85.8%) patients, but only 138(31%) labels were correctly done. CHVs disinfected pricking sites for almost all patients 342 (98.7%) and correctly collected blood samples for 391 (87.7%) patients. The correct amount of buffer was added to the right well for 427 (95.7%) patients, the

Table 2. Factors associated with quality of service.

Characteristics	Quality of service			p- value	AUOR	95% CI For UUOR	
	Total	< 75%	>= 75%			Lower	Upper
Total	147	56 (38.1%)	91 (61.9%)				
Q1_Experience duration							
< 1 year	31 (22.6%)	13 (41.9%)	18 (58.1%)	0.252			
1-2 Years	66 (48.1%)	21 (31.8%)	45 (68.2%)				
>= 2 years	40 (29.2%)	19 (47.5%)	21 (52.5%)				
Q2_Stock outs of ALs							
Yes	125 (85.0%)	52 (41.6%)	73 (58.4%)	0.037*	1		
No	22 (15.0%)	4 (18.2%)	18 (81.8%)		3.2	1.03	10.03
Q4_Stock outs of RDTs							
Yes	56 (38.0%)	31 (55.4%)	25 (44.6%)	0.001**	1		
No	91 (62.0%)	25 (27.5%)	66 (72.5%)		3.3	1.63	6.59
Q7_Times of Invalid RDTs							
0	103 (70.1%)	40 (38.8%)	63 (61.2%)	0.538			
1	24 (16.3%)	7 (29.2%)	17 (70.8%)				
2 times and above	20 (13.6%)	9 (45.0%)	11 (55.0%)				
Q13_Difficulties in referrals							
Yes	95 (64.6%)	35 (36.8%)	60 (63.2%)	0.672			
No	52 (35.4%)	21 (40.4%)	31 (59.6%)				
Q14_Ever had support supervision?							
No	16 (11.0%)	11 (68.8%)	5 (31.3%)	0.007**	1		
Yes	131 (89.0%)	45 (34.4%)	86 (65.6%)		4.2	1.38	12.85
Q17_Education level							
Primary	16 (11.0%)	9 (56.3%)	7 (43.8%)	0.119			
Above Primary	130(89.0%)	47 (36.2%)	83 (63.8%)				
Q19_Religion							
Christian	145 (98.6%)	54 (37.2%)	91 (62.8%)	0.069			
Muslim	2 (1.4%)	2 (100%)	0				
Age (Mean (SD))		39 (8.2)	41 (9.1)	0.334			
Gender							
Male	58 (39.5%)	24 (41.4%)	34 (58.6%)	0.508			
Female	89 (60.5%)	32 (36.0%)	57 (64.0%)				
Q21_Currently married							
Not Married Currently	10 (6.8%)	3(30.0%)	7 (70.0%)	0.585			
Currently Married	137 (93.2%)	53(38.7%)	84 (61.3%)				
Referrals difficulties							
Yes	52 (35.4%)	21 (37.5%)	31 (34.1%)	0.004			
No	95 (64.6%)	35 (62.5%)	60 (65.9%)				

*Association is significant; **Association is highly significant.

results were read after the correct time (within 15–20 minutes) and were correctly interpreted in 95% of patients.

Malaria treatment by CHVs

One hundred and nine patients tested positive for malaria of which 95 (87.2%) were given the correct dosages of AL for the treatment of uncomplicated malaria. CHVs explained the treatment duration and adequately repeated the instructions to the majority of patients 95 (87.2%). CHV administered paracetamol for fever management to a small number of patients 15 (13.8%), with 11 (73.3%) using correct dosages.

Counselling and follow up by CHV

Two hundred and ninety two (64.7%) patients were given follow up appointments, and were thanked and wished well. Over one third of patients 176 (39.2%), were not given health education messages such as use of long lasting insecticide-treated nets (LLINs) and draining stagnant water.

