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Strengthening maternal and newborn health in rural Ethiopia: Early results from frontline health worker community maternal and newborn health training

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ABSTRACT

Objective: to describe early results from the Community Maternal and Newborn Health (CMNH) training programme of the Maternal and Newborn Health in Ethiopia Partnership (MaNHEP) project. *Design:* a non-experimental, descriptive design was employed to assess training implementation. *Setting:* six rural districts of Amhara and Oromiya regions, Ethiopia.

Participants: 91 Health Extension Workers (HEWs) and 626 Guide Team members including Traditional Birth Attendants (TBAs) and volunteer Community Health Promoters (vCHPs).

Intervention: CMNH is one aspect of a broader strategy to improve maternal and newborn health at the community level in rural areas of Ethiopia where pregnant women have limited access to health facilities. *Measurements:* performance testing of HEWs, TBAs, and vCHPs was conducted to assess transfer of knowledge and skills from CMNH Master Trainer level to CMNH Trainer level, and from CMNH Trainer level to CMNH Guide Team (GT) level on the topic areas of *Prevent Problems before Baby is Born* and *Prevent Problems after Baby is Born*.

Findings: post-training performance scores were significantly higher than immediate pre-training scores for Amhara and Oromiya regions on both topic areas (p < 0.001). For HEWs and GT members, respectively, average scores increased over 250% and 300% for *Prevent Problems before Baby is Born*, and over 300% and 400% for *Prevent Problems after Baby is Born*.

Key conclusions: CMNH was successful in transferring knoweldge to HEWs at the CMNH Trainer level and to Guide Team members at the community level. In order for gains to be realised and sustained, the CMNH programme will be nested within an enabling environment created through behaviour change communication to increase demand for CMNH services, emphasising evidence-based maternal and newborn care practices, teamwork among frontline health workers, and an enhanced role of HEWs in provision of safe care during pregnancy, birth, and the early postnatal period.

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Introduction

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An estimated 350,000 women die from complications related to pregnancy and childbirth each year (Hogan et al., 2010), and 99% of these deaths occur in developing countries (Hill et al., 2007). Both women and their newborns are most vulnerable during birth and the early postnatal period, making the presence of a skilled health provider during this time an essential element in reducing maternal

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and newborn deaths (Darmstadt et al., 2005; WHO & UNICEF, 2008; Baqui et al., 2009). However, a shortage of skilled health workers has slowed progress in improving maternal health in many lowincome settings (Hongoro and McPake, 2004). This shortage has prompted a shift in the provision of health care that is based on the activities of lower skilled community-level health workers who deliver maternal and newborn health (MNH) services (Say, 2007; Kinfu et al., 2009).

Ethiopia has among the highest maternal mortality ratios (MMR) in the world, estimated at 470 deaths per 100,000 live births in 2008 (WHO, 2011). The newborn mortality rate is also high at 37 deaths per 1,000 live births (Central Statistical Agency (Ethiopia) & ICF MACRO, 2011). Although mortality rates have declined over time, Ethiopia is far from meeting the target Millennium Development Goal 5 (MDG5) of 218 maternal deaths per 100,000 live births and a two-thirds reduction in under-5 deaths by 2015 (UN & Inter-Agency Expert Group on MDG Indicators, 2009). The skilled health worker shortage is readily apparent in rural areas of Ethiopia where only 3% of births are attended by a skilled birth attendant (WHO, 2011). Moreover, according to recent estimates Ethiopia has one of the largest gaps in the midwifery workforce needed to reach the MDG5 target of skilled birth attendance by 2015 at a gap of 19,489 midwives (UNFPA, 2011).

Background

The health extension programme

At over 88 million people, Ethiopia has the second largest population in Africa (Central Statistical Agency, Ethiopia & ORC Macro, 2006). However, Ethiopia is among the least urbanised countries on the continent with 83% of the population living in rural and remote areas (CIA World Fact Book, 2011). This demographic distribution results in a substantial gap between the country's health-care needs and the availability and accessibility of health services. In 2003, the Ethiopian government made a commitment to its Health Sector Development Programme by launching a new health-care plan, the 'Accelerated Expansion of Primary Health Care Coverage', through the Health Extension Programme (HEP). The HEP takes an innovative approach by targeting the household and community level; it is designed to 'improve the health status of families with their full participation, using local technologies and the community's skill and wisdom' (Health Extension and Education Center & Federal Ministry of Health, 2007, p. 2). It seeks to increase health service coverage and strengthen referral systems at all levels, particularly for people who live in rural areas where access to services is often limited.

