Can Low-literacy Mothers Deliver Essential and Life-saving Care to Young Children in Rural Niger?

FINAL OPERATIONS RESEARCH REPORT

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ACRONYMS

ACT	Artemisinin-based Combination Therapy
ARI	Acute Respiratory Illness
CHA	Community Health Agent
FGD	Focus Group Discussion
iCCM	Integrated Community Case Management
IMCI	Integrated Management of Childhood Illness
KII	Key Informant Interview
ML	Mother Leader/Maman Lumière
MOH	Ministry of Health
MUAC	Mid-Upper Arm Circumference
NGO	Non-Governmental Organization
OR	Operations Research
ORS	Oral Rehydration Solution
RDT	Rapid Diagnostic Test
USAID	United States Agency for International Development
WHO	World Health Organization

ABSTRACT

Objectives: To examine the acceptability and effectiveness of integrated community case management (iCCM) provided by volunteer, low literacy Mother Leaders (ML) and compare service quality provided to that of paid Community Health Agents (CHAs).

Methods: Pre-test post-test comparisons of caregivers' and community members' views on acceptability of iCCM provided by MLs, measures of iCCM effectiveness in improving care-seeking, and post-test only comparisons of application of the iCCM algorithm between the study groups.

Results: Qualitative evidence at the community level suggested there is significant support for the MLs and their iCCM work. Care provided by MLs was widely accepted in the communities and replaced all other sources of care for children in their villages. Early treatment (< 24 hours after onset) increased significantly from 59% to 82%. MLs were as able as CHAs to achieve the benchmark of correct classification and treatment prescribed for at least 80% of the children consulted. Few MLs or CHAs were consistent in applying all steps for iCCM; though ML showed lower levels of compliance in some areas than CHAs.

Discussion: Despite requiring more support with mastering complete and consistent application of the iCCM algorithm, MLs demonstrated that they are capable of providing correct treatment and they are an acceptable option for first line treatment of sick children at the community level. These achievements and the improvements in care seeking practices in the community indicate that iCCM provided by MLs can make meaningful contributions to child survival.

I.   Introduction

Background: The correct treatment of pneumonia, diarrhea, and malaria through integrated management of childhood illnesses (IMCI) is one of the most powerful interventions to reduce child mortality.[1]   However, in many countries with high child mortality rates, primary healthcare facilities do not provide adequate access to treatment because of insufficient population coverage.[2] [3] A major challenge facing policy-makers and health service managers is how to fill the remaining gaps. Renewed interest in and experience with community health workers[*] (CHWs) is growing rapidly, and CHW programs are expanding in many countries.[4,5]

Community-based interventions are generally used to increase access to and coverage of health services. One strategy in particular, Integrated Community Case Management (iCCM), trains community members, usually volunteers, to provide curative services for common childhood illness including the treatment of diarrhea, malaria and pneumonia/acute respiratory illness (ARI). Evidence exists on the benefits of iCCM in reducing child mortality.[6,7,8] This approach is used to deliver lifesaving curative care in locations that have limited access to facility based services. In

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[*] Community Health Workers can refer to a paid or volunteer community based provider.

addition to equipping community based providers to deliver curative interventions, this strategy also ensures strong linkages in the form of referral to and supervision from the existing health facilities; iCCM is not a standalone approach to primary health care[9].

Beyond treatment at the community level, iCCM endorses community health promotion activities, including encouragement of timely care-seeking and appropriate home-based care[10]. Community volunteers have been successfully trained to conduct health promotion activities under a variety of models. One unique model, known as the Care Group model, creates a network of volunteer mothers with children under the age of five years to work as community-based peer health educators. These volunteer mothers, called Mother Leaders (MLs), are elected by their community and meet regularly in a group for training, supervision and support from a Health Promoter or outreach worker (either project supported staff or a government health care worker). Following their Care Group meetings, MLs hold group education sessions and conduct household visits to other mothers in their community to encourage the adoption of health behaviors and share health knowledge. The Care Group model is gaining recognition because of its effectiveness in promoting behavior change and expanding population coverage with a set of key household interventions that promote improved reproductive, maternal, neonatal and child health outcomes.[11,12,13] Although there is robust evidence that Care Group MLs can influence household level knowledge and behavior[14], there is no evidence concerning the potential for Care Group MLs to provide curative services, such as iCCM, in addition to their regularly scheduled Care Group responsibilities and health promotion activities.

Study Context: To determine if MLs have the potential to address the problems of access by responding to the coverage needs in countries with high child mortality burdens, we conducted an operations research (OR) project in Bambeye Commune of Tahoua Health District in Niger. The aim of the OR study was to examine the acceptability and effectiveness of an intervention focused on training and equipping low literacy volunteer mothers who are members of Care Groups to provide iCCM at the household level compared to CHAs who offer basic primary health services including iCCM at health posts.

Bambeye Commune has an estimated total population of 112,962 including 25,404 children under five years of age.[15] The primary source of livelihood is agriculture with some mix of regional migratory workers and nomads. In this rural area, only 25% of the population lives within five kilometers of a health center.[16]

In the last ten years, the MoH has been deploying Community Health Agents (CHAs) to fixed locations, called health posts[φ], in communities generally located more than five kilometers from a health center. Community Health Agents are formally recognized, trained in basic curative and preventive care including iCCM, and paid by the MoH to provide a reduced package of primary health care services to a catchment area of 2,500-5,000 people. In Bambeye, basic services and iCCM provided by the 16 health posts improve coverage for an additional 45% of the population

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[φ] For a comparision of the basic parameters of a heath post and health center see Appendix 1

(live within a radius of 5 km). Despite this, health care coverage remains inadequate as 30% of the population is still without easy geographical access[17] and absenteeism is high at the health posts[α].

Study Objectives:

Objective #1: To measure the acceptability of Care Group MLs as first line health providers for curative services for sick children under the age of five;

Objective #2: To determine the effectiveness of the deployment of MLs for iCCM in improving care-seeking and treatment for sick children;

Objective #3: To compare the quality of iCCM services provided by MLs at the community level to that of MoH recognized CHAs at the health post.

II.   Methods
A. Study Design

Design: Pre-test post-test comparisons were used to determine the effectiveness of iCCM by ML in improving care seeking and treatment for sick children while post-test only comparisons were used to measure acceptability and the quality of iCCM services provided. A mixed method study was conducted consisting of quantitative and qualitative components. Data collection methods included household surveys, key informant interviews (KIIs), focus group discussions (FGDs), and direct observations. The study was conducted in 12 villages with a combined population of approximately 22,436 including 5,046 children under five years of age.[18] All villages were situated more than five km from the nearest health center and possessed no other health structure in the community including a health post.

Participants: The study population consisted of Care Group MLs conducting health education activities (n=198) and a subgroup of Care Group MLs selected and trained to conduct iCCM in addition to health education activities (n=20). The comparison population consisted of CHA (n=8) deployed to rural health posts to provide basic health services.

To be eligible for selection as a Care Group ML, women were mothers with children under the age of five, a resident of the community, present in the community year-round (i.e. no seasonal migration), had consent from her husband or family members to participate, at least 18 years of age, and willing to work for her community without compensation. Each Care Group ML was chosen by a group of her peers living in the same geographical area in the village.

The Care Group MLs selected and trained to conduct iCCM were chosen from among the Care Group MLs in the 12 intervention villages. Two MLs from each of the Care Groups were chosen to conduct iCCM. Selection was based on their level of interest to provide iCCM, assessment by project field

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[α] Due to extremely low literacy rates in many rural areas, the possibility of recruiting from the local population is reduced and CHAs come from larger neighboring communities instead of from the communities which they serve. Limited community amenities in health post placement sites increase the difficulties in retaining qualified health workers and contribute to high levels of absenteeism.

staff of the MLs potential to master and conduct iCCM activities (assimilation of prevention topics, capacity to conduct education activities, assiduity in meeting attendance and participation in Care Group and community activities), and acceptance by the community. An additional literacy criterion was added by the Ministry of Health (MoH) and the final 20 ML[*] were all women who had at least four or more years of schooling.

The CHAs used for comparison were MoH employees who had ten years of formal education, a minimum of six months of formal training in basic primary healthcare, and on average nine years of practical experience. The CHAs were stationed at seven health posts that were in the same catchment areas as ML villages and were identified by ML communities as their usual source of health care in addition to the health center covering their geographic area. In addition to providing basic primary health care services that included but were not limited to iCCM services, the CHA also provided health information to clients and treated the general population not just children under the age of five years for a range of symptoms.

Ethical Approval and Informed Consent: Ethical approval was obtained from the Niger Ministry of Health Ethical Review Committee. Mother Leaders signed/opposed their thumb print on a consent form outlining their roles as Mother Leaders and their participation in the project, including the possibility of being selected for the iCCM component. The consent form was countersigned by their husbands as well as the village chief.

Informed consent was verbally obtained from each respondent prior to participating in the baseline and endline population surveys as well as the observations of case management and FGDs and KIIs during the qualitative endline assessment.