Safety precautions by CHV

CHV used gloves for only one third of patients 153 (34.5%), although this was partly due to their unavailability. They appropriately disposed waste materials for only 110 (24.7%) of patients.

Data capture by CHVs

CHV correctly filled the required forms for over half the patients 239 (53%). The remaining forms were incompletely filled.

Availability of AL and RDT

At the time of the survey, two thirds (61.6%) of CHVs were experiencing stock outs of drugs and commodities, with 85% of these reporting stock outs of ALs and 38% reporting stock outs of RDTs. A logistic regression model was used to assess the relationship of availability of various commodities to quality of service (Table 2). Availability of AL and RDT were strongly associated with quality of service; the odds of providing a satisfactory score ($\geq 75\%$) for service among CHV who had adequate stocks of AL and RDT were three times higher than those with stock outs (uOR=3.2, 95% CI: 1.03-10.03; $p = 0.037$ and 3.3, 95% CI: 1.63-6.59; $p = 0.001$ respectively). (Figures 1 and 2).

Support supervision

The majority (89.1%) of CHV reported receiving support supervision in the preceding year. CHVs gave the following responses about the benefits of support supervision: to learn in 87 (29.9%), to recognise and correct mistakes in 95 (32.6%), to share and discuss challenges in 106 (36.4%) and a waste of time in 1 (0.3%). There was a strong relationship between support supervision and quality of services provided by CHV. The CHV who had support supervision in the previous year were four times more likely to provide satisfactory services (uOR 4.2, 95% CI: 1.38-12.85; $P = 0.007$).

Referrals

Although 95 (64.6%) of CHV stated they did not experience referral difficulties, the following referral

Figure 1. Quality of service and availability of AL (p=0.032).

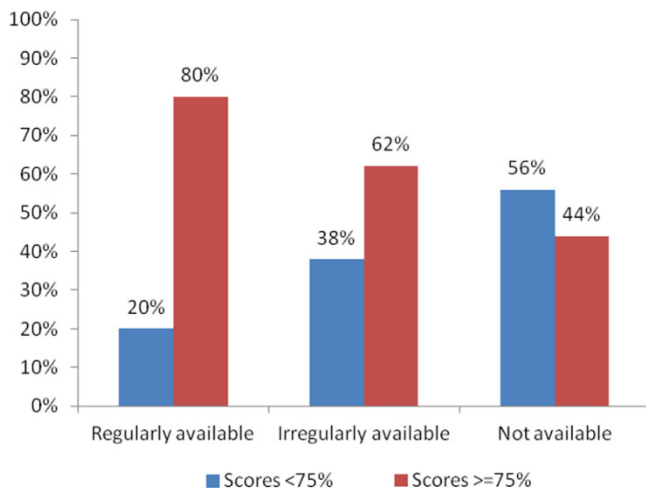
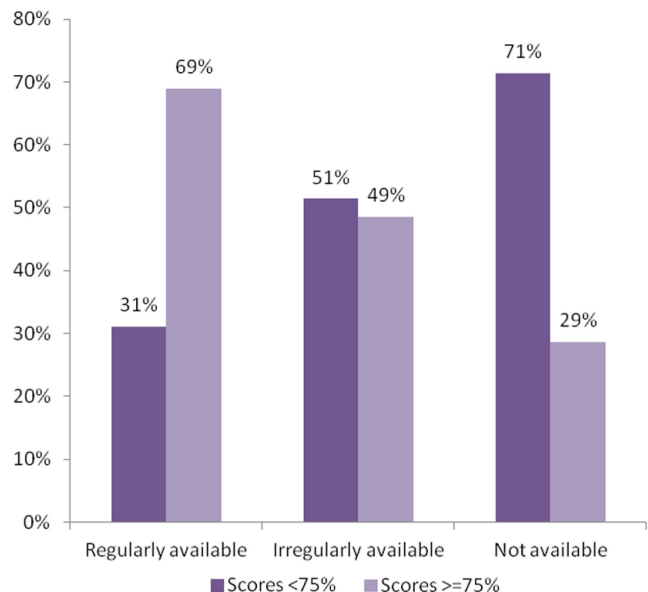


Figure 2. Quality of service and availability of RDT (p=0.016).



challenges were noted: unavailability or irregular supply of referral forms in 28 (27.2%) CHVs; the referral facility being far away in 22 (21.4%); not confident enough to refer 14 (13.6%), referral not recognized by health facility workers 14 (13.6%) and other hindrances 25 (24.3%).