A primary strategy of the HEP is the training of Health Extension Workers (HEW), who are recruited from local villages, possess a 10th grade education and are given one year of didactic and clinical health education. Since 2003, the government of Ethiopia has committed to training 30,000 HEWs who are being deployed in 15,000 rural kebeles (communities). The HEW educational programme focuses on 16 modules of health related content with four major components: (1) family health services; (2) disease prevention and control; (3) hygiene and environmental sanitation; and (4) health education and communication (Federal Democratic Republic of Ethiopia Ministry of Health, 2003; Federal Ministry of Health and Regional Health Bureaus, 2008). HEWs are expected to spend 75% of their time conducting community outreach with a focus on health promotion and serve as a connection between the home and health post (Koblinsky et al., 2010). Maternal and newborn health care is located within the family health service component of this programme and will be the focus of this paper.

Maternal and newborn health in Ethiopia partnership

In Ethiopia, most of the maternal and newborn deaths occur at home due to a lack of basic health care; the HEP aims to address this critical health-care shortage (Federal Ministry of Health, Family Health Department, 2005). Efforts over the past five years have focused on ensuring that HEWs and health posts are in place to help reach their Health Sector Development Goals in rural areas. Despite significant strides, an opportunity exists to collaborate with the Ministry of Health to further strengthen the HEP and position it to better meet the needs of mothers and newborns during birth and the early postnatal period when they are most vulnerable.

The Maternal and Newborn Health in Ethiopia Partnership (MaNHEP) is a two-and-a-half year initiative funded by the Bill and Melinda Gates Foundation (Sibley, 2009). MaNHEP seeks to demonstrate a community-oriented model for improving maternal and newborn health (MNH) care in rural Ethiopia and to prepare for its expansion nationwide. Four key strategies are being employed to demonstrate this community-oriented model: (1) implementation of a MNH care package at the community level (including updating skills of HEWs); (2) a quality improvement approach to identify barriers and solutions to accessing and obtaining MNH services; (3) behaviour change communications, and (4) strengthening the ability of district level managers to advocate for and support MNH activities at the community level. MaNHEP is being implemented in a total of six rural districts in Amhara and Oromiya regions.

A key MaNHEP intervention is implementation of the MNH care package of home-based practices that have been proven to prevent maternal and newborn death and disability, such as clean delivery and essential care in the immediate and early postnatal period (see Box 1: MNH Care Package). HEWs, volunteer Community Health Promoters (vCHPs) and Traditional Birth Attendants (TBAs) (referred to collectively herein as frontline health workers) will work collaboratively to implement the Community Maternal and Newborn Health (CMNH) care package by training pregnant women, their family caregivers, and homebirth attendants. When successfully delivered in the birth-to-48 hr window, the evidence-based interventions included in CMNH can reduce newborn mortality by as much as 37% (Darmstadt et al., 2005; WHO & UNICEF, 2008; Baqui et al., 2009).

To ensure the package of care reaches *all women and newborns*, *in time, every time*, the MaNHEP project incorporates a

Box 1–MNH care package.

Mother Care at delivery:	Newborn Postnatal health assessment:				
Clean delivery	Colour check				
• Uterotonics (misoprostol)	Activity check				
• Uterine massage Postpartum health assessment:	• Feeding check <i>Counseling:</i>				
• Breast check	• Promotion of immediate,				
 Bleeding check 	exclusive breastfeeding				
• Trauma check (fistula)	 Thermal care, kangaroo mother care 				
• Fever check Counseling:	Hand-washing				
Breast care	Clean cord care				
• Nutrition (esp. fluids)	 Illness recognition and care seeking 				
 Personal hygiene 	seeking				
• Rest					
Uterine massage					
 Illness recognition and care seeking 					

collaborative quality improvement approach that enables frontline health workers and community members to identify barriers that may prevent women and newborns from seeking and obtaining quality health services. Once barriers are identified, communities work to develop and implement locally relevant solutions to these problems. Communities themselves measure and compare key indicators with baseline measures in order to identify solutions that are most successful in initiating the desired change. The implemented solutions undergo a continuous improvement process in which results are monitored on a frequent basis. Results either iteratively reinforce solutions or suggest opportunities for modification of solutions that are less successful. Successful solutions can then be shared across kebeles and regions and altered and improved upon to meet locally specific needs. CMNH quality improvement teams meet on a regular basis to share lessons learned and successful solutions to overcoming barriers in an effort to reach all pregnant women and their newborns in time, every time.