Study Duration: The baseline household survey was conducted in March of 2011 and lasted one month. The iCCM intervention was implemented for a total of 16 months from June 2013 - September 2014. Endline data were collected between June and August 2014.

B. Intervention

The main components of the intervention were: 1) establishment of Care Groups; 2) training and implementation of iCCM; and 3) health system strengthening for IMCI and basic child health care.

Establishment of Care Groups: Population data collected from community-led censuses were used to assign households with pregnant women and mothers of children under five years of age to groups that would be covered by a Mother Leader. Households were grouped geographically and the women selected from among themselves those who would be trained as a Care Group Mother Leader. A total of 198 Care Group ML were chosen and16 Care Groups were formed to cover the 12 study villages. Each Care Group ML was responsible for following an average of 13 households.

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[*] 21 Mother Leaders were trained and began conducting iCCM but one Mother Leader was requested by her community to stop case management due to issues not related to her iCCM activities. Monitoring information includes all 21 ML up until her removal and end line information was collected from the 20 remaining Mother Leaders.

Training and implementation of iCCM: The project trained all 198 MLs to conduct behavior change communication activities and deliver messages focused on child health and illness. Each Care Group met two to four times a month. The MLs received health information and training from a paid Health Promoter hired by the project. Following this meeting, each ML conducted home visits and small group education sessions to promote the adoption of key health practices by their group of community mothers. After mastery of health promotion and community mobilization activities, the MLs selected for iCCM were further trained and equipped to provide iCCM services.

The MLs selected for iCCM were trained by MoH nurses to provide curative services for malaria, diarrhea, and pneumonia and to identify children under five years of age with signs of malnutrition. The training module and iCCM tools used by the CHAs were designed by the MoH for a higher literacy level than what was attained by the majority of the ML selected to conduct iCCM. Because of the literacy limitations, a new suite of resources including a training module and iCCM tools (algorithm, individual consultation sheets, referral slips and drug management tools) for low-literate/illiterate iCCM providers was developed for the intervention. Adapted from the CHA module, these pictorial tools were specifically developed so that they could be completed without reading and writing skills.[α]

The iCCM training for the 20 MLs consisted of a four-day theoretical course followed by a five-day clinical practicum. The training covered signs and symptoms of child illness, general danger signs for immediate care-seeking, use of a rapid diagnostic test for malaria, use of a respiratory timer and counting beads to identify a rapid breathing rate, and treatment algorithms to permit MLs to assess children 2-59 months of age presenting with fever, cough and/or difficulty breathing and diarrhea and malnutrition. Mother Leaders used the algorithms to classify and treat cases of simple illness and refer cases of children less than two months of age or children presenting with a general danger sign, severe or complicated illness and/or cases of suspected severe malnutrition. The MLs were also trained on how to provide referrals, fill in the individual patient sheet, manage the drug supplies and counsel caregivers.

At the end of the clinical practicum, the senior nurse at the health center evaluated the MLs performance during case management and indicated whether she had sufficiently mastered the steps to begin treating children in her community. For those who had not yet reached adequate levels of performance, they had the option to continue the practicum. All 20 of the MLs were certified as having attained sufficient mastery to begin practicing iCCM.

After certification, each ML was provided with a 'care box' that included all the matieriels needed for iCCM (illustrated treatment algorithms, data collection forms and referral slips, and medications

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[α] While the Mother Leaders selected for iCCM all had some level of literacy the majority had only completed primary school in a system where many children can still not read even after completing three to four years of formal education

and materials to diagnose and treat diarrhea, fever/malaria, and pneumonia/ARI and identify malnutrition[+]).

Refresher trainings for iCCM were held in November 2013 and May 2014 (five and ten months after the initial training). During these one- to two-day workshops, MLs shared and discussed their experiences providing iCCM. In addition, their knowledge and skills were reinforced, especially in areas seen as problematic during supervision visits.

The senior nurse at the health center conducted supervision visits for the MLs in villages in the health center catchment area. Supervision tools were developed for use by the District Health Team and health center staff during monthly supervision of iCCM including: a monthly data collection form and supervision tool as well as tools for drug management—guides for calculating individual drug quantities and recording drug re-supply. Supervisors monitored skills and performance using direct observation of cases (when possible), review of patient forms and treatment registers, interviews with caregivers (on knowledge of danger signs, administration of medication received, and advice received) and review of stock management forms and supplies available in the Mother Leader's care box. Bi-monthly supervision of MLs was conducted during the first few months, followed by monthly supervision visits. Medical supplies were distributed during monthly supervisory visits and supervisors aggregated treatment information and submitted to the Project Manager.

Health System Strengthening: Project activities also focused on strengthening basic child health services at the health center and health post. Activities included clinical training, support for supervision, and provision of equipment, materials and medicines. Health center staff attended a seven-day clinical IMCI training while CHAs attended a five-day session on iCCM. This training was reinforced through monthly coaching and on-the-job-training visits conducted by clinical nursing staff working on the project. Support was also provided to the District Health Team and health center staff to conduct regular quarterly and monthly supervision visits at the health center and health post level. Health centers and health posts also received basic medicines and supplies for IMCI and iCCM activities.

Table 1 shows the similarities and differences between the intervention and comparison groups.

Table1 Comparison of Intervention and Comparison Group Variables

	Community Health Agents	**Mother Leaders**
Location	Health Post	Community (village)
Salary or Incentives	$100 USD/month; paid by MOH	Volunteer; member of a Care Group

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[+] zinc and oral rehydration solution, rapid diagnostic tests (RDTs), paracetamol, Artemisinin-based Combination Therapy (ACT), gloves, a sharps box, respiration timer and counting beads to assist in measuring respirations, cotrimoxazole), and mid-upper arm circumference band (MUAC).

Duration of Training	Initial training: Six months of training, including one week on iCCM In-service training: five day iCCM training every two to three years	Initial training: Four day training, followed by five day clinical practicum at a health center In-service training: One to two day workshops every three to six months
Required Education Level	Attainment of a secondary level of education	Must demonstrate ability to read and write
Clinical Services (Symptoms Assessed)	Assessment of and treatment for diarrhea, fever, acute respiratory infection (ARI) symptoms, screening for malnutrition plus other non-complicated symptoms of illness and infection in children under five years of age and the general population; family planning and child birth (delivery services	Assessment of and treatment for diarrhea, fever, acute respiratory infection (ARI) symptoms, screening for malnutrition in children under five years of age
iCCM Treatments Provided	ORS, zinc, ACT, RDTs, Cotrimoxazole, Vitamin A, mebendazole/albendazole for deworming	ORS, zinc, ACT, RDTs, Cotrimoxazole
iCCM Referral Protocol	Referral to health center for severe or complicated cases of malaria, pneumonia, and diarrhea, any child exhibiting general danger signs, acute malnutrition measured by weight-for-height and/or mid-upper arm circumference, or <two months of age	Referral to health center for severe or complicated cases of malaria, pneumonia, and diarrhea, any child exhibiting general danger signs, suspected acute malnutrition as measured by mid-upper arm circumference, or <two months of age
Supervision	Supervised monthly by health center nurse	Supervised by health center nurse bi-monthly for first two months and then once per month
Health Promotion activities	Group education sessions at the health post for clients; community-wide village assemblies as needed to discuss pertinent health topics	Monthly household visits and small group education sessions for a group of community mothers

C. Intervention Monitoring

Project staff attended all ML training sessions and conducted joint supervision with the MoH during the initial months of iCCM implementation. Project staff followed and monitored key processes and activities by the ML.

In addition, the following information from MLs registers and supervisory report forms completed by the MoH supervisors were tracked on a monthly basis:

- Frequency of supervision: percentage of MLs who received a supervision visit in the last month and percentage receiving a visit within 30 days of the previous supervision visit
- Drug stock outs: percentage of MLs with all materials necessary for iCCM (disaggregated by product: Artemisinin-based Combination Therapy (ACT), Rapid Diagnostic Test (RDT) for malaria, Oral Rehydration Solution (ORS), Zinc, cotrimoxazole)

D. Dependent Measures

The OR measured outcome variables in three areas: acceptability, improvements in care seeking and treatment, and quality of care as compared to the standard of care provided by CHA.

Acceptability: Ministry of Health staff and community member's experience and satisfaction with the health services provided by Care Group MLs were measured through KIIs and FGDs one year after iCCM services were offered in the community. Topics explored included perceptions of the overall intervention in terms of accessibility, acceptability/satisfaction, and quality/effectiveness of care provided by MLs, as well as the selection, training, and supervision of MLs, and factors affecting ML motivation. Additional aspects of acceptability of the iCCM intervention were assessed through questions included in a post intervention household survey on care seeking administered to caregivers of children 0-23 months of age who were sick in the two weeks preceding the survey. . Quantitative measures of acceptability included reported:

- Ever use of a ML and use of a ML for last illness

- Perceived advantages and disadvantages of using ML as health care providers

- Whether the ML was the first source of care and reasons for the choice of source of care

Effectiveness: The household survey on care seeking behaviors conducted with mothers of sick children 0-23 months of age in the villages served by ML providing iCCM was also used before and after the intervention to measure the effectiveness of iCCM in improving care-seeking behavior and treatment practices. Improvements in care-seeking and treatment for sick children 0-23 months were measured through four key indicators:

- Overall care seeking behavior (% of children age 0-23 months presenting with fever, diarrhea, or ARI symptoms (cough and rapid or difficult breathing) in the last two weeks who were taken for care)

- Timely care seeking (% of children age 0-23 months presenting with fever, diarrhea, or ARI symptoms in the last two weeks taken for care within 24 hours)

- Source of care (disaggregated by source)

- Treatment follow-up (% of children 0-23 seen for treatment who received a follow-up visit during and/or following treatment)

In addition, service statistics on the number of consultations and treatments provided by ML, disaggregated by illness, were collected.

