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Narrowing the treatment gap with equitable access: mid-term outcomes of a community case management program in Cameroon

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Coverage of case management interventions remains low and inadequate to achieve millennium development goal (MDG) target reductions in child mortality. Children living in the poorest households are particularly disadvantaged. Community case management (CCM) uses trained and supervised community health workers to improve access to, quality of and demand for effective case management. Evidence that CCM programs can achieve equitable improvements in coverage is limited. This cross-sectional study uses a quasi-experimental design with intervention and comparison areas. Outcomes of a CCM program for malaria and diarrhoea operating in two districts of Cameroon were measured after 1 year of implementation. A household census ($N = 16\,954$) provided measurement of treatment-seeking behaviour for recent episodes of fever and diarrhoea. Results were compared between areas using chi-square tests. Intervention-area children with fever or diarrhoea were nearly nine times more likely to receive treatment with artemisinin combination therapy or oral rehydration salts, respectively, vs neighbouring comparison-area children. High levels of effective treatment were equitable across socioeconomic status in intervention areas, whereas disparities were observed in neighbouring comparison areas. CCM can achieve rapid and equitable improvements in coverage of case management for malaria and diarrhoea, and is a promising strategy for achieving MDG 4. Improved access to treatment, quality of care and caregiver demand were achieved in two districts of Cameroon. CCM must be scaled up to demonstrate outcomes and impact at scale.

Keywords Community case management, community health worker, child survival, diarrhoea, malaria

KEY MESSAGES

- Community case management (CCM) uses trained and supervised community health workers (CHWs) to improve access to, quality of and demand for effective case management of childhood illnesses.
- CCM can achieve rapid and equitable improvements in coverage of case management for malaria and diarrhoea among children under five, and is an important strategy for achieving millennium development goal (MDG) target reductions in child mortality.
- Further gains towards achieving MDG 4 could be attained by closing the gap in effective case management of pneumonia using trained and supervised CHWs.

Introduction

More than 22 000 children under the age of five die worldwide each day. Nearly all these deaths occur in the developing world and most are preventable. Current global targets towards improving child survival focus on achieving millennium development goal 4 (MDG 4): 'to reduce the global rate of under-five mortality by two-thirds between 1990 and 2015'. While some parts of the world are on target to achieve MDG 4, sub-Saharan Africa has shown the least progress since 1990. Under-five mortality has reduced by 28% from 1990 to 2008, and some countries are showing an upward trend in under-five mortality rates (Bhutta *et al.* 2010).

Among the leading causes of death in children under five are pneumonia, diarrhoeal disease and malaria (Black *et al.* 2003; UNICEF 2009). The key interventions to treat these causes of child deaths are well established (Jones *et al.* 2003). Effective treatments include oral rehydration salts (ORS) and zinc supplementation for dehydration due to diarrhoeal disease (WHO and UNICEF 2004a), antibiotics for pneumonia (WHO and UNICEF 2004b) and effective antimalarial drugs for malaria (WHO 2010). Coverage of these case management interventions remains low and inadequate to achieve MDG 4 (Bryce *et al.* 2006; Countdown Coverage Writing Group 2008; Bhutta *et al.* 2010). As compared with their peers living in relatively wealthier households, children living in the poorest households are particularly disadvantaged with respect to effective treatment for childhood illnesses (Bryce *et al.* 2006; Countdown 2008 Equity Analysis Group 2008), and experience higher rates of morbidity and mortality (Victora *et al.* 2003; Marmot 2007; UN 2011). Improving case management of these common diseases requires focus on improving access to care for children living in the poorest, most isolated communities lacking access to adequate public health systems (UNICEF 2009; UN 2011).

Community case management

Community case management (CCM) is a strategy to prevent child deaths in settings where access to facility-based care is limited. CCM involves community-based treatment provided by trained and supervised community members. Community health workers (CHWs) also promote timely treatment seeking, encourage appropriate home care and facilitate referrals to facilities. The CCM model aims to prevent child deaths by addressing access to, quality of and demand for CCM services within a favourable social and policy environment (CORE Group, Save the Children, BASICS, MCHIP 2010) (Figure 1).

Evidence on services delivered by CHWs is limited in quality and quantity, but suggests that with appropriate support and training, CHWs can improve coverage of essential interventions for child survival. Where employed, rigorous study designs find that community-based interventions for diseases such as pneumonia can significantly reduce child mortality (Kidane and Morrow 2000; Sazawal and Black 2003). Nonetheless, evidence on outcomes and impact of CCM interventions delivered by CHWs is documented primarily through smaller scale project case studies and experimental study designs are rarely employed (Haines *et al.* 2007; Bhutta et al 2010). In addition, the extent to which CCM programs improve effective case management coverage and promote 'equitable' access across socioeconomic status (SES) is not well documented (Haines *et al.* 2007; Bhutta *et al.* 2010). This study was undertaken to evaluate the effect of a CCM package on equitable coverage after 12 months of CCM programming in the central African country of Cameroon. Study results can be used to inform program and policy decision making, and to inform and/or adjust CCM programs implemented in Cameroon and other similar contexts.