Under the MaNHEP framework, a successful communityoriented model would be exemplified by a district health system that is capable of and committed to addressing the needs of childbearing women and their families, and has the ability to identify, test, and disseminate a package of local solutions, thereby creating environments for frontline health workers to meet these needs. Broadly, this district health system will then be able to tackle other critical challenges in health service delivery.

Need for community maternal and newborn health-care strengthening

MaNHEP's approach to overall implementation has been to first gather qualitative and quantitative data focused on understanding local norms about maternal and newborn care practices, community perceptions of appropriate care, and care seeking among women with a recent birth. Special attention has also been given to frontline health workers in order to develop a better understanding of their knowledge, perceived skills, and selfconfidence in carrying out tasks related to MNH. In addition, consideration has been given to understanding factors that predispose, reinforce and enable performance and teamwork among frontline health workers.

MaNHEP baseline information collected during the summer of 2010 (prior to the CMNH training, but with the same population of frontline health workers) reinforces the need for CMNH training in both regions (Stephenson et al., 2011). For example, only 29% of HEWs in Amhara region report hearing about giving women misoprostol for the prevention of postpartum haemorrhage. In both Amhara and Oromiya regions, only half of HEWs have heard of rubbing the womb after delivery of the placenta to prevent and reduce bleeding (57% and 59%, respectively). Onethird of HEWs in Amhara region have not heard of resuscitating a newborn by giving mouth-to-mouth breathing. In addition, HEWs in both regions report lower self-confidence in providing labour and birth care as compared to other MNH services such as pregnancy, postpartum, and newborn care. In Amhara region, confidence scores (on a scale from one to 10) for providing labour/ birth care average only 6.97 (SD=1.69), while scores are higher for prenatal (7.26), postpartum (7.69), and newborn (8.17) care. In Oromiya, the average confidence score for labour/birth is 7.44 (SD=2.43), which is lower than average scores for confidence in providing prenatal (8.79), postpartum (8.82), and newborn (8.10) care. This evidence supports the need for further training that focuses on gaining knowledge and skills required during labour, birth, and the early postnatal period.

The formative research findings provide additional contextual information from which to understand the challenge of providing MNH services in Amhara and Oromiya regions (Hadley et al., 2010). In addition to gaps in knowledge and skills, the formative research suggests that many HEWs do not prioritise delivery of MNH services in their role as health workers. For example, when listing responsibilities, some HEWs do not include labour, birth, and postpartum care as part of their work. The data suggest that while some HEWs mobilise pregnant women for check-ups and provide antenatal and postnatal counselling, few HEWs attend deliveries or provide postnatal care. There is also regional variation in the prioritisation of MNH tasks that correlates with the confidence pattern found in the baseline survey; more HEWs in Oromia region report delivery and postnatal care provision compared to Amhara region.

Labour notification provides an additional challenge in delivering MNH services (Hadley et al., 2010). Particularly in Amhara region, HEWs report finding women in labour or the postpartum period by accident as they travel house-to-house in the community, revealing that most community members do not purposively seek birth and postpartum care services from HEWs (a finding supported by interviews with mothers in the area). Family members often call TBAs to assist with labour and birth, however limited interaction between HEWs and TBAs means that TBAs may not have the opportunity or desire to link HEWs with labouring women. In addition to the need for supplementing skills training, these findings support the need for strategies that explore task prioritisation, methods of labour notification, and venues for frontline health worker interaction and teamwork to ensure that the CMNH package reaches the home in time, everv time.

Taken together, the MaNHEP baseline and formative research findings reinforce the MaNHEP strategy of skills strengthening for frontline health workers, building frontline health worker team identity through the CMNH training, and community engagement in both CMNH training and collaborative quality improvement processes. This strategy, coupled with targeted behaviour change communication, should increase MNH care supply and demand in the project areas. The purpose of this paper is to describe early results from the Community Maternal and Newborn Health (CMNH) training programme of the Maternal and Newborn Health in Ethiopia Partnership (MaNHEP) project. Furthermore, the programme and results will be discussed in a broader context of training and support systems necessary for sustainability.