Quality of Care: Quality of a care is defined as providing the appropriate service correctly. This assessment focused on observations of the ability of the MLs to 1) provide correct treatment and 2)

apply clinical iCCM guidelines in assessing, classifying and treating sick children. In addition to providing the child with appropriate medicines for his/her condition, quality iCCM from a technical perspective also includes a number of standard assessment and counseling tasks set out in the protocol (see Appendix 2 for a list of these elements). Sick child consultations conducted by ML and CHA were observed by nurses who were recruited specifically for the study. Compliance with the iCCM protocol and performance on correct treatment was compared between the two groups of providers based on the following indicators:

a. **Correct treatment**

i. Percent of providers who classified correctly all illnesses and prescribed treatment or referral that matches the classification

ii. Percent of providers who administered the first dose during the consultation

b. **Adherence to and consistent application of clinical guidelines**

i. The percent of providers who followed the algorithm and performed all assessment, treatment counseling, and prevention and care counseling steps

Performance for correct treatment was measured as the ability to classify and provide correct treatment for all symptoms for at least 80% of consultations observed. Diagnosis was based on the integrated management of childhood illness classifications of simple and severe disease (see Appendix 3 for definitions). As per the iCCM protocol, correct treatment should include receiving the first dose of treatment immediately and in the presence of the provider.

Adherence with the clinical guidelines was classified into four categories a) consistent application of the iCCM protocol (applied for ≥80% of observed consultations), b) regular but not yet systematic application of the protocol (≤79% and ≥51%), c) inconsistent application of the protocol (≤50%) and d) non-adherence to the protocol (0% or not performed).

Data Collection Methods:

Table 2 Summary of data collection methods

Outcome variables	Data Collection Method	When Administered	Respondents	Sample Size
Acceptability	Key Informant Interviews (40) and Focus Group Discussions (2): Topics explored during the KII and FGs include perceptions of the overall intervention itself, including the selection, training, and supervision of Mother Leaders.	June to August 2014	MOH staff Project Staff Mother Leaders and Community members in 8 villages, 3 health centers and 2 health posts	**KII**: 7 MOH staff (1 member of district health team, 1 doctor, 3 nurses, 2 CHA) 4 project staff (3 field staff and Behavior Change and Community Strategies Officer) 21 Mother Leaders (including 16 iCCM providers) 8 other community members (3 women, 2 men, 3 village leaders) **FGD**: 11 husbands of Care Group ML

Care seeking and treatment and acceptability	Household Survey in 12 intervention villages (cluster sampling with 23 clusters and 10 cases per cluster)	Baseline (April 2011) Endline (June 2014)	Mothers of children age 0-23 months with an episode of fever, diarrhea, or ARI symptoms in the previous 2 weeks	199 caregivers (baseline) 220 caregivers (endline)
Care seeking and treatment	Mother Leader reporting data	Monthly July 2013 – Sept 2014	Mother Leaders	21 Mother Leaders
Quality	Observations of case management	August 2014	Mother Leaders CHAs	20 Mother Leaders 8 CHAs 135 sick child consultations/199 cases of illness

The baseline and endline household survey collected information on care-seeking and treatment of children 0-23 months who had been sick in the two weeks preceding the survey with fever, diarrhea, or ARI symptoms. At baseline random sampling was used to select households from a list of households with children 0-23 months of age in each village (list was based on village-wide censuses conducted for project activities). Households without a sick child were replaced with the next randomly selected household on the list until ten caregivers were interviewed. As updated household censuses were not available at endline, lists of households with children 0-23 months of age were reconstructed through information from ML and other key informants. Door-to–door visits were made to identify households with children sick in the preceding two weeks. Ten households were then selected from the list of eligible households using numbers generated from a random number calculator. A recall period of two weeks was used for purposes of eliciting responses to questions about the management of the most recent illness episode. This was done to minimize recall bias because of the details expected from the respondents. The recall period was extended for more general questions around health seeking choices, reasons for choices and utilization of ML iCCM services. The primary outcome of timely care-seeking and source of care were estimated using the first healthcare option reported by the caregiver.

Each provider (Mother Leader or CHA) was observed over a maximum of two days or until five sick child consultations were observed, whichever came first. Observations were conducted by independent nurses recruited by the project and trained on an observation checklist during a one-day training session. The overall focus of the observation was whether the MLs and CHA followed all the steps in the protocol. The nurses marked each item on the observation checklist as having been performed or not or "not applicable" if an item did not apply to a particular case. For diagnostic steps (measure of upper arm circumference or weight and height, rapid diagnostic test for malaria (RDT) and respiration counts) the nurses indicated if the procedures had been performed correctly or incorrectly and if the classification was correct or incorrect. All 20 Mother Leaders were observed. Three of the ten health posts originally selected for the study were visited but not included in the final results (two health posts were not open during the data collection

period and one health post had no sick child clients during the two days of observation). As a result only, eight CHAs were observed.

III.   Results
A.   Intervention Monitoring Results

Besides short periods of individual non-activity due to illness, travel, and/or recuperation after childbirth or due to stock out of drugs, all MLs actively performed iCCM during the study period.

Supervisors were not consistent in submitting their supervision reports; on average, reports were received for 75% of MLs each month. A review of the supervision forms submitted showed that supervisors consistently conducted a record review and were able to make observations of a consultation and interviews with caregivers for the majority of MLs each month. The data show that supervisors were not able to ensure a consistent drug supply for the MLs. Explanations given by the supervisors for the stock outs revolved around lateness in conducting the supervision visits and errors in using the drug re-supply tools.

The OR protocol and work plans were used to guide implementation however a number of adjustments or deviations were made from the OR protocol during implementation and these are noted in Table 3.

Table 3 Planned Interventions versus Actual Interventions

Planned Intervention	Actual Intervention
Avg. under five population per ML: 160	Avg. under five population per ML: 270
Supervision: twice monthly visits for the first two months followed by monthly visits every 30 days or less	Calendar of twice monthly visits for first two months not respected. First supervision visit occurred four to five weeks after the ML began iCCM. On average 85% of MLs received a visit each month but only 20-50% received the visit within the 30 day window. For the three month period from mid-November to mid-February, no supervisory visits were conducted; this time period also corresponds to a period of drug stock out and suspension of iCCM activities.
CHAs independently supervise ML	One CHA independently supervised ML.
Medications continuously available to ML	No medications available during Dec. – Feb. due to stock outs. Supervisors were not able to ensure a consistent drug supply for the MLs at other times. In any given month, 30% or more of MLs experienced a stock out of at least one essential medicine. Length of stock outs minimimised by drug provision between supervisory visits.

B. Equivalence of groups and demographic characteristics

Providers of iCCM

Mother Leaders were all female and had an average age of 32 years. The CHAs were also majority female and had an average age of 36 years. Factors that could significantly impact the quality of care provided (level of education, number of years of experience and length of initial training) varied between the two groups with MLs having attained a lower level of schooling, and having had less training and fewer years of experience with iCCM.

Table 4 Characteristics of Mother Leaders and Community Health Agents

Indicator	Mother Leaders N=20	CHAs N=8
Ave number of years of schooling	6.6 (range: 4 – 9 years)	9.6 (range: 8 – 10 years)
Ave number of years of experience in iCCM	1	9.6 (range: 6 – 12 years)
Ave number of months of initial training	0.5	7.9
In-service training	One to two day workshops in November 2013 and May 2014 (5 and 10 months after initial training).	Five day iCCM training during the intervention for five CHA and in the two years preceding the intervention for two others

Target Population: the children taken for care according to the household surveys at both baseline and endline were distributed across the 0 to 24 month age range, equally distributed by sex, represented all three illnesses and in the majority presented with one symptom of illness. There was a change in disease patterns with significantly fewer suspected pneumonia cases seen at endline and children more likely to have experienced a single symptom at endline compared to the baseline (see Table 5).

Morbidity is seasonal so the change in timing of the survey from the baseline in March to June for the endline is a likely explanation for the difference in number of children with suspected pneumonia. This difference would not influence the study results as there were no significant differences in whether a caregiver sought care for a child with suspected pneumonia compared to fever and diarrhea cases at baseline.