Methods

Intervention description

In October 2009, Population Services International (PSI) (www.psi.org), its local affiliate the Cameroonian Association for Social Marketing (ACMS) and the Ministry of Health launched a CCM program in Doumé and Ngeulemendka districts of Cameroon. Early launch in these two districts was in advance of a larger program launch occurring in an additional 19 districts in 2011. Cameroon is one of the 60 priority countries for targeting child survival interventions in the countdown to the MDG 4. Cameroon has the 13th highest child mortality rate in the world—154 under five deaths per 1000 live births in 2009 (UNICEF 2011). The country has failed to make significant progress towards achieving MDG 4 (Bhutta *et al.* 2010; UNICEF 2011). In 2005, national policy in Cameroon was created in support of home-based management of malaria administered through trained CHWs. The Ministry of Health, together with the international nongovernmental organization (NGO) Plan, developed a detailed community-based integrated management of childhood illnesses (IMCI) training manual covering diarrhoea, nutrition, malaria and immunization (Core Group 2009). National policy does not support community-based management

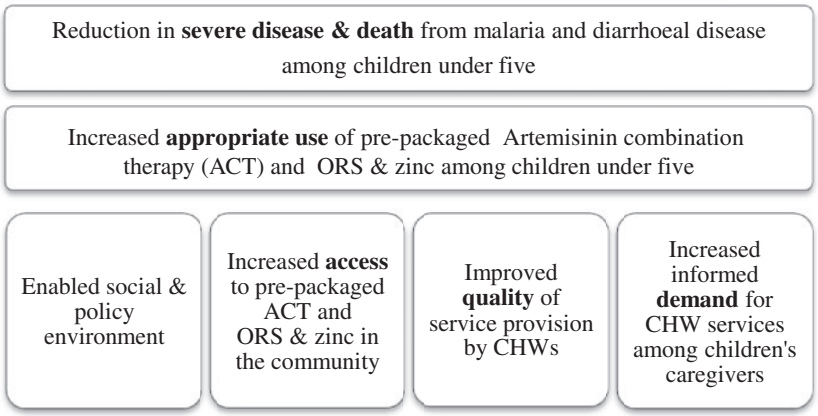

Figure 1 CCM results framework (CORE Group, Save the Children, BASICS, MCHIP 2010)

of suspected pneumonia with distribution of antibiotic treatment (Marsh *et al.* 2009). During the study period, national health policies included public facility user fees, and public sector blood testing and treatment for malaria were not available free of charge (Witter 2010; WHO 2011).

In line with national policy, the CCM package provided community-based diagnosis, treatment and referral for suspected malaria with artemisinin combination therapy (ACT)[1] and diarrhoeal disease with ORS and zinc[2]. The Ministry of Health and ACMS recruited and trained 456 CHWs to cover all communities—~13 200 children under five (18% of the total population, 73 400). Training occurred in September and October 2009 utilizing the national IMCI curriculum. CHWs were assigned catchment areas of ~100–300 people and operated alone or in pairs. Where necessary given small villages sizes, and where feasible given geographic conditions and social relations, villages were combined under a single CHW or a pair of CHWs. Many recruited for this program had served their communities as CHWs under previous NGO-sponsored community-based health projects. Where communities were lacking individuals who had previously served as CHWs, village leaders selected individuals for service. CHW recruitment criteria included willingness to work on a voluntary basis; identification by community leaders; basic literacy skills necessary to complete client registers and report forms; and preference for individuals who had served as a CHW under previous projects. Upon completing a 5-day training, CHWs received pre-packaged ACT and ORS and zinc for treating children in their catchment area. Community sensitization about the program invited children's caregivers to access services at any time of the day or night—either by visiting the home of the CHW or requesting a home visit. When children present with illness, CHWs use national IMCI guidelines for assessing the cause of illness and its severity on clinical grounds. Children with severe illness are referred to health facilities. Where CHWs diagnose uncomplicated malaria or diarrhoea, they provide treatment free of charge.

CHWs are supervised by facility-based health workers. Supervisory visits occur at the health facility or in the community, and include review of the client register and CHW stock. Supervision periodically includes direct observation of the CHW, follow-up with recent CHW clients, review of the treatment algorithm and simulation exercises. Supervisory health facilities are stocked through the district health system, and the district is supplied by ACMS. Two animators work in the intervention area, and are tasked with using behaviour change communications to improve caregiver treatment-seeking behaviour and utilization of CHW services. Animators communicate key messages during community meetings and through interpersonal communication. Key messages focus on symptom recognition (e.g. fever as a symptom of malaria), prompt treatment seeking and services provided by CHWs.

A paper-based routine monitoring system was designed to measure indicators of program progress. Data were collected during routine supervision visits made on a quarterly basis. The system recorded CHW delivery of 13 428 blister packs of artesunate + amodiaquine (ASAQ) and 6350 diarrhoea treatment kits (two sachets of ORS and 10 tablets of zinc) to children under five. Of the 426 CHWs who were trained, 29 left the program over a course of 1 year, and 16 new CHWs were trained. The percentage of CHWs with stock at the time of quarterly supervisory visits was generally high (95% or higher) in both districts with the exception of lower stocking rates observed in Ngeulemendouka during Quarter 2 (78%) and Quarter 4 (65%). CHWs observed without stock during supervisory visits were immediately provided with stock. During supervisory visits, CHW knowledge of the treatment algorithm and of danger signs necessitating referral was assessed. Direct observation of CHW assessment skills on a routine basis was often not feasible given unpredictable client flows and the limited amount of time that supervisors could dedicate to site visits. Therefore, correct knowledge was typically assessed by asking the CHW to describe each step in the assessment and treatment process and to name all danger signs that necessitate immediate referral. Correct knowledge was defined as responses consistent with the program treatment algorithm. CHW knowledge improved over time; the percentage of CHWs demonstrating knowledge of the treatment algorithm improved from 41 to 89%, and of danger signs from 55 to 81%.

Study districts

The intervention area covers the districts of Doumé and Ngeulemendouka and the comparison area is Abong-Mbang

district. These districts border one another and are located in the East region of Cameroon. Thick rainforests support the breeding of disease vectors including anopheles mosquitoes, and the primary livelihood is subsistence farming. Transportation in the region is limited by a lack of infrastructure; three main roads cover the territory. Access to public health care throughout this region is limited. Much of the population lives far from public health facilities, and rural roads are often of poor quality, especially during the rainy season. In addition, public health facilities in the region often face difficulty maintaining adequate medical personnel and supplies of essential medicines resulting in poor quality of care (Médard 2002). Total fertility rate (6.0), under-five mortality (187 under five deaths per 1000 live births) and prevalence of fever, diarrhoea and acute respiratory infection (ARI) among children under five are among the highest in the country. Vaccination rates are among the lowest in the country (e.g. basic vaccinations among children age 12–23 months is 38%) (INS and ORC Macro 2004).