Community maternal and newborn health programme

The CMNH training component of MaNHEP was implemented during the summer and fall of 2010 in three districts of Amhara region (Mecha, South Achefer, and North Achefer) and three districts of Oromiya region (Wara Jarso, Degem, and Kuyu). These six districts were chosen in close consultation with the Amhara and Oromiya Regional Bureaus of Health; criteria for selection were based on their comparability to each other by population (and population density) and health indicators, as well their overall representativeness of the region and level of accessibility. The methodology and content were adapted from the Home-Based Life Saving Skills (HBLSS) programme developed by the American College of Nurse-Midwives (ACNM) Department of Global Outreach (Buffington et al., 2004; Buffington et al., 2010). As with HBLSS, CMNH is a community-based programme developed as a way to reduce maternal and newborn deaths and disability in places where homebirth is common (often resulting from either a lack of access to health facilities and/or from culturally embedded norms that may limit health seeking behaviour).

The CMNH programme is a skills-based programme specifically designed for low or non-literate participants where



Fig. 1. CMNH training cascade.

knowledge is spread through a training cascade (Fig. 1). A major strategy of CMNH, modelled after HBLSS, is the use of Take Action Cards (TACs) to maximise the transfer of knowledge from trainers to participants. TACs are pictorial representations of a prevention strategy or complication on one side with approximately six small pictures of actions to take in response to the prevention strategy or problem on the other side. Pregnant women, their family caregivers and birth attendants practice CMNH skills using the TACs: the pictures act as a checklist, reminding community members of the actions to take in order to prevent problems or actions to take in case of emergency. CMNH guide teams provide TACs in the form of a booklet to participants following CMNH meetings. The training approach is structured to encourage full group participation through sharing of local knowledge and cultural practices. This process of sharing and learning not only grants trainers an increased understanding of local traditional practices, but it also promotes formation of respect and trust by acknowledging and respecting the unique and additive contributions of individual group members. Participants build on local knowledge and skills through discussion, demonstration, negotiation and practice of CMNH skills. Together, the frontline health workers and community members work towards identifying and implementing practices that are not only safe, but also culturally acceptable, thereby making them more likely to be used in the home when complications arise.

In August 2010, the CMNH training programme began with the training of health personnel by three CMNH consultants in five meetings: (1) Introduction, (2) Women and Baby Problems, (3) Prevent Problems: Before Baby is Born and After Baby is Born, (4) Too Much Bleeding After Birth, and (5) Baby Has Trouble Breathing. By December 2010, eight Master Trainers (including 2 MaNHEP Regional Managers and 6 MaNHEP MNH Specialists) and 91 CMNH trainers (HEWs) had completed training. The first two weeks of CMNH training also included 45 Ministry of Health staff and HEW supervisors who will act in the capacity of programme support and supervision. The CMNH trainers then went on to train 638 CMNH guides (330 in Oromiya; 308 in Amhara) comprised of vCHPs and TBAs (Fig. 1). It is anticipated that the CMNH guides will train approximately 25,000 community participants over the 2 years of the project. The primary focus of this paper is to describe the training and performance testing of HEWs and Guide Team members.

Methodology

A non-experimental, descriptive design was employed to assess the implementation of CMNH training. Performance testing of HEWs was conducted to assess transfer of knowledge and skills from CMNH Master Trainer level (MaNHEP Regional Managers and MNH Specialists) to Trainer level (HEWs), and from Trainer level to Guide Team level (vCHPs and TBAs). The study protocol was approved by the Emory University Institutional Review Board, Addis Ababa University Institutional Review Board, and the Amhara Regional Health Bureau as part of the initial MaNHEP protocol.