Table 5 Characteristic of Children 0-23 months of age ill in the two weeks preceding the survey

Characteristic	Baseline n=199	Endline n=220	p-value[*]
Age (%)			
0 - 5 months	17.6	20.0	
6 - 11 months	39.7	33.2	0.589
12 - 23 months	42.7	46.8	
Mean age	11.2 months	11.7 months	0.398
Sex (%)			
Male	47.0	50.9	0.572
Female	53.0	49.1	
Illness (%)			
Fever/convulsions/malaria	54.3	52.3	0.682
Suspected pneumonia (cough with rapid/difficult breathing)	58.3	28.6	<0.000
Diarrhea	43.7	42.3	0.765
Number of presenting symptoms (%)			
One symptom	54.3	77.7	
Two symptoms	35.2	20.9	<0.001
Three symptoms	10.6	1.4	

Observations: A total of 135 children were observed, 99 seen by MLs and 36 by CHAs, contributing a total of 89 cases of fever, 67 cases of cough with difficult/rapid breathing and 43 cases of diarrhea. More children were seen per ML during the two days of observation (an average of 5.0 children) than per CHA (4.5 children). However, as a child could have multiple symptoms/illnesses, the total number of treatments observed for each illness showed no significant differences between the two types of providers. On average, MLs treated 3.4, 2.5 and 1.5 cases of fever, cough and diarrhea respectively versus 2.8, 2.1, and 1.6 of fever, cough and diarrhea respectively treated by the CHA. The average age of children treated was 16.6 months for children seen by MLs and 17.3 months for children seen by CHA.

C.   Objective 1: Acceptability of the Intervention

Acceptability of the iCCM intervention among the target population and other key stakeholders
Community members and district-level stakeholders were extremely supportive of iCCM provided by MLs at the household level. Qualitative evidence at the community level suggested there was significant support for the MLs and their work.

MOH Staff Views
Before the intervention two conflicting points of view were expressed: those who believed in the feasibility and potential success of MLs implementing quality iCCM and those who were more hesitant about the ability of MLs to provide quality care. The Chief Medical Officer of the health district asserted that volunteers cannot provide quality health care according to the standards set by the health system because their expertise does not extend beyond the simple administration of

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[*] Pearsons Chi Square test to test for difference in distribution for age, sex and number of presenting symptoms, T test for comparison of proportion of child presenting with each illness/symptom

medicines. However, the IMCI focal point person in the regional health department felt that health volunteers could provide quality health care in their communities as long as they were motivated and received the necessary support including training, supplies (e.g. medicine, materials,), and supervision. Three out of five health center nurses and four out of the five CHAs interviewed before the intervention also believed in the potential of MLs to provide quality care. For many health staff, their confidence in MLs stemmed in part from their past experiences with similar projects; for others, it was driven more by a desire to see women promoted as leaders within the community. In contrast, there were some health staff who were skeptical about the capacity of the MLs, stating that women from the community may not have the necessary education, qualifications, leadership skills, or commitment necessary to fulfil such a demanding role.

By the end of the study, opinions of MoH staff witnessing MLs providing iCCM were unanimous and the MoH staff had become their champions.

> *"In some areas of the district, people can't believe that there are illiterate women doing the work of Mother Leaders (iCCM) – they can't believe that these women can diagnose malaria, signs of malnutrition, diarrhea, and do treatment. So at each meeting, I would tell about this and no one believed me at first." (*Member of District Health Team)

Health personnel did not feel that ML (MLs had an average of six years of primary school education attained in rural schools with poor quality instruction and weak scholastic achievement) literacy levels were an issue for two reasons. First, the training was done in the local language and the MLs understand fully the content of the modules related to children's diseases. Second, the monitoring tools that the MLs completed were simple and based on images and signs that the MLs mastered perfectly. This was confirmed by supervisors who observed MLs.

> "*One needs willingness in particular to do iCCM because it is the images that speak. One doesn't need to go to school for that. "(*Head Nurse, health center)

> "*One doesn't need not go to school because the illiterate Mother Leaders conduct case management and fill out the forms very well."(*CHA, health post)

As supervisors, they were satisfied that MLs had mastered the protocol and its application. For most supervisors, they felt the Care Group MLs were very competent at case management, including diagnosis, danger signs, case referral, etc. and that MLs were equal to the CHA with whom they have almost the same technical job. Supervisors acknowledged that the MLs had some difficulty in maintaining the register for drug management. Not all had mastered completing stock management records for drugs. Supervisors suggested this failure could be explained by two factors. First, MLs did not have enough time during training to master filling out the form and second, some MLs did not immediately fill out the form but waited until a few days later or even the day of supervision to try to remember the number of drugs provided. The supervisors indicated that this problem tended to resolve over time with supervision visits and regular refresher sessions to address specific problems or issues related to case management,

including drug management. The MOH staff felt that the four day classroom session followed by five days of practicum was too short.

> *"The Mother Leaders have problems filling out the follow-up sheet for sick children and the drug management form. That's why I think we can extend the training by a week to spend much more time explaining"* (Head nurse, health center)

The MoH staff also embraced their role as trainer and supervisor of MLs. Each supervisor referred to the MLs under their charge as "my Mother Leaders" and stanchly defended their capacity to conduct iCCM. Even those who were unable to conduct supervision activities within the timeframe agreed upon were reluctant to hand over supervision to another health worker.

While the MoH staff accepted the MLs and iCCM as an addition to the continuum of care, they were less sure of its sustainability.

> *"This is my concern for Mother Leaders…without Concern there… the DHT does not have the means or capacity to do it. To do follow-up, to give them the materials, drugs, etc. What mechanism can we put in place?"* (Member of District Health Team)

> *"If there is no Concern, I do not know how the project will be done after"* (CHA, health post)

Community Member Views
Mother Leaders were respected in the villages and their services were highly appreciated by members of the community for two reasons. First, MLs were valued for their voluntary commitment to development action for their community and secondly for their responsibilities and role in the community. They were considered "madouban gari" (village mirrors) that is to say a model and example to follow on good practices for the promotion of health in the community.

The function of the iCCM Care Group ML gave women the power to act on illness, particularly that of children, who are the most vulnerable population group in the village.

> *"They treat the children well and they are healed. For fever and colds we do not need to go to Bambeye where you pay over 2,000 francs CFA (equivalent to approximately $4) for transportation on a motorcycle. The medicine box of the Mother Leader has helped us a lot. The iCCM Mother Leaders treat and care for children and are available"* (male representative of village leader)

Unlike the majority of health agents in health facilities that were from outside of the community, the MLs were members of the community.

> *"There is a confidence and familiarity related to knowing the person we have chosen and to whom we can easily explain our health problem. Service from someone who we know and that from someone who we do not know is not the same."* (Female caregiver to child under five)

Thus, the fact that MLs belonged to the community they served helped facilitate communication between users and the provider and utilization of iCCM services.

The communities' views on the quality of services provided by the ML as it relates to the acceptability of the iCCM by MLs was also analyzed from their comments on the welcome received, drug availability and effectiveness of treatment.

Caregivers said they were very satisfied with the reception they received from the MLs. Not a single complaint was received from iCCM service users or other members of the community. The mothers of children treated liked the fact that the ML spent more time treating their children than nurses in health facilities.

The MLs had a drug kit with essential medicines and were able to use a blood test for the rapid diagnosis of malaria. According to the community, the fact that the ML analyzed the blood was a sign of "modernity" and effectiveness of iCCM that was not always found in all of the health facilities serving the community.

Integrated Community Case Management reduced the distance and suffering that are associated with travel from remote villages to health facilities which are not easily accessible given the long distances.

> *"Now the drug is with us, we no longer need to go to Mogheur to care for our children."* (Female community member)

In fact, women used to travel distances of more than five to ten kilometers to seek care for their sick children. Now the iCCM provider was a neighbor located a few steps from the house. This intervention removed the difficulties related to foot travel with a child on the back to get to the health center in the nearby village or the danger and cost of treacherous travel on a motorcycle on impassable roads.

According to the community, the treatment provided by the Care Group ML was effective

> "*As soon as she gives the medicine, the child is cured in one or two days.*" (Female caregiver)

> "*I appreciate the work of ML which is effective. My child had a fever; she gave him a blood test (RDT) which was negative. She then gave him a three day treatment for a cold and the child was cured.*" (Female caregiver)

This perception of the effectiveness of the services provided by ML contributed significantly to the increase in the use of iCCM services and reduced the use of faith healers, traditional practitioners, and drug peddlers in the villages.

> "*Before the people of the village were using the drugs from the street vendors; they bought para, two colors, nivaquine to reduce the fever. Now*

with the arrival of iCCM by the Mother Leader, children are immediately brought to her home for care." (Village leader)

Selection of the MLs was a participatory and consensual process. Members of the community chose the MLs and following the selection, consent of the woman and her husband was requested. This selection process was based on strong local social values. Community members used terms in the local language signifying agreement / authorization when speaking indicating that the Care Group ML was invested with the consent and approval of the community who placed its confidence in her for the care of their children. In turn, in agreeing to her selection the ML demonstrated her commitment to the community to carry out the Care Group activities including the management of child illness in her community.