Design and sampling

The study utilized a quasi-experimental design with intervention and comparison areas and measurement of program outcomes after 1 year of implementation. Intervention and comparison districts were purposively selected. Specifically, the intervention district was selected based on high burden of disease affecting children under five and relatively low intervention coverage. The comparison district was selected to be comparable to the intervention district on key indicators related to burden of disease and intervention coverage as well as socioeconomic and cultural context, relative to other districts in Cameroon. Intervention areas received the CCM program for 1 year (October 1, 2009—September 30, 2010), whereas comparison areas received the current national standard of care for treatment of childhood illnesses (i.e. public facility-based care of limited accessibility in rural areas). CHWs trained in various community health promotion activities for previous NGO-sponsored programs were present in both intervention and comparison communities. However, there was a lack of NGO presence supporting comparison-area CHWs during the CCM intervention period. Furthermore, comparison-area CHWs were not systematically trained in CCM under previous NGO projects (i.e. how to provide case management using an IMCI algorithm) and they were not supplied with medicines to treat children.

A census of all households within rural villages of intervention and comparison districts was conducted. A census approach was employed due to donor interest in estimating trends in all-cause child mortality. Nearly 100% of households were successfully interviewed through a series of up to three visits per household and by setting appointments for interview times with busy household members. Data from the census approach yielded information on 9605 households in intervention and 7349 households in comparison areas. A 96% response rate was achieved with respect to data on all children under five. Most commonly, failure to interview eligible respondents was due to lack of availability to participate during the survey timeframe (i.e. within three visits to each household).

Training and fieldwork

Data were collected between October 22 and December 15, 2010. The study period overlapped with one of two annual rainy seasons in Cameroon (March–June and September–November). Although malarial transmission is endemic and perennial, seasonal peaks occur during and immediately following the rainy season. Diarrhoeal disease cases also peak during rainy seasons. A team of 60 interviewers and 15 field supervisors received training in study design; methodology; and collection and management of data using personal digital assistant (PDAs). Visual CE software (©Syware, Cambridge, MA, USA) was used for data collection using PDAs and Microsoft Access (©Microsoft, Redmond, WA, USA) for data management. Fieldwork was organized and supervised by the National Institute of Statistics. This study operates under the approval of the National Ethics Board of Cameroon. Consent to operate within study areas was obtained from local authorities. Consent to participate was obtained from heads of household and children's caregivers.

Survey instruments

Household and woman questionnaires modeled after the Demographic and Health Survey (DHS, www.measuredhs.com) were utilized in this study. The household questionnaire collected information on household residents; characteristics of housing, water and sanitation; and household assets. The woman questionnaire includes modules on respondent background and experiences with and attitudes towards the CHW program. For all children under age five, information was collected from women on prevalence and treatment of diarrhoea, fever and ARI in the 2 weeks preceding the survey. Information on all children under five was collected from women serving in the primary caregiver role.

To improve the accuracy of caregiver reports, a field manual of visual aids was used to assist the caregiver and the interviewer to identify antimalarials, antibiotics and ORS and zinc. The manual contained pictures of all antimalarials and antibiotics that were found during visits to several drug outlets, and pictures of the ASAQ blister pack and ORS and zinc distributed by the CHWs. Accurate classification of treatments was also bolstered by recording categorization of drug types (e.g. ASAQ, quinine, amoxicillin), as well as the brand and/or generic drug names as string variables. This allowed for more accurate classification of treatments during the analysis stage even when the interviewer may have misclassified a drug because he or she was not familiar with the brand name mentioned by the caregiver.

Measures

Indicators on treatment-seeking behaviour were constructed for children under five who had fever, diarrhoea or symptoms of ARI (cough accompanied by short, rapid breathing that is chest-related) in the past 2 weeks. Indicators were constructed based on caregiver reports on places in which treatment was sought (including home), type of treatments acquired and given to children and timing of treatments. In addition to treatment-seeking behaviour for ARI, other contextual variables measured included mosquito net use among children under five; household access to improved sanitation and drinking water; and

anthropometric measures—height-for-age and weight-for-height. These indicators were constructed according to standard methodology employed by the DHS.

Dichotomous indicators were created with respect to awareness of the CHW program and accessing the CHW program within the past year among caregivers of children under five. Caregiver attitudes towards CHWs with respect to access, quality of service provision and demand for CHW services were assessed using single items (e.g. 'It is easy to find the CHW when he or she is needed') with four-point response patterns (strongly agree, agree, disagree and strongly disagree). Dichotomous variables were created to indicate agreement vs disagreement with each statement.

The extent to which the CCM program reached the poorest households was assessed by examining differences in treatment outcomes for malaria and diarrhoea across relative household wealth. SES was assessed for each household relative to other households in the study. The creation of an SES index was guided by items and methods employed by the DHS. Items utilized in the Cameroon DHS were included to assess ownership of several household assets (e.g. bicycle, kerosene lamp and radio), livestock ownership (e.g. cattle and chickens), dwelling characteristics (i.e. type of walls, floor and windows), toilet facilities and drinking water source. SES index items were assigned a weight through principal components analysis and standardized in relation to a standard normal distribution (Rutstein and Johnson 2004). Each respondent was then characterized according to this score as falling within one of three SES categories (poorest, middle and wealthiest/least poor). This measure of SES was used to evaluate the extent to which case management coverage was equitable. Disparity or inequality is defined as disadvantage among the poorest children in comparison with the least poor children with respect to access to health care and appropriate case management for fever and diarrhoea (Braveman 2006).

Data analysis

Data were analysed using Stata 11.0 (© Stata Corporation, College Station, TX, USA). Chi-square tests of association were utilized to examine group differences in treatment-seeking behaviour for malaria and diarrhoea as well as awareness of, attitudes towards and history of accessing the CHW program. Chi-square tests also examined significant associations between these key program outcomes and household SES.