Performance testing was determined through pre- and posttesting to determine change in demonstrated knowledge and skill level. Participants in the CMNH programme were pre-tested on the first day of training and post-tested on the last day of training. Participants were tested through the use of a skills checklist in which each participant was provided with a scenario and asked to show and explain what they would do in response to the problem or prevention strategy in the form of a role-play. They were tested on 14 steps for Prevent Problems before Baby is Born and 16 steps for Prevent Problems after Baby is Born. Performance was scored by Regional Team Managers and Maternal and Newborn Health (MNH) Specialists from the MaNHEP (Master Trainers). Master Trainers received training from the consultants on how to preand post-test participants, including in-depth discussions on what constituted a full point for each step. The consultants then co-scored alongside the Master Trainers until scoring was deemed consistent across trainers. Participants received one point for each step completed correctly; a point was awarded only when the step was conducted in full. A maximum number of 14 points was possible for Prevent Problems before Baby is Born and 16 points for Prevent Problems after Baby is Born.

Prior to analysis, respondents with missing data points were identified and excluded from the final analysis, leaving a final analysis sample size of 91 HEWs (100%) and 626 Guide Team members (98%). Analysis of performance testing data was conducted using the matched pair's *t*-test to compare the mean differences in pre-testing and post-training scores. In addition, paired *t*-tests were used to compare pre- and post-test scores for individual steps within each CMNH topic.

Main findings

Social and demographic characteristics

A total of 91 HEWs and 638 guides completed the CMNH training programme from Oromiya and Amhara Regions (HEWs: N=49 and 42, respectively; Guides: N=330 and 308, respectively). Although not collected during the training, demographic and work history data can be drawn upon from the MaNHEP baseline survey that was conducted with a representative sample of the same population (Stephenson et al., 2011). Data reveal that the mean age for HEWs is 23.2 years (SD=3.6) and 23.7 years (SD=3.0) for Amhara and Oromiya, respectively. Mean age for vCHPs in Amhara and Oromiya regions is 39.2 (SD=9.4) and 38.7 (SD=8.3) years, respectively, while mean age for TBAs is 42.1 (SD=8.3) and 47.1 (SD=8.3) years, respectively. All HEWs and TBAs surveyed from Amhara region and 96.6% of HEWs and 97.4% of TBAs from Oromiya region are female, while only 11.4% (Amhara region) and 44.4% (Oromiya region) of vCHPs are female. While HEWs have an average of 11.24 (SD=0.87) years of formal education, they report relatively little experience in their role as HEWs with an average of only 3.2 (SD=1.4) and 4.1 years (SD=1.2) for Amhara and Oromiya regions, respectively. In contrast, TBAs report less than one year of formal education (0.9 for both regions), but have far more years of experience caring for women in pregnancy and birth at 14.9 years (SD=9.7) for Amhara region and 11.9 years (SD=10.0) for Oromiya region.

Performance

The post-test performance scores for CMNH topics were significantly higher than immediate pre-training scores for both Amhara and Oromiya regions among HEWs (Fig. 2) and guide team members (Fig. 3). In Amhara region, the average HEW pretraining score for Prevent Problems before Baby is Born was 21% as compared with 73% for the post-training score, an increase of 350% over baseline. In Oromiya region, the average HEW posttraining score was 70%, an increase of 246% over the baseline score of 28%. Results were even more dramatic for Guide Team (GT) members. In Amhara region, the average GT pre-training and post-training scores for Prevent Problems before Baby is Born were 16% and 77%, respectively, representing a 468% increase over baseline. Similarly, in Oromiva region, the average pre-training score was 20% as compared to the post-training score of 77%, a nearly 400% increase over baseline. A paired t-test was performed to determine if the training was effective in transferring knowledge to HEWs and GT members. For Amhara and Oromiya regions, and among both HEWs and GT members, the mean change in score was significantly greater than zero with a two-tail p < 0.001(Table 1).

Statistically significant improvement in scores was also noted for *Prevent Problems after Baby is Born.* For Amhara region, the HEW mean pre-training score was 29% as compared with 91% for the post-training average, a 316% increase over baseline. Similarly for Oromiya region, the HEW post-training score of 86% increased



Fig. 2. CMNH pre-training and post-training scores for HEWs. Amhara: N=42; Oromiya: N=49.

Pre-Training and Post-Training Scores among Guide Team Members in Oromiya and Amhara



Fig. 3. CMNH pre-training and post-training scores for guide team members. Amhara: *N*=304; Oromiya: *N*=322.

by 300% over the baseline score of 29%. In Amhara region, the mean pre- and post-training scores for *Prevent Problems after Baby is Born* were 14% and 85%, an improvement of over 600% between pre- and post-testing. Among GT members in Oromiya, the average pre- and post-training scores were 20% and 82%, respectively, an increase of 410% over baseline. A paired *t*-test was performed to determine if CMNH training was effective in transferring knowledge to HEWs and GT members. For both regions, and among HEWs and GT members, the mean change in score was significantly greater than zero with a two-tail p = < 0.001 (Table 2).