Discussion

Owing to critical challenges in human resources for health, CHVs' contribution to healthcare delivery at primary healthcare level is gaining popularity across the world especially in underserved communities [15].

In this study, 91 (62%) of CHVs offered quality services based on the 75% cut off score. Generally, history taking, rapid diagnostic testing for malaria and prescription for uncomplicated malaria were well managed by CHVs. This is in support of other studies looking at the suitability of CHVs to manage uncomplicated malaria at community level [16]. Therefore CHVs can effectively contribute to attaining universal health coverage and realising the sustainable development goals.

The performance of CHV would be improved by a reliable supply of AL and RDT as well as more regular support supervision by CHEWs. Supervision is essential for this lay cadre of personnel who offer important health services close to communities. Supervision ensures errors, gaps and omissions are identified and can be rectified early. Supervision also provides continuing education and mentorship. Poor quality or ineffective supervision may be a contributor to low CHV morale and poor productivity [17].

Access to medical products and technologies as one of the health systems building blocks is a vital component of quality of service. Periods of non-practice due to stock outs may lead to poor performance once stocks are replenished. In their research on increasing community health worker productivity and effectiveness, Jaskiewicz *et al.* reported that stock outs not only interrupt productivity but also have other unintended outcomes such as loss of confidence from the communities they serve [18]. Poor performance of community health workers in Zambia was also associated with an irregular and unreliable supply of drugs [19].

It would be expected that education levels and experience (length of time in practice) would have a significant influence on performance and quality of service. This was not confirmed in this study, since most CHV had low education levels and barely two years' experience; however, the variations in

performance among CHV were too small to detect a significant difference.

Of concern were biosafety precautions since CHV provide their services at community level. The majority of CHV (65.5%) were operating without gloves and few (24.7%) were disposing of healthcare waste appropriately. This was attributed to low or no supply of gloves to CHVs and inadequate healthcare waste management among CHVs. This could expose CHV and community members to injuries and further risk of infection, especially since this is an area of high HIV/AIDS prevalence. Another concern was documentation by CHV: only half the patients' forms were filled completely, with others either incompletely filled or not filled at all. Incomplete or no data hinder monitoring of CCMM activities and impacts on accuracy of health information. In addition, inadequate labelling may lead to mismatching of test results especially if there are two or more patients in a household; however, this error was not observed in this study.

Study Limitations and Risks

Observed performance may be subject to the Hawthorne effect if providers modify their behaviour while being observed [20] and providers may not perform in a consistent manner with every patient they encounter (16). Their performance may have been better or worse under observation depending on whether CHV felt nervous under observation or whether they were more eager to follow guidelines.

In the analyses, CHW socio-demographic characteristics were not correlated with service delivery outcomes for each patient. Based on the way data collection was done it was not possible to pool errors for each individual CHV.

Conclusions

Majority of the observations made, the CHVs offered quality services. Most requirements for malaria testing protocol and treatment were achieved by the CHVs. Counselling/health education, safety precautions and documentation were average or below average and needed to be boosted by capacity building or provision of essentials such as gloves. Stock outs of ALs and RDTs negatively impacted performance of CHVs hence there should be steady supply of the commodities. Support supervision to CHVs was found to be important in CHVs offering quality services.

Therefore, with a reliable supply of commodities, regular support supervision and adequate biosafety, CHV can be entrusted to offering CCMM in Kenya.

Appropriate steps should be taken to address the identified gaps.

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