Results

Sample characteristics and contextual variables

Table 1 compares context and background characteristics among children living in intervention and comparison areas. Given the large sample size, significant differences are observed across several contextual factors; however, practical differences are minimal. Children living in study areas are similar with respect to nutritional status and prevalence of fever, diarrhoea and ARI. Children are similar in their levels of access to prevention interventions including mosquito nets and water and sanitation. With respect to treatment, intervention-area children with symptoms of ARI were significantly more likely to be taken to a CHW (29%) as compared with children in comparison areas [3%, $\chi^2(1) = 111.18$, $P < 0.001$]. However, intervention/comparison area was not significantly associated with receiving treatment with a recommended antibiotic (Table 1). Across areas, where antibiotics were received for ARI treatment, they were commonly sourced from public health facilities (39% of treated children) and mobile vendors (28% of treated children; data not shown).

Treatment-seeking behaviour for fever and diarrhoea in children under five

Figures 2 and 3 compare initial actions taken by children's caregivers in response to fever or diarrhoea. Intervention-area children are frequently taken directly to a CHW for care (51% with fever and 58% with diarrhoea). Children living in comparison areas more commonly had not yet received any form of treatment at the time of the survey, or were initially treated at home (Figures 2 and 3).

Table 2 examines treatment seeking for fever and diarrhoea at any point during the illness (combining initial and subsequent sources). Children living in intervention vs comparison areas were significantly more likely to receive treatment at a public health facility or through a CHW for fever [66 vs 30%, $\chi^2(1) = 256.23$, $P < 0.001$] and diarrhoea [12 vs 22%, $\chi^2(1) = 39.30$, $P < 0.01$, $P < 0.001$] (Table 2).

Case management coverage

Appropriate treatment was significantly higher among children in intervention vs comparison areas including: antimalarial treatment for fever [57 vs 25%, $\chi^2(1) = 220.96$, $P < 0.001$], ACT for fever [43 vs 5%, $\chi^2(1) = 359.56$, $P < 0.001$], ORS for diarrhoea [61 vs 7%, $\chi^2(1) = 1100.00$, $P < 0.001$] and zinc for diarrhoea [46 vs 1%, $\chi^2(1) = 872.92$, $P < 0.001$] (Figure 4). Many intervention-area children who received antimalarial and ACT treatment were treated the same or next day after onset of fever (prompt antimalarial treatment, 45%; prompt ACT treatment, 35%; data not shown). In intervention areas, most children treated with an antimalarial received the national first-line ACT, ASAQ (72%) or the ACT artemether + lumefantrine (AL) (13%). In comparison areas, most children treated with an antimalarial received quinine (63%); 9% receive ASAQ and 13% receive AL (data not shown). Other non-artemisinin monotherapies received by children include amodiaquine (intervention, 9%; comparison, 12%) and chloroquine (intervention, <1%; comparison, 4%; data not shown).

Most antimalarial (82%) and nearly all ACT (96%) and ORS (92%) treatments received by intervention-area children were provided by a CHW. Among the relatively fewer treated children in comparison areas, treatments were commonly acquired from a public facility (antimalarial, 52%; ACT, 77%; ORS, 82%) (Table 3).

Awareness, access and attitudes towards CHW services among caregivers

Many caregivers in intervention areas report that a CHW is working in their community (81%), and over half (59%) reported accessing CHW services within the past year. In comparison areas, 26% of caregivers report a CHW working in

Table 1 Sample characteristics and contextual variables among children under five

	Intervention	Comparison	
Children under five	($N = 8261$)	($N = 516$)	χ^2
% 0–11 months	22.3	22.1	
% 12–23 months	19.1	19.7	
% 24–35 months	20.5	19.2	
% 36–47 months	19.4	20.5	
% 48–59 months	18.7	18.5	6.04
% Mosquito net use the night preceding survey	32.8	38.5	53.05***
% ITN[a] use the night preceding survey	17.6	19.8	12.16***
Height-for-age[b]	($N = 7228$)	($N = 5327$)	t
% Below −3 SD	34.5	30.0	
% Below −2 SD	58.4	53.0	
Mean Z-score (SD)	−2.22	−2.10	5.40***
Weight-for-height[b]	($N = 7496$)	($N = 5950$)	t
% Below −3 SD	1.4	1.5	
% Below −2 SD	4.3	3.9	
Mean Z-score (SD)	0.42	0.40	−0.96
Children under five	($N = 7965$)	($N = 6115$)	χ^2
% Fever within 2 weeks preceding survey	17.0	13.1	44.46**
% Diarrhoea within 2 weeks preceding survey	22.9	24.9	10.32**
% ARI[c] symptoms within 2 weeks preceding survey	6.7	6.6	0.10
Children with symptoms of ARI[c]	($N = 551$)	($N = 405$)	χ^2
% Sought treatment from a CHW	29.1	2.5	111.18***
% Sought treatment from a public health facility	22.9	28.5	3.74
% Received cotrimoxizole or amoxicillin	45.7	45.3	0.02
Households with children under five	($N = 4762$)	($N = 3744$)	χ^2
% With improved source for drinking water[d]	32.8	36.0	9.52**
% Treating drinking water[e]	4.1	3.8	0.65
% With improved toilet/latrine facility[f]—shared	6.0	4.6	
% With improved toilet/latrine facility[f]—not shared	4.1	4.0	
% Without an improved facility	89.8	91.4	8.63*
Relative household wealth[g]			
% Lowest	31.6	31.3	
% Middle	31.6	33.5	
% Highest	35.2	36.9	4.10

[a]A long-lasting insecticide-treated net or a conventional mosquito net treated with insecticide in the past 12 months.
[b]Indices expressed in standard deviation units (SD) from the median of the World Health Organization (WHO) Child Growth Standards adopted in 2006. Height-for-age is an indicator of the long-term effects of malnutrition (stunting). Weight-for-height is an indicator of acute malnutrition (wasting), and can be the result of recent illness or seasonal variation in food supply.
[c]Cough accompanied by short, rapid breathing that is chest-related.
[d]Piped water, public tap, borehole, protected dug well, protected spring or rainwater.
[e]Boiling, filtering or adding bleach/chlorine.
[f]Flush/pour toilets piped with sewer, septic tank or pit latrine; ventilated improved pit latrine or pit latrine with slab.
[g]Relative wealth index across all study households creating using principal components analysis with standard index items.
*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

their community, and 7% reportedly visited a CHW in the year preceding the survey (Table 4).