Performance testing was also tabulated by individual step for the topics of Prevent Problems before Baby is Born (Table 2) and Prevent Problems after Baby is Born (Table 3). In both regions, and among HEWs and GT members, all steps of Prevent Problems before is Born were found to be significantly higher following training as compared with pre-training scores (p < 0.05). HEWs showed particular strength, scoring above 90%, with Steps 1 and 6 (Amhara and Oromiya), Steps 3, 8, and 9 (Amhara), and Steps 4 and 5 (Oromiya). GT members scored 90% or above on Steps 1, 3, and 6 (Amhara and Oromiyia) and Step 4 (Oromiya). Among HEWs, post-training scores for Step 2, Misoprostol stored in the home or know birth attendant with misoprostol (Amhara and Oromiya), and Step 10, Use good pushing positions (Oromiya), did not reach 70%. Steps 12, 13, and 14 were conducted around or below 50% of the time in both regions among HEWs and GT members; these steps are atypical in that they require participants to remind others what NOT to do in order to prevent problems.

For Prevent Problems after Baby is Born, 15 of 16 steps were found to be significantly higher following training as compared to pre-training scores among HEWs (p < 0.05). For GT members, all steps were found to be significantly higher following training as compared to pre-training scores (p < 0.001). Among HEWs, knowledge was noted to be very high with post-training scores at or above 90% for Steps 1, 5, 7, and 12 (Amhara and Oromiya), Steps 2, 4, 9, 11, and 16 (Amhara), and Steps 6 and 8 for (Oromiya). For GT members, post-training knowledge was very high for Steps 1, 2, 5, 11, and 13 (Amhara and Oromiya) and Steps 4, 8, and 9 (Amhara). While significant improvements were made, post-testing scores for Step 3, Check the baby for good colour, breathing, and activity, did not reach 70% for HEWs or GT members in either region. In addition, post-test scores did not reach the 70% threshold for Step 9, Do NOT pull on the cord, among HEWs in Oromiya, and for Step 10, Rub womb after placenta comes out, among HEWs (Oromiya) and GT members (Amhara and Oromiya).

Discussion

The CMNH programme findings

CMNH pre-test scores highlight substantial knowledge deficits in the prevention of problems in pregnancy and after birth among HEWs and GT members in both regions, emphasising the critical need for CMNH training. Significant increases between pre- and post-training scores provide strong evidence that the CMNH programme can increase knowledge and skills of participants. Moreover, results demonstrate that community-level health workers with low levels of formal education (e.g., TBAs) have the ability to learn life-saving MNH skills. In fact, GT members, on average, scored at or above HEWs on 12 of 14 Steps for *Prevent Problems before Baby is Born* and at or above HEWs on 10 of 16 Steps for *Prevent Problems after Baby is Born*.

Low post-test scores for three steps of *Prevent Problems before Baby is Born* highlight areas in need of improvement: (1) Step 12

Table 1

t-Tests for mean change in scores by topic, region, and health worker type.

	Mean change in score (SD)			T-statistic				95% confidence interval				
	Amhara		Oromiya		Amhara		Oromiya		Amhara		Oromiya	
Торіс	GTs	HEWs	GTs	HEWs	GTs	HEWs	GTs	HEWs	GTs	HEWs	GTs	HEWs
Prevent problems before baby is born Prevent problems after baby is born	0.61 (0.01) 0.72 (0.01)	0.52 (0.03) 0.62 (0.02)	0.58 (0.01) 0.62 (0.01)	0.41 (0.02) 0.57 (0.02)	54.23*** 62.30***	18.25*** 25.73***	59.41*** 58.29***	16.85*** 23.16***	(0.59– 0.63) (0.69– 0.74)	(0.46– 0.58) (0.57– 0.67)	(0.56- 0.59) (0.60- 0.64)	(0.36– 0.45) (0.52– 0.62)

Amhara: GTs N=304, HEWs N=42; Oromiya: GTs N=322, HEWs N=49.