In addition to the process of choosing MLs for iCCM in their village, some communities also asserted ownership of the activity by putting in place local mechanisms to safeguard and monitor the system. Measures were taken and agreed upon in the community to ensure that MLs were available to treat children (such as setting hours when the ML would be in the village to treat children). In one village, the community appointed the members of the School Management Committee to support and monitor the behavior change communication and iCCM activities of the MLs in the village.

The acceptance and confidence of the community was also manifested in the solicitation of these same women for other roles in addition to their Care Group and iCCM role. Several MLs providing iCCM were also selected to conduct family planning and nutrition activities in their communities.

Husbands Views
Husbands played an important role in the success of the activities of the MLs. By allowing their wives to engage in this community work, men also felt they had a certain responsibility for the iCCM activities being conducted. For men, it was an honor and a source of pride that their wives were chosen by the community to provide care for children of the village.

> *"In the whole village, that your wife is chosen and entrusted with a job is truly an honor"* (Husband of Care Group iCCM provider)

In addition, husbands provided diverse support for their wives to facilitate their iCCM activities in the community. These included:
− Excusing their wives from field work,
− Providing their phone or calling supervisors on behalf of their wife
− Providing their wives the funds for a small business to enable the ML to remain at home to conduct iCCM activities

The support provided by men to their wives conducting iCCM services was noted by others in the communities.

> *"When you bring a child [for treatment], it is the husband himself who is going to go call his wife to treat the child"* (Community leader)

Women with many community functions in addition to iCCM noted increased potential for conflict with their husbands due to their frequent absences from the household and the accumulation of tasks.

> *"Sometimes my husband expresses his dissatisfaction especially when I am called for an activity while I am preparing the meal. He says it's not right to leave the preparation of meals to go to another Concern activity in addition to treating children"* (iCCM Mother Leader)

Mother Leader Views

The source of MLs' motivation was symbolic; it resided in social recognition from the community. The MLs' motivation to conduct iCCM was not financial or material; they were motivated by the thanks and expressions of satisfaction from caregivers of the children they have cared for.

> *"Volunteering is not a problem and everyone knows that it is volunteer work for our children. For me, the availability of medication and the training of Mother Leaders from the village for iCCM is the best way to effectively solve the health problems of the population"* (iCCM Mother Leader)

> *"I knew from the start that it is voluntary. I am especially motivated when passing people thank me for helping children"* (iCCM Mother Leader)

Despite acknowledging that they were volunteers, several constraints were noted by MLs and several indicated a desire for remuneration. Some MLs indicated that it was not easy during the agricultural season to respect the agreement with the community to be available in the mornings up to nine or ten o'clock and again in the afternoons beginning at three or four. This was especially true for women whose husbands have migrated or who do not have older children or co-wives to help with the field work or domestic tasks.

Some MLs expressed a desire for materials or cash to start income generating activities to contribute to supporting the family. This could be the result of discussions with Concern staff around support to the Care Groups for income generating activities. Others expressed a desire for working conditions to be improved. As the MLs treated children in their homes, they noted that consultations often occurred when their husbands were home from the fields and trying to rest. This posed a problem of discretion and privacy; MLs suggested that constructing small hangers in their yard for consultations could improve the situation. Lastly some MLs with higher levels of education hoped to one day be recruited as a CHA at a health post.

Acceptability reported from service users

Reasons why women sought care from MLs varied. At endline, caregivers cited proximity most often as a reason for use of a ML for the child's most recent illness followed by availability of services, quality, and access to follow-up care. These same reasons were listed as advantages to

using services provided by MLs from respondents who had ever used iCCM services provided by a ML (see table 6).

Table 6 Advantages to utilizing services from Mother Leaders

Advantages	Endline (N=202) %
Proximity	51.5
Quality of treatment	46.0
Less wait time	31.7
Availability of Mother Leader	22.3
Access to follow-up care	17.3
Knowledge raising and advice/counseling	7.9

Furthermore survey respondents who had ever used iCCM services provided by a ML were asked about disadvantages. The overwhelming majority indicated that there were no disadvantages (89%). Stock-out was cited by 6% of respondents and non-availability of the ML by 2% of respondents.

Caregivers who had never used ML iCCM services (a total of 17 mothers) were also asked about disadvantages of using the MLs and reasons why they had never brought their sick child to see the ML for care. For more than half of the caregivers (five caregivers), it was a question of not knowing the ML treated children or not knowing the ML who provided treatment (four caregivers). For the other caregivers, it was because the caregiver did not seek care, or the illness of the child was not treatable by the ML. One mother indicated it was because the ML was sick at the time of the child's illness. None of the responses given for never use were linked to the quality of care or other aspects related to the acceptability of iCCM services provided by MLs.

A final indication of acceptability is level of satisfaction with the care received. Satisfaction by source of care shows high levels overall with a higher percentage of caregivers receiving care from a ML indicating complete satisfaction.

Table 7 Level of Caregiver Satisfaction with Care

Caregiver completely satisfied with care	Endline	
	N	%
Mother Leader	171	94.2
Heath Center	53	83.0
Health Post	15	86.7

D.   Objective 2: Improvements in timely care-seeking and treatment

Table 8 presents changes in care-seeking and treatment for sick children 0-23 months before and after the iCCM intervention. While there was no change in overall care seeking, care-seeking within 24 hours of onset of illness increased significantly after the intervention.

Table 8 Changes in Care-Seeking and Treatment Before and After the Intervention

Indicator	Baseline		Endline		p-value
	N	%	N	%	
% children 0-23 months presenting with fever, ARI symptoms, or diarrhea who were taken for care	199	92.0	220	91.8	0.569
% children 0-23 months presenting with fever, ARI symptoms, or diarrhea who sought care within 24 hours	189	57.7	220	75.9	<0.000
% children 0-23 months with fever who were treated with an effective anti-malarial drug within 24 hours	108	27.8	115	50.4	<0.001
% children 0-23 months with confirmed malaria$^{\Psi}$ who were treated with an effective anti-malarial drug within 24 hours	108	27.8	59	88.1	<0.000

In addition to bringing their children for care sooner, timely care was also improved by reductions in travel and wait time. The majority of caretakers traveled to the provider on foot (93%). Virtually all care-givers using MLs indicated that it took less than 30 minutes to access care while half and three quarters of those using health posts and health centers respectively indicated spending more than one hour to reach the post. For a quarter of those seeking care at a health center, it took two to three hours to reach the facility.

More than 90% of the caretakers indicted that they were seen immediately by the ML. Only 19% and 27% of caretakers receiving care at a health center or health post respectively indicted that they were seen immediately. The majority were seen within 30 minutes but 38% and 27% of caretakers still indicated waiting more than 30 minutes.

There was a significant shift in where caregivers of sick children sought care between the pre-intervention (baseline) and the post-intervention (endline) surveys. In the endline survey, the majority of caregivers sought care from MLs with a corresponding decrease in the proportion that sought care at the rural health facilities. Use of unqualified providers (traditional healers, street vendors and shops) also decreased significantly (see Table 9 source of care). Ever use of the ML by caregivers was slightly higher (92%) than use during the preceding two weeks. Use of the ML for first source of care was slightly lower for suspected pneumonia (79%), than for fever and diarrhea (88% and 89% respectively).

After one year of implementation, uptake of the iCCM intervention was high. Before the intervention, the majority of caregivers went to the health center as their first source of care. After the intervention, MLs had overwhelmingly replaced all other sources of care in their communities indicating high levels of acceptability of the iCCM intervention (use of ML for last illness was 88% and ever use of ML was 92%) (see Table 9 under Objective 2).

$^{\Psi}$ Rapid Diagnostic Tests were not part of protocol in 2011; baseline values are for presumptive treatment only.

Table 9 Source of Care

First source of Care	Baseline (N=176) %	Endline (N=202) %	P-value[∞]
Health Center	79.0	8.9	
Health Post	7.4	1.0	
Mother Leader	0.0	88.1	<0.001
Traditional Healer	2.3	0.0	
Street Vendor	9.1	1.5	
Shop / Pharmacy	2.3	0.5	

iCCM case load and treatment

Caseloads were high; the MLs saw more than 5,949 sick children (4,233 cases of fever, 1,466 cases of diarrhea, and 2,768 cases of cough and rapid breathing[∂]). The average number of children seen per month was 29 but some MLs saw upwards of 60-80 children per month during peak malaria and ARI seasons.[*] Forty-four percent of the fever cases were confirmed as malaria (ranging from 13% to 74% depending on the time of year) and 98% received treatment with ACT. Ninety-five percent of the children with diarrhea received ORS and zinc. Of children presenting with cough and difficult breathing, 86% had rapid breathing. All reported cases of rapid breathing received cotrimoxazole. It should be noted that the peak period for ARI was also during the time period for which there was a drug stock out. During drug stock out, MLs referred the children to the health facilities and they were not counted as consultations.

A total of 120 children brought to the MLs were referred immediately for treatment at a health center (2% of the total children brought for consultation). The reasons for immediate referral were for danger signs (47), severe malnutrition (44), younger than two months (7) and severe illness (33). The number of children with immediate referral declined over time (97 immediate referrals were in the first four months). Of the children referred, 95% were seen in a health facility.