Among intervention-area caregivers who report a CHW working in their community, attitudes towards the CHW were highly favourable. For example, most caregivers agreed that CHWs are easy to find when needed (93%), medicines are always available with the CHW (88%) and CHWs know how to help sick children (96%). Nearly all intervention-area caregivers

demonstrated demand for CHW services through agreement with statements such as: the CHW is a convenient source of treatment (94%), the CHW gives medicines of good quality (94%) and the CHW provides treatments that cure children (94%). Comparison-area caregivers were less likely to demonstrate favourable perceptions towards CHWs (Table 4).

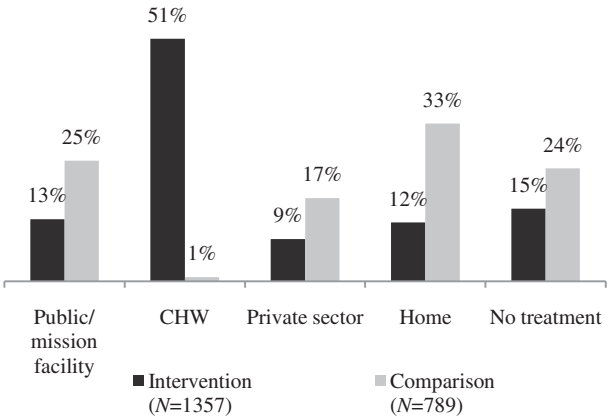

Figure 2 Initial place visited by caregivers for treatment of fever in children under five

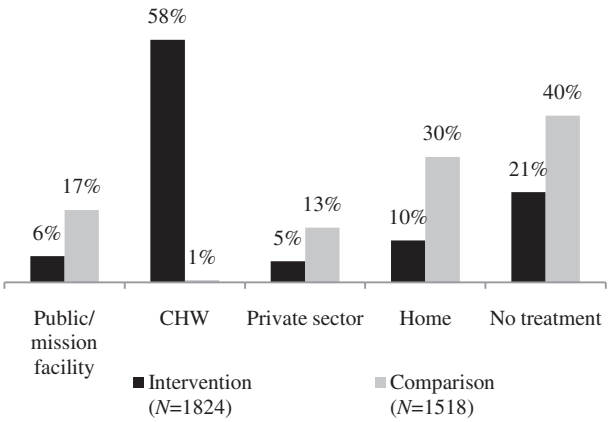

Figure 3 Initial place visited by caregivers for treatment of diarrhoea in children under five

Treatment-seeking outcomes across household SES

Caregivers living in the relatively wealthier households were least likely to be aware of services and to access them in both intervention and comparison areas. For example, intervention area caregiver reports of accessing CHW services in the past year were highest among the poorest (66%) followed by relatively middle SES (61%) and wealthiest caregivers (52%) (Table 5).

In comparison areas, receiving fever treatment from the public health system (facility or CHW care) was significantly associated with household SES and the association was in favour of children living in the wealthiest households [$\chi^2(2) = 7.55$, $P < 0.05$]. In intervention areas, there was no significant difference in access to public health care for fever across household SES. This appears to be driven by the fact that in intervention areas, CHW care for fever was significantly higher among the poorest children (59%) as compared with the least poor children [45%, $\chi^2(2) = 20.02$, $P < 0.001$]. Similarly, CHW care for diarrhoea treatment in intervention areas was significantly associated with household SES [$\chi^2(2) = 6.86$, $P < 0.05$] and the association was in favour of the poorest children (Table 5).

In comparison areas, ACT [$\chi^2(2) = 6.80$, $P < 0.05$] and antimalarial [$\chi^2(2) = 11.67$, $P < 0.01$] treatment for fever were significantly associated with household SES and the

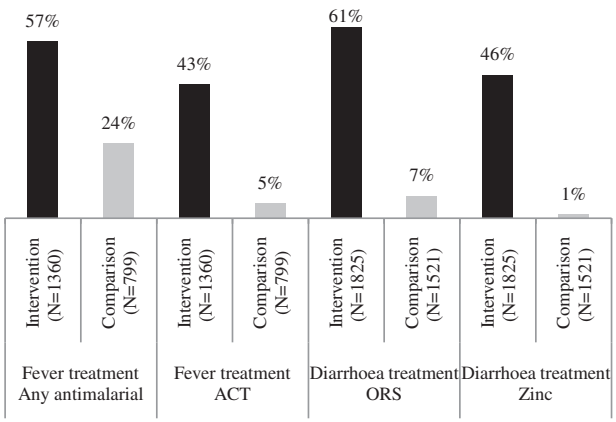

Figure 4 Treatment received for fever and diarrhoea among children under five

Table 2 Places that caregivers sought treatment for children with fever or diarrhoea[a]

	Intervention fever cases	Comparison fever cases		Intervention diarrhoea cases	Comparison diarrhoea cases	
	($N = 1357$)	($N = 798$)	χ^2	($N = 1824$)	($N = 1518$)	χ^2
% Public health facility or CHW	65.7	30.1	256.23***	64.5	19.5	680.60***
% Public/mission health facility	17.0	28.8	42.19***	7.7	19.1	95.07***
% CHW	52.2	1.9	570.14***	58.3	0.5	1300.00***
% Private sector	12.1	22.3	39.3***	5.6	16.0	96.79***
% Home	14.2	35.0	127.46***	10.8	31.5	220.45***
% Did not seek treatment	15.2	23.6	23.61***	21.5	39.7	131.89***

[a]Places where treatment was sought are not mutually exclusive as some children were taken to more than one place for treatment.
***$P < 0.001$.