GTs are Guide Teams comprised of Traditional Birth Attendants and volunteer Community Health Promoters; HEWs are Health Extension Workers.

*** Statistical significance at < 0.001 level.

Table 2

Percentage of guide team members and HEWs who correctly completed each step for *Prevent problems before baby is born* and results of paired *t*-tests for differences between pre- and post-test scores.

		Amhara	a region	Oromiya region			
		% Correct pre/post <i>t</i> -stat					
	Prevent problems before baby is born	GTs	HEWs	GTs	HEWs		
Step 1	Plan for the birth: clean birth kit	59/98	50/98	77/99	88/100		
		14.15***	6.11***	9.5***	2.59**		
Step 2	Misoprostol stored in home or know birth attendant with misoprostol	0/74	2/69	3/73	8/51		
		29.13***	9.06***	26.4***	5.20***		
Step 3	Clean: woman, helpers, environment	26/90	48/100	37/91	55/84		
		21.51***	6.40***	17.67***	3.10**		
Step 4	Referral plan (people, money, and transport)	24/87	26/88	31/93	82/94		
		21.73***	6.44***	20.91***	1.77*		
Step 5	Call for helpers when labour begins	19/72	36/86	35/86	76/96		
		16.37***	5.33***	15.34***	3.14***		
Step 6	Drink or eat light foods every hour	66/98	88/98	55/95	80/96		
		12.01***	2.08*	13.41***	2.42**		
Step 7	Woman and helpers wash hands before and during labour and hand protection	4/81	5/79	10/86	8/78		
		31.27***	8.16***	30.52***	-9.55***		
Step 8	Woman change positions during labour: walk, sit, lie on side, rest	11/87	17/95	15/87	6/90		
		29.67***	12.26***	26.36***	13.76***		
Step 9	Use safe birth practices: feel or look for baby's head before pushing	9/82	2/93	2/86	0/78		
-		26.69***	17.42***	40.08***	12.88***		
Step 10	Use good pushing positions	11/82	17/74	4/81	6/63		
-		25.13***	7.39***	31.08***	7.41***		
Step 11	Woman squat or pass urine before and after baby is born	2/86	2/86	2/85	0/76		
-		39.71***	14.32***	40.05***	12.17***		
Step 12	Do NOT give oxytocin before baby is born	1/55	0/36	1/49	0/25		
-		18.84***	4.77***	17.45***	3.95***		
Step 13	Do NOT push on woman's belly	1/48	0/26	3/43	0/20		
-	· ·	16.41***	5.02***	14.64***	3.51***		
Step 14	Do NOT put anything in the birth canal before or after baby is born	0/42	0/24	0/24	0/25		
•		14.65***	3.58***	10.12***	3.95***		

Amhara: GTs N=304, HEWs N=42. Oromiya: GTs N=322, HEWs N=49.

* Significance level < 0.05.

** Significance level < 0.01.

*** Significance level < 0.001.

(Do NOT give oxytocin before baby is born); (2) Step 13 (Do NOT push on woman's belly); and (3) Step 14 (Do NOT put anything in the birth canal before or after baby is born). These steps stress verbal cuing rather than a specific action. Results mimic those from prior trainings, demonstrating that participants remember to conduct steps more frequently when the steps involve a physical action or prop as opposed to simply verbal cuing (Dynes et al., 2011). There are potentially serious complications for the health of mothers and newborns if frontline workers do not learn these critical steps. For example, if HEWs, TBAs, and vCHPs fail to teach families 'Do NOT push on woman's belly', this dangerous practice may continue, causing uterine rupture or placental separation, both of which can lead to maternal and

fetal death. Subsequent CMNH trainings have and will continue to place greater prominence on these areas. In addition, learning transfer of these critical verbal cues is being monitored closely at each step of the training cascade. Furthermore, trainers have engaged the community in a discussion on creative strategies that may heighten awareness of these steps in order to increase knowledge transfer and retention.

Contextualising the CMNH programme findings

Though it is recognised that HEWs cannot alone fill the gap of skilled birth attendance in Ethiopia, there are community-level services that HEWs and other frontline health workers can

Table 3

Percentage of guide team members and HEWs who correctly completed each step for *Prevent Problems after Baby is Born* and results of paired t-tests for differences between pre- and post-test scores.