[∞] Pearsons Chi Square test to test for difference in distribution.
[∂] Number of cases does not equal number of children treated as children could present with multiple symptoms and be treated for multiple illnesses
[*] Peak malaria season is August to October depending on the start and duration of the rainy season and the peak ARI season in December to February.

Figure 1 Average number of cases treated per Mother Leader per month from July 2013 to September 2014 (disaggregated by illness)
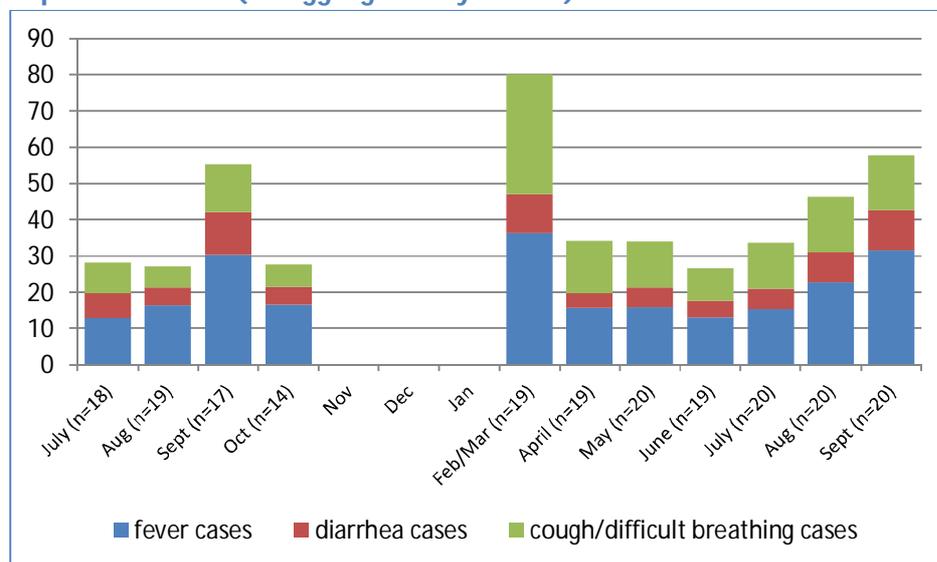
Nov 2013 to Jan 2014 corresponded to a period of stock out

A significantly greater number of children seen by a ML received a visit at their home or were brought back to the health care provider for a follow-up visit: 87% of caregivers with sick children seen by a ML versus 31% seen at the health center or 7% at the health post[±] received a follow-up visit.

E.   Objective 3: Quality of iCCM services

Correct treatment

Overall, 15 MLs and five CHAs achieved the benchmark for correct classification and treatment (correctly classified and treated all illnesses for at least 80% of the children consulted). There was no significant difference between MLs and the CHA in terms of consistently providing correct treatment for children using the iCCM protocol to diagnose, classify and treat children. Treatment prescribed was consistent with the illness classification and classifications were correct except for some difficulties diagnosing pneumonia and in several instances, following procedures when negative malaria test results were observed. Some of the MLs experienced difficulties with counting respirations and both ML (6) and CHAs (1) treated cases not meeting the case definition for pneumonia (respirations within normal range). No children with negative malaria tests results received malaria treatment from a ML however two CHAs gave antimalarial drugs either without performing a malaria test or after obtaining negative test results. In one case the CHA was experiencing a stock out of essential drugs and could not diagnose fever cases or provide treatment to children with diarrhea[θ].

[±] Very few children were seen at the health posts: a total of 17 children (1% as a first source and 7% referral)

Table 10 Number of Mother Leaders and CHA who provided correct treatment

Indicator: % performing for 80% of consultations observed	Mother Leaders N=20	CHAs N=8
Correct classification and treatment prescribed for each consultation[Υ]	15	5
Correct treatment fever/Malaria	20	6
Correct treatment cough and difficult or rapid breathing	14	7
Correct treatment diarrhea[φ]	18	6

Overall, five cases were identified as needing referral, four seen by MLs and one by a CHA. Mother Leaders referred correctly for three of the four cases while the child seen by the CHA at the health post did not receive a referral.

In addition to diagnosing the illness and prescribing correct medicines, correct case management should include immediate administration of the first dose of treatment. Once the requirement to provide the first dose of treatment during the consultation is added, adherence with the iCCM protocol for 80% or more of the children consulted declines to 50% (4) of the CHAs and 30% (6) of MLs, indicating that this step was often neglected during the consultation, especially by MLs. Despite the availability of drugs, six MLs did not administer drugs during any of their consultations instead allowing the mothers to leave with the full treatment to administer the first dose at home.

Adherence to and consistent application of clinical guidelines

The iCCM algorithm consists of a number of tasks and subtasks to be completed to ensure that the treatment received is comprehensive. Adherence to and consistent application of all assessment, treatment and prevention, and care counseling steps in the algorithm was low for MLs and CHAs. Based on the criteria used (≥80% of consultations observed) only three MLs and one CHA adhered to and consistently applied the full iCCM algorithm (for full results for individual steps see Appendix 5) indicating no difference between the ML and the CHA for consistent application of the complete protocol. Differences however were apparent when looking at performance levels (see Table 11). Two ML applied all the steps for some of their consultations but did not meet the 80% level while 15 out of 20 MLs did not apply all the steps for any of their consultations. Four out of eight CHAs also did not apply all of the steps during any of their consultations.

[θ] The ability to correctly diagnosis and treat requires that all the necessary materials and medicines are available. Information was collected on availability of essential materials. The majority of Mother Leaders and CHAs had all the materials and drugs necessary (see Appendix 4). Availability of the items missing would not have had a significant difference on the results as at most it could have increased by one the number of CHAs consistently providing correct treatment. Of the two Mother Leaders and three CHA who did not have all the materials and medicines available, diagnosis and/or treatment was not impacted for four of them (for the two Mother Leaders and two CHAs the malaria tests for all observed children presenting with a fever were either negative or the correct dosage was available). This would not have changed the overall results.

[Υ] All illness classifications are correct and treatment prescribed matches classifications

[φ] Not all Mother Leaders and CHA treated a child with diarrhea: 18 Mother Leaders and 7 CHA

Table 11 Performance Achieved by Provider on Application of Full Protocol

Indicator: performing at indicated level across consultations observed	Mother Leader N=20				CHA N=8			
	≥80%	≤79% and ≥51%	≤50%	0%	≥80%	≤79% and ≥51%	≤50%	0%
Conducted all assessment, treatment counseling, and prevention and care counseling tasks	3	1	1	15	1	-	3	4

Performance on the three sub-sectors of tasks (assessment, treatment counseling and prevention and care counseling) showed differences between ML and CHA (for full results for individual steps see Appendix 5 and for graphic illustrations of the differences see Appendix 6).

Mother Leaders and CHAs had similar results in consistent application (≥80% of consultations observed) of the complete protocol on assessment tasks (see Table 12), but MLs in most cases fell into one of two groups: the first category (demonstrating mastery, consistent performance, and compliance with the protocol for assessment tasks) or the last category (non-application) whereas the majority of CHA demonstrated full compliance during more than 50% of their consultations. MLs were especially weak in asking about all danger signs and looking for edema and relatively weak in looking for chest in-drawing and signs of dehydration.

Table 12 Performance Achieved by Provider on assessment

Indicator: performing at indicated level across consultations observed	Mother Leader N=20				CHA N=8			
	≥80%	≤79% and ≥51%	≤50%	0%	≥80%	≤79% and ≥51%	≤50%	0%
All assessment tasks completed	6	2	-	12	2	4	1	1
Used individual treatment algorithm form	18	-	-	2	8	-	-	-
Asked about all three illnesses	13	1	2	4	5	1	1	1
Asked about all four danger signs	9	-	3	8	6	2	-	-
Performed all steps for nutritional assessment	11	1	1	7	5	3	-	-
Evaluated fever cases with RDT	20	-	-	-	7	-	-	1
Evaluated rapid breathing (respirations/chest in-drawing)	14	1	2	3	7	-	1	-
Evaluated diarrhea (bloody stools and dehydration)[φ]	12	1	1	4	6	-	1	-

Complete application of tasks related to counseling was weak for both the MLs and CHAs. Mother Leaders showed a weaker performance in mastery of treatment counseling and a slightly stronger performance in prevention and care counseling in comparison with CHAs (see Tables 13 and 14).

For treatment counseling, results show that a significant number of MLs did not apply the algorithm in the areas of administering the first dose of treatment, confirming understanding by the caregiver of how to administer treatment or demonstrating how to administer the treatment (closely linked to providing the first dose), and explaining signs of aggravation of the illness.