Table 3 Source of medicines acquired for children with fever or diarrhoea

	Intervention	Comparison	χ^2
Source of antimalarial treatment	($N = 772$)[a]	($N = 189$)[a]	
% Public/mission health facility	10.5	52.4	175.01***
% CHW	82.4	5.3	409.53***
% Private sector	6.0	30.2	92.92***
% Home	1.7	13.8	56.83***
Source of ACT	($N = 586$)[b]	($N = 39$)[b]	
% Public/mission health facility	3.4	76.9	
% CHW	96.1	12.8	
% Private sector	0.3	5.1	
% Home	0.2	5.1	307.22***
Source of ORS	($N = 1104$)[c]	($N = 96$)[c]	
% Public/mission health facility	5.6	82.3	
% CHW	92.3	2.1	
% Private sector	1.3	6.3	
% Home	0.8	9.4	582.69***

[a]Number of children treated with any antimalarial; $N = 24$ children received more than one antimalarial.

[b]Number of children treated with any ACT.

[c]Number of children treated with ORS.

***$P < 0.001$.

associations were in favour of children from the wealthiest households. In intervention areas, there was no significant association between antimalarial treatment for fever and household SES. ACT treatment was significantly associated with household SES; however, it is children living in the poorest households who were most likely to receive ACT treatment (51%) as compared with 45% of children in middle SES households and 36% of children in the wealthiest households [$\chi^2(2) = 22.52$, $P < 0.001$]. ORS and zinc treatments for diarrhoea were not associated with household SES in the intervention area; however, zinc was significantly associated with SES in comparison areas [$\chi^2(2) = 15.72$, $P < 0.001$] with an association in favour of the wealthiest children (Table 5).

Discussion

This study demonstrates the potential of CCM to rapidly increase case management coverage for diarrhoea and suspected malaria among children under five. Implementation of a CCM package including ACTs and ORS and zinc for 12 months achieved relatively high coverage of prompt and effective treatment in two districts of eastern Cameroon. Children living in intervention areas with fever were nearly nine times more likely to receive ACT treatment as compared with children living in a neighbouring comparison area. Intervention-area children with diarrhoea were nearly nine times more likely to receive ORS as compared with comparison-area children. Whereas zinc supplementation for diarrhoea was practically non-existent in comparison areas, nearly half of intervention-area children with diarrhoea received zinc supplementation. Nearly all children treated with ORS, zinc and ACT in intervention areas received the treatment from a CHW. There appears to be minimal replacement of treatment-seeking behaviour and treatment for malaria and diarrhoea from public health facilities with CHW care. Although causation cannot be established in the absence of randomization and baseline measures, relative patterns of treatment-seeking behaviour and levels of coverage in intervention vs comparison areas suggest that the CCM approach facilitates treatment of children who, in the absence of community-based care, go untreated or receive some sort of home remedy.

Given coverage levels achieved, CCM is also an approach that could improve pneumonia treatment in Cameroon. Globally, a large gap in pneumonia treatment exists with 120 million cases annually of which 43 million are not managed by an appropriate provider. Cameroon has a high pneumonia burden and a large treatment gap, but no plans to implement CCM for pneumonia (Marsh *et al.* 2009). Recent research suggests that with training and supervision, CHWs are capable of managing suspected pneumonia in the context of an integrated CCM approach (Mukanga *et al.* 2011). Findings from this study suggest that improved coverage in case management of pneumonia could potentially be achieved through additional training and proper supervision of the CHW network in place.

Improving coverage through addressing access, quality and demand

Study results highlight program achievements towards addressing CCM pillars of access, quality and demand (Figure 1), thereby facilitating improvements in case management coverage. With respect to improved access to case management, most intervention-area caregivers reported that CHWs are easy to find when needed and are a convenient source of treatment. Nearly 60% reported visiting a CHW in the past year. CHWs effectively improved the reach of public health care into remote communities with sparse facility coverage and poor transportation infrastructure. More than twice as many children with fever and three times as many children with diarrhoea were taken to a public health provider for treatment in intervention vs comparison areas. Caregivers living in remote areas face geographic and financial barriers to accessing public health care, which can lead to delays in treatment-seeking behaviour and progression to severe illness. The opportunity with CCM to consult a health worker at any time of the day or night, 7 days per week facilitates prompt treatment-seeking and case management (George *et al.* 2009; Chanda *et al.* 2011).

The CCM program ensured that when caregivers sought treatment from a CHW, effective medicines were available. Most intervention-area caregivers reported that CHWs always have medicines available. Quarterly data from a routine monitoring system show that most CHWs maintained stock of ACT and ORS and zinc throughout the program, ensuring availability of effective medicines at community level. CHWs were restocked through the local health centre, and when supervisors discovered stock outs during supportive supervision, they restocked CHWs during the visit. Health centres were stocked through a district health facility, and district facilities

Table 4 Awareness of, access to and attitudes toward CHW services among children's caregivers

	Intervention ($N = 6555$)	**Comparison** ($N = 5190$)	χ^2
% Report a CHW is working in their community	81.3	26.4	4000.00***
% Visited a CHW within the past year	58.8	7.0	3400.00***
Caregivers—visited a CHW within the past year	($N = 3849$)	($N = 364$)	
Reason for visiting a CHW			
% Child had fever	69.9	45.7	88.39***
% Child had diarrhoea	70.8	26.5	295.31***
% Child had cough	21.4	22.3	0.18
% Other[a]	3.0	29.1	456.92***
CHW services received			
% Referral	19.2	30.5	26.63***
% Medicine	96.5	42.3	1300.00***
Caregivers—referred by a CHW	($N = 737$)	($N = 111$)	
% Followed referral advice	93.5	90.1	1.72
Caregivers—received medicine from a CHW	($N = 3712$)	($N = 151$)	
% Report that the CHW explained how to take prescribed medication	99.9	97.4	45.34***
Caregivers—report a CHW in their community	($N = 5327$)	($N = 1350$)	
Access to services—% agree			
It is easy to find the CHW when he or she is needed	93.3	63.9	841.85***
The home of the CHW is nearby	83.7	61.6	317.03***
Medicines are always available with the CHW	87.8	25.8	2200.00***
Quality of care—% agree			
The CHW knows how to help sick children	95.5	48.5	2000.00***
The CHW takes the time to answer questions	94.1	60.0	1100.00***
The CHW shows respect for clients	94.8	65.6	923.37***
Demand			
The CHW is a convenient source of treatment	93.5	36.9	2300.00***
The CHW gives medicines that are good quality	93.6	40.2	2100.00***
The CHW provides treatments that cure children from sickness	94.3	40.2	2200.00***