[φ] Only 18 Mother Leaders and seven CHA saw children with diarrhea

Table 13 Performance Achieved by Provider on treatment counseling

Indicator: performing at indicated level across consultations observed	Mother Leader N=20				CHA N=8			
	≥80%	≤79% and ≥51%	≤50%	0%	≥80%	≤79% and ≥51%	≤50%	0%
All treatment counseling tasks conducted	6	-	6	8	4	-	4	-
Caretaker received explanation of illness	17	1	2	-	8	-	-	-
Child received first dose of treatment	7	-	7	6	4	2	2	-
Confirmed understanding and/or show how to administer	14	3	3	-	8	-	-	-
Gave all treatment information (dose, frequency, duration)	17	2	1	-	7	1	-	-
Informed caregiver of signs of aggravation of the illness	11	1	7	1	7	1	-	-

In the area of prevention and care counseling, MLs did not perform as well in the individual areas of vaccination and feeding related prevention and care counseling messages but were more consistent in providing the complete package of messages compared to CHAs.

Table 14 Performance Achieved by Provider on Prevention and care counseling

Indicator: performing at indicated level across consultations observed	Mother Leader N=20				CHA N=8			
	≥80%	≤79% and ≥51%	≤50%	0%	≥80%	≤79% and ≥51%	≤50%	0%
All Prevention and care counseling messages given	5	-	6	9	1	1	3	3
Feeding of sick child	7	-	5	8	5	-	2	1
Hand washing	13	2	4	1	5	-	2	1
Infant and young child feeding[β]	9	2	5	3	6	1	1	-
Bed net use	15	1	4	-	7	-	1	-
Vaccinations[β]	11	2	2	4	5	1	2	-

IV. Discussion

The main findings of the study confirm that iCCM services provided by low literacy volunteer Care Group MLs are an acceptable option for first line treatment of sick children for both MoH staff and communities. The study also demonstrated that MLs were effective in improving sick child care-seeking and treatment practices and the quality of the MLs work was comparable to that of the lowest cadre of paid facility-based community health workers in Niger, the CHA.

A majority of sick children in the villages were taken to the MLs who replaced the CHAs as the main provider at the village level. The iCCM intervention appears to have contributed to improvements in care-seeking and treatment practices as significantly more children were taken for care within the first 24 hours and seeking care from untrained providers had nearly vanished. The change in disease pattern seen between baseline and endline (in which fewer children presented with multiple symptoms) is likely to be a direct result of the improved care seeking and treatment

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[β] Children 0-23 months only : 19 for Mother Leaders and 8 for CHA
[β] Children 0-23 months only : 19 for Mother Leaders and 8 for CHA

practices as children received care before illness became more severe. Mother Leaders and CHA performed equally well on treatment quality with a majority in both cases meeting the benchmark for correct diagnosis, classification and treatment. Although MLs experienced more difficulties with counting respirations for pneumonia diagnosis, both CHAs and MLs treated cases not meeting the case definition for pneumonia (respirations within normal range) and CHAs were less likely to rely on malaria test results.

Despite providing clinically correct treatment for the majority of cases, the performance of MLs was less than optimal on consistent application of all steps in the iCCM algorithm. While this overall result was similar to that of the CHA, differences were seen between the two types of provider with a larger number of MLs appearing to have not yet fully mastered some of the basic steps in the algorithm. Mother Leaders were less likely to ask about all danger signs, look for edema, and administer the first dose of treatment. A lower percentage of MLs provided information during counseling on reasons for a caretaker with a sick child to return immediately; this is an important aspect of care that will need to be reinforced. Information from caretakers in the household survey indicated that they were significantly more likely to see a ML for a follow-up visit than other health providers. These visits allow the MLs to follow the child's condition and may compensate for some of the weaknesses in counseling on signs of aggravation or worsening of the child's condition.

Overall, the deficiencies in MLs performance should be put in perspective: MLs had only received a total of 12 days of formal training, had been providing iCCM for one year, most steps were mastered by more than half of the MLs, and most importantly, the majority of children received correct treatment even if all algorithm steps were not always performed.

Data on the quality of care were collected through observation, a technique that captures the "best care" rather than the average care given by providers. Therefore, it is likely that actual care was of a somewhat lower quality than observed, especially for CHAs who are used to being evaluated through client observations. The small number of MLs and CHAs observed in the study limits generalization of the findings and does not allow for exploration of factors linked to performance such as education level or number of supervision visits.

Other iCCM studies have also showed high levels of acceptance of iCCM activities and community health workers treating large numbers of children[19,20,21]. The performance of MLs in this study was consistent with other studies which have shown that low-literate community members are able to provide home-based care for simple malaria, diarrhea and pneumonia cases and that they are able to perform case management at acceptable levels of care.[22,23,24,25]. The specific strengths and weaknesses in case management noted in this study were in general the same issues seen in other studies of iCCM. In our results as well as in other studies, management of malaria and diarrhea cases showed very high levels of successful diagnosis and treatment while difficulties linked to correct counting of respirations were observed with the assessment and treatment of suspected pneumonia[26,27,28,29,30]. Similar to our results, CHWs in other studies were also not consistent in providing the first treatment dose[31] and similar weaknesses were noted in assessing for danger signs and providing clear and systematic counseling messages[32,33,34].

During the planning stages of the study the MoH did not have a policy for management of child illness at a level below the health post. During the preparation phase for the iCCM training, the MoH adopted management of iCCM at the household level as an accepted strategy. Though no longer needed to influence acceptance of iCCM as a potential strategy, this study provided important information supporting the decision. Moreover, the results can still contribute to the knowledge and evidence base around how these activities can be adapted to the context of Niger and the results will be presented to district, regional and national health authorities as well as other international and national organizations working in or interested in supporting iCCM at the household level. Plans are in development with other international and national organizations for a forum presenting current experiences with iCCM and/or malaria case management at the household level in Niger.

Deficiencies observed in MLs' skills require further consideration especially because they were compared with CHAs who had on average three more years of education and nine additional years of practice. For practitioners who lack a strong educational background such as the MLs, consistent and complete application of a set of new and complex tasks to identify and treat illness is expected to need adequate time and sufficient support for full mastery. More work with the MLs on consistent and complete application of the iCCM protocol is required, including mechanisms to ensure regular supervision. However it is promising that performance with regard to correct treatment was very high. The demonstrated improvements in care seeking within 24 hour and the numbers of children receiving appropriate treatment signal already meaningful contributions toward improving child survival.

Recommendations specifically related to the findings include the need to conduct refresher training and supervision visits focused on key tasks for case management. In addition, supervision and supply chain management for iCCM commodities need to be improved and integrated into the health system so that delivery is more consistent. Research is also required on the acceptability, effectiveness and quality of iCCM by non-literate ML as the necessary numbers of literate women are not available in Niger and many other developing country settings.

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VI. Appendices

Appendix 1 Comparision of Health Post and Health Center

	Health Center	Health Post
Catchment area	10,000 inhabitants	2,500-5,000 inhabitants
Infrastructure	building: waiting area, office, consultation room, injection room, wound dressing room, delivery room, observation room, hospitalization room, pharmacy, room for prenatal, post natal and FP services; moto; energy source; water source; incinerator; cold chain equipment	building: consultation room, treatment room, delivery room; water source
Minimum Staff	2-3 nurses ; plus 2 midwives for facilities with a separate maternity	1 community health agent and 2 birth attendants
Health Services	IMCI, curative (malaria, diarrhea, ARI), care for chronic disease (diabetes, hypertension, leprosy), vaccinations, well child care, case management of malnutrition, prenatal/postnatal care, delivery, family planning, basic laboratory tests, STI treatment, voluntary counseling and testing for HIV, health education, outreach services for preventive care	iCCM , curative (simple cases of malaria, diarrhea, ARI), delivery, family planning, health education; site of outreach services for the health Center
Administration/ Management	Commodities logistics management for health center and health posts in the health zone, book-keeping for income from service fees and drug sales, management committee meetings, service and epidemiologic statistics, financial reports, quarterly activity reporting	Drug stock management, book-keeping for income from service fees and drug sales, service and epidemiologic statistics, monthly activity reporting

Appendix 2 Essential Elements for Assessment of Quality

Quality Element	Questions	Indicators
Assessment	• Did the iCCM provider use the algorithm and iCCM tools? • Did the iCCM provider properly question the caregiver, check for general danger signs, observe signs of illness, evaluate nutritional status, measure the child's respiratory rate, and perform a RDT if applicable?	- Used algorithm/counseling cards and recording form - Checked for four danger signs - Checked for presence of cough/difficulty breathing, diarrhea and fever - Evaluated nutritional status (take mid-upper arm circumference or height and weight measures) - Tested for malaria with RDT - Assessed for presence of fast breathing - Assessed for dehydration and dysentery
Classification and Treatment	• Did the iCCM provider correctly identify the problem(s)? • Did the iCCM provider give the right medicine, in the right dose and quantity? • Did the iCCM Provider correctly combine treatments when needed? • Did the iCCM Provider refer when appropriate? • Did the iCCM Provider help the caregiver initiate and complete the referral? • Did the iCCM Provider follow up with the child according to protocol?	- Did all classifications match with assessment results - Child with cough and fast breathing correctly prescribed an antibiotic - Child with positive RDT prescribed an antimalarial correctly (ACT) - Child with diarrhea prescribed ORS and zinc - Child with multiple illnesses treated and/or referred correctly for all illnesses - Child with danger signs or severe illness received correct pre-referral treatment and referred - Child received the correct first dose in presence of provider - Child received at least one follow-up visit on the third day following the consultation
Treatment counseling	• Did the iCCM provider explain the illness to the caretaker? • Did the iCCM Provider give correct instructions to the caregiver about the treatment (dose, frequency, and length of treatment)?	- Caretaker received explanation of illness - Caretaker instructions and was shown how to administer drug and understanding was confirmed - Caretakers of children prescribed ORS, zinc, antibiotics or antimalarial received dosage and duration counseling messages for administering treatments - Caretaker advised on signs of aggravation of the condition and when to return immediately for care
Prevention and Care Counseling	• Did the iCCM Provider give correct instructions to the caregiver about related preventive and supportive measures?	- Caretaker advised to give extra fluids and continue feeding - Caretaker advised on hand washing with soap - Caretaker advised on infant and young child

		feeding (for children under two years of age)
		- Caretaker advised on bed net use
		- Caretaker advised on vaccinations (for children under two years of age)