[a]Other reasons include a number of health conditions and symptoms. Common other reasons in the intervention area include skin problems (15%), stomach-ache/vomiting (14%), helminth infections (12%) and immunization (10%). Common other reasons in the comparison area include adult health issues (39%) and immunization (16%).

***$P < 0.001$.

were stocked directly by PSI. This supply chain was adequate for implementation in two districts, and was closely monitored through review of routine data and field visits so as to address the common challenge of maintaining reliable drug supply at community level (Bhutta *et al.* 2010).

Study results show high levels of perceived CHW quality of care among children's caregivers. Most intervention-area caregivers agreed that CHWs know how to help sick children, take time to answer questions and show respect for clients. Although quality of care provided by CHWs was not formally evaluated in this study, routine monitoring data show that CHW knowledge of the IMCI treatment algorithm and danger signs necessitating referral improved over time. Training and supportive supervision are key to ensuring quality of care provided by CHWs. Programs without consistent supervision are typically less functional, and large-scale programs are rarely able to achieve consistency in supervision (Bhutta *et al.* 2010). The integrated CCM program in Cameroon managed to provide consistent supervision on a quarterly basis in two districts.

Building informed demand among children's caregivers to seek prompt treatment from an appropriate provider is an important component of any intervention aimed at improving case management coverage. Competing behaviours include treatment at home with home remedies or other medicines, or no treatment at all. This study finds an association between CCM and treatment-seeking behaviour for children with fever or diarrhoea. Caregivers living in areas without CCM were more likely to refrain from taking any action to treat the child as compared with those living in areas with CCM. In addition, initial treatment at home with home remedies or medicines stored at home is less common for children in areas with vs without CCM. Rather than treat at home first or not at all, more than half of intervention-area children with diarrhoea or fever were taken directly to a CHW. In comparison areas, CHWs

Table 5 Awareness and access of CHW services, and treatment-seeking behaviour for fever and diarrhoea in children under five, and across relative household SES

	Intervention				Comparison			
	Low ($N=1845$)	Middle ($N=2038$)	High ($N=2664$)	χ^2	Low ($N=1471$)	Middle ($N=1737$)	High ($N=1981$)	χ^2
% Caregivers that report a CHW is working in their community	85.2	84.5	76.2	83.20***	26.5	29.8	23.4	55.63***
% Caregivers that visited a CHW within the past year	65.8	60.9	52.2	88.70***	7.3	8.4	6.1	7.33*
Children with fever	($N=412$)	($N=422$)	($N=523$)	χ^2	($N=247$)	($N=279$)	($N=272$)	χ^2
Sought treatment[a]								
% Public (facility or CHW)	67.7	66.1	63.9	1.56	23.5	32.3	33.8	7.55*
% CHW	58.7	55.0	44.7	20.02***	1.2	1.4	2.9	2.56
% Public/mission health facility	10.9	15.2	23.1	25.81***	22.3	31.5	32.0	7.51*
% Did not seek treatment	14.6	16.1	14.9	0.44	30.8	19.4	21.3	10.62**
Treated with								
% An ACT	51.0	45.0	35.8	22.52***	2.4	4.7	7.4	6.80*
% Any antimalarial	60.2	58.8	53.2	5.41	17.0	24.7	29.8	11.67**
Children with diarrhoea	($N=561$)	($N=607$)	($N=654$)	χ^2	($N=497$)	($N=504$)	($N=519$)	χ^2
Sought treatment[a]								
% Public (facility or CHW)	66.7	63.9	63.2	1.72	17.7	20.8	20.0	1.68
% CHW	62.0	58.8	54.7	6.86*	0.6	0.4	0.4	0.33
% Public health facility	6.4	6.9	9.6	5.19	17.1	20.4	19.7	1.97
% Did not seek treatment	20.0	22.7	21.5	1.33	38.6	39.3	41.0	0.66
Treated with								
% ORS sachet/solution	61.7	62.3	60.5	0.46	5.4	7.5	8.5	3.69
% Zinc	48.8	45.3	44.7	2.34	0.3	0.8	2.9	15.72***

[a]Places where treatment was sought are not mutually exclusive as some children were taken to more than one place for treatment.
*$P<0.05$, **$P<0.01$, ***$P<0.001$.

trained in various community health initiatives by previously NGO-sponsored programs were present but were rarely the first source for treatment sought for sick children.

The access, quality and demand framework guided implementation of the CCM program in Cameroon. Results from this study show that relatively high levels of case management coverage are observed in communities where programming effectively addresses these pillars; that is, where caregivers promptly seek treatment from CHWs who have been trained, receive routine supervision and maintain a continuous supply of effective medicines.

Improving coverage with equity across household SES

High levels of effective treatment in intervention areas were found to be equitable across SES. Where inequities disadvantaging the poorest children were observed in comparison areas, equity (no significant difference across SES) was achieved in intervention areas for access to public health care and effective case management for fever and diarrhoea. In the current era of intervention coverage scale-up for child survival, gradual progress towards reducing the overall gap has been made since 1990. However, within-country patterns of inequality are persistent and change only gradually if at all (Countdown 2008 Equity Analysis Group 2008; UN 2011). Strategies are needed to reduce the coverage gap quickly across socioeconomic strata. Specific aspects of a CCM program that facilitate equitable coverage were not tested in this study. However, the approach implemented in Cameroon focused on access, quality and demand appears to have addressed key barriers that often differentially affect the poorest children. These include lower likelihood of being taken to an appropriate provider for care, poor quality of care among facilities serving the poor and lower education levels contributing to relatively poorer health knowledge and practices (Victora *et al.* 2003). Evidence from this study suggests that programming around CCM pillars can effectively address these barriers to equitable coverage.

Strengths, limitations and need for additional evidence

This evaluation has a number of unique strengths, allowing for a strong contribution to the emerging evidence base for CCM programs. Standard methodologies for measurement of intervention coverage were utilized with data quality measures including training and close supervision of fieldwork, and use of PDAs for data collection to minimize data entry errors. With respect to study design, use of a comparison group allowed for taking into account levels of intervention coverage that would likely have been achieved at the time of the study in the absence of programming. However, this study is cross-sectional

and lacks baseline measurement. A baseline would have verified assumptions about the comparability of intervention and comparison areas, and would have allowed for reporting on the differences in magnitude of change over time in intervention vs comparison areas. Although baseline levels of intervention coverage were not measured for this study, contextual factors including population coverage with health facilities and child survival initiatives and interventions in these areas are similar. Additionally, treatment of ARI in children under five was measured and provides evidence supporting comparability of intervention and comparison areas with respect to case management intervention coverage. Treatment-seeking behaviour was found to differ significantly in intervention and comparison areas; nearly one-third of intervention-area children with symptoms of ARI were taken to a CHW as compared with 3% of children in comparison areas. However, the percentage of children with symptoms of ARI that received a recommended antibiotic was similar in both areas. This finding suggests that the CCM program facilitated treatment-seeking behaviour in favour of CHWs. However, in the absence of effective treatment provided by the CHW, treatment outcomes in intervention and comparison areas are similar.

This study assessed treatment-seeking behaviour and treatment outcomes using caregiver reports, which can be subject to recall bias. To minimize this bias, standard questions to assess symptoms and treatment-seeking behaviour were utilized, including a standard recall period of 2 weeks. To minimize recall bias with respect to treatments acquired, a field guide with pictures of antimalarials, antibiotics and ORS and zinc was used. Although caregiver reports may be biased by challenges with recall, this bias is not likely to have influenced caregivers differently in intervention vs comparison areas and thus bias in the conclusions on relative intervention coverage is not of concern.

Evidence presented in this article was derived from a census of households in intervention and comparison areas using a survey instrument focused on treatment-seeking behaviour. Additional methods and measures are needed to continue to build the evidence base to inform CCM scale up. These include objective quality of care indicators, such as assessment of correct case management through analysis of client register data, direct observation and/or client follow-up studies. Additionally, while malaria rapid diagnostic tests (RDTs) were not used by CHWs in this program, integration of RDTs into CCM programs is important due to global and national policy and strategy shifts emphasizing diagnosis. Initial evidence suggests that CHWs can correctly administer RDTs and provide appropriate treatment based on test results, particularly with quality training, supervision and job aids (Harvey *et al.* 2008; Mubi *et al.* 2011; Mukanga *et al.* 2011; Hamer *et al.* 2012). Monitoring CHW quality of care and evaluating strategies for ensuring quality of care with CHW networks operating at scale will be key to maximizing potential coverage of appropriate case management through a CCM approach.

The CCM program in Cameroon aimed to generate demand through use of community-based animators tasked with promotion of prompt and appropriate treatment-seeking behaviour. The approach recognizes that optimal levels of community sensitization may best be achieved by employing dedicated individuals with strong communication skills and willingness and time to devote to such activities. Demand creation for prompt and appropriate treatment-seeking may also be promoted through interpersonal communication; caregivers satisfied with CHW services and child outcomes may promote the services to family and friends. This evaluation did not explore levels of and outcomes associated with exposure to various channels with potential to influence behaviour. CCM demand creation activities in Cameroon and elsewhere should be informed by additional evidence on the most influential and cost-effective channels for promoting behaviour change.

With respect to access, CCM scale up beyond what was achieved in two districts with this program will no doubt require significant investment to address the challenges of maintaining supply through accurate and timely procurement, and supply chain management. Experience and evidence at scale is needed to inform best practices.

Conclusions

As the deadline for achieving the MDGs draws near, large gaps remain in coverage of key interventions to improve child survival. These gaps include case management for the leading causes of death in children under five—pneumonia, diarrhoea and malaria. Not only do coverage gaps exist but also significant disparities in coverage according to SES persist. Strategies are needed to rapidly scale up equitable coverage. Findings from this study support the use of CCM to achieve rapid and equitable improvements in coverage of case management for malaria and diarrhoea, and suggest that CCM is an important strategy for achieving MDG 4 by 2015. Findings also suggest that further gains towards achieving MDG 4 in Cameroon could be achieved by closing the gap in effective case management of pneumonia using trained and supervised CHWs. This would require a shift in current policy followed by political and donor will for implementation.

The keys to success of CCM programs include ensuring access to treatment through effective supply chain management, quality of care delivered by trained and supervised community-based health workers and informed demand for CCM provider services among children's caregivers. These pillars were achieved for program delivery in two districts of Cameroon. It is important that CCM packages are scaled up to demonstrate that such positive outcomes can be achieved on a larger scale. Evidence that large-scale CCM programs can achieve a significant reduction in all-cause child mortality is also needed.

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Endnotes

[1] Co-formulated fixed-dosage tablets containing ASAQ administered once daily for 3 days with dosage according to age: 2–11 months, 25/67.5 mg; 12–59 months, 50/135 mg.

[2] Two ORS sachets and 20 mg zinc tablets administered once daily for 10 days with dosage according to age: 2–5 months, ½ zinc tablet per day (10 mg); 6–59 months, one zinc tablet per day (20 mg).

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