Appendix 3 Integrated Management of Childhood Illness classifications

Children are classified as having malaria if they have fever or history of fever and a positive rapid diagnostic test, diarrhea if they have had 3 or more loose stools in 24 hours and as having suspected pneumonia if they have a cough and fast breathing (≥50 breaths per minute in children aged two to 11 months and ≥40 breaths per minute in children 12 to 59 months). A diagnosis of severe disease is made if the child has any of the four general danger signs: convulsions, repeated vomiting, lethargy/ unconsciousness, failure to feed, or other any other sign of severe illness: chest in drawing, noisy breathing (stridor), severe dehydration, bloody stools, fever for more than seven days or diarrhea or cough for more than 14 days.

Appendix 4 Availability of iCCM Materials and Medicines (day of observations)

	ML	CHA
Algorithm/guide		
Has iCCM individual form	18/20	8/8
Has iCCM module/algorithm	19/20	8/8
Materials		
Has functioning and accessible scale and/or MUAC band	20/20	8/8
Has functioning timer or watch	20/20	8/8
Has counting beads	20/20	NA
Has RDT	20/20	7/8
Has pitcher, cup and spoon for ORS and administration of drugs	19/20	8/8
% with all essential supplies (ML: timer, beads, RDT, cup & spoon, MUAC; CHA: timer, RDT, cup & spoon, scale or MUAC)	*19/20*	*7/8*
Medicines		
Has ORS packets	20/20	7/8
Has zinc	20/20	7/8
Has first line child pneumonia drug	20/20	8/8
Has first line antimalarial for infants	19/20	5/8
Has first line antimalarial for children	19/20	6/8
Has paracetamol	20/20	8/8
% with all essential child drugs	*18/20*	*5/8*

Appendix 5
Performance Achieved by Provider (main task categories)

Indicator: performing at indicated level across consultations observed	Mother Leader (N=20)				CHA (N=8)			
	≥80%	≤79% and ≥51%	≤50%	0%	≥80%	≤79% and ≥51%	≤50%	0%
All assessment tasks completed	6	2	-	12	2	4	1	1
All treatment counseling tasks conducted	6	-	6	8	4	-	4	-
All Prevention and care counseling messages given	5	-	6	9	1	1	3	3

Performance Achieved by Provider (full results including all sub-elements)

Indicator: performing at indicated level across consultations observed	Mother Leader (N=20)				CHA (N=8)			
	≥80%	≤79% and ≥51%	≤50%	0%	≥80%	≤79% and ≥51%	≤50%	0%
Conducted all assessment, treatment counseling, and prevention and care counseling tasks	3	1	1	15	1	-	3	4
All assessment tasks completed	6	2	-	12	2	4	1	1
Used individual treatment algorithm form	18	-	-	2	8	-	-	-
Asked about all three illnesses :	13	1	2	4	5	1	1	1
Fever	17	-	-	3	7	1	-	-
Cough and difficult or rapid breathing	15	1	2	2	5	2	-	1
Diarrhea	13	2	2	3	7	1	-	-
Asked about all four danger signs :	9	-	3	8	6	2	-	-
Unable to eat or drink	13	1	2	4	8	-	-	-
Vomit everything	12	-	2	6	8	-	-	-
Convulsions	9	-	3	8	6	2	-	-
Lethargy	12	-	1	7	7	1	-	-
Performed all steps for nutritional assessment:	11	1	1	7	5	3	-	-
MUAC	17	1	1	1	7	1	-	-
Weight and height	NA	NA	NA	NA	8	-	-	-
Looked for edema	11	1	1	7	6	2	-	-
Evaluated fever cases with RDT	20	-	-	-	7	-	-	1
Evaluated rapid breathing (respirations/chest in-drawing):	14	1	2	3	7	-	1	-
Counted respirations	20	-	-	-	8	-	-	-
Looked for chest in-drawing	14	1	2	3	7	-	1	-
Evaluated diarrhea (bloody stools and dehydration)$^{\varphi}$:	12	1	1	4	6	-	1	-
Asked about blood in stools	15	-	1	2	6	-	1	-
Looked for signs of dehydration	13	1	1	3	6	-	1	-
All treatment counseling tasks conducted	6	-	6	8	4	-	4	-
Caretaker received explanation of illness	17	1	2	-	8	-	-	-
Child received first dose of treatment	7	-	7	6	4	2	2	-
Confirmed understanding and/or show how to administer	14	3	3	-	8	-	-	-
Gave all treatment information (dose, frequency, duration):	17	2	1	-	7	1	-	-
Dose	20	-	-	-	7	1	-	-
Frequency	19	1	-	-	7	1	-	-
Duration	18	1	1	-	7	1	-	-
Informed caregiver of signs of aggravation of the illness	11	1	7	1	7	1	-	-
All Prevention and care counseling messages given	5	-	6	9	1	1	3	3
Feeding of sick child	7	-	5	8	5	-	2	1
Hand washing	13	2	4	1	5	-	2	1
Infant and young child feeding$^{\beta}$	9	2	5	3	6	1	1	-
Bed net use	15	1	4	-	7	-	1	-
Vaccinations$^{\beta}$	11	2	2	4	5	1	2	-

$^{\varphi}$ Only 18 Mother Leaders and seven CHA saw children with diarrhea

$^{\beta}$ Children 0-23 months only : 19 for Mother Leaders and 8 for CHA

Appendix 6 Performance Levels Achieved by Mother Leaders and Community Health Agents on mastery of and adherence to iCCM protocol

Mother Leader
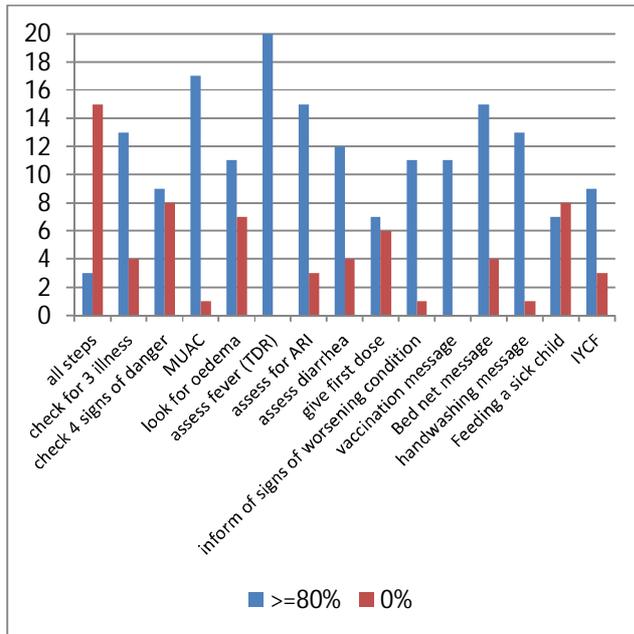
Community Health Agent
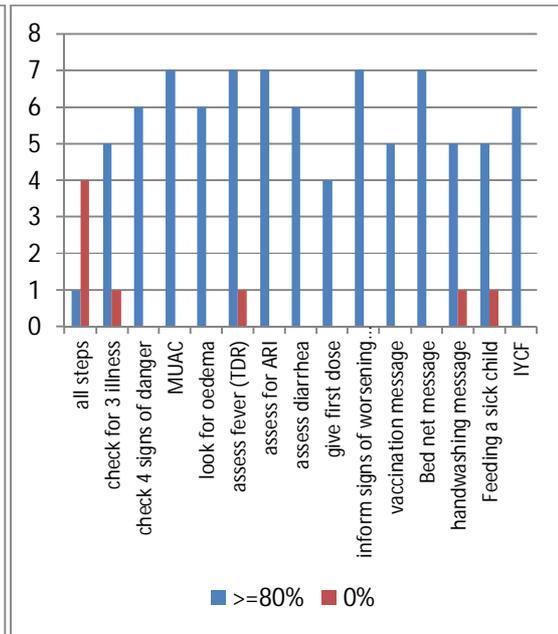
β Children 0-23 months only : 19 for Mother Leaders and 8 for CHA

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