		Amhara	a region	Oromiya region			
		Correct pre/post <i>t</i> -stat (%)					
	Prevent problems after baby is born		HEWs	GTs	HEWs		
Step 1	Hold baby, wipe face, and dry as soon as baby is born	10/97 46.05****	26/98 10.12****	27/99 28.01****	31/96 8.75***		
Step 2	Wrap all of baby in dry blanket and give to mother to hold and rub back	7/94 44.72***	24/91 7.06***	16/93 19.85***	27/90 8.39***		
Step 3	Check baby for good colour, breathing, and activity	3/55 17.87***	0/50 6.40***	4/58 19.27***	14/51 4.87***		
Step 4	Give misoprostol if trained person and no second baby	2/91 49.88****	2/98 28.64***	6/73 24.83***	27/82 7.11***		
Step 5	Tie and cut cord using clean cord care practices	45/98 18.59***	91/100 2.08*	51/95 14.26***	71/94 3.08**		
Step 6	Safe delivery of placenta: woman squats and passes urine	2/79 30.17***	10/86 10.19***	6/83 31.82***	8/92 13.76***		
Step 7	Semi-sit	9/84 29.63***	19/91 10.12***	15/84 25.52***	16/92 10.13***		
Step 8	Breast feed within 1 hr watching for baby's colour, breathing, activity	13/95 37.45***	50/86 3.53***	32/89 19.06***	57/94 4.54***		
Step 9	Do NOT pull on cord	13/92 33.08***	29/93 7.82***	16/89 27.62***	18/69 6.14***		
Step 10	Rubs womb after placenta comes out	1/63 21.71***	14/81 9.06***	4/63 20.66**	12/69 8.00***		
Step 11	Safe disposal of placenta	9/95 43.48***	24/98 10.75***	26/92 24.63***	12/90 12.88***		
Step 12	Watch for danger signs	12/72 19.51***	12/95 14.32***	8/72 22.91***	25/94 10.43***		
Step 13	Advise woman/family on nutrition, rest, and cleanliness	70/98 10.11***	55/100 5.82***	53/94 13.77***	51/90 4.76***		
Step 14	Advise exclusive breast feeding for at least 6 months	19/84 21.40***	50/79 2.91**	42/86	1.22		
Step 15	Good breast-feeding position, feed every 2–3 hrs	4/88 39.72***	17/83 8.22***	7/72 22.93***	14/74 8.00***		
Step 16	Advise woman to rest with baby under bednet for at least 12 days	5/83 31.01***	2/93 19.74***	4/67 22.89***	2/78 12.17***		

Amhara: GTs N=304, HEWs N=42. Oromiya: GTs N=322, HEWs N=49.

* Significance level < 0.05.

** Significance level < 0.01.

*** Significance level < 0.001.

provide to reduce maternal and newborn mortality and morbidity (Koblinsky et al., 2010). In a recent review of Ethiopia's progress towards Millennium Development Goal 5, Koblinsky and colleagues (2010) point to six key services that HEWs could provide now to improve maternal and newborn survival at community-level health facilities: (1) family planning; (2) hygienic delivery; (3) active management of third stage; (4) immediate postpartum visit to the mother and newborn; (5) continued promotion of birth preparedness, complication readiness, and knowledge; and (6) means of communication with a referral centre. Further, Tesfaye (2010), reporting on cultural discordance and the polarisation of identities, convened a workshop to examine how better to work with individuals, families, and communities to improve maternal and neonatal health in Ethiopia. Tesfaye (2010) reinforces the analysis by Koblinsky et al. (2010) and proposes specific community-level approaches such as engaging and collaborating with men and community leaders, among others.

The MaNHEP CMNH training programme strengthens many of the services identified by Koblinsky et al. (2010) by targeting the birth-to-48 hr window and incorporates approaches recommended by Tesfaye (2010). In fact, the CMNH programme extends these by not only enhancing the performance of HEWs, but also increasing the knowledge and skills of other frontline health workers, pregnant women, family caregivers and birth attendants, and by including essential newborn care. Strengthening services at both the home and facility level is essential in settings where access to facility-based health services is limited in the near future, as it is in Ethiopia.

Implications and limitations

There are several key implications of the CMNH programme for the health of mothers and newborns in Ethiopia and in other rural, low-resource settings. Firstly, pretest scores for HEWs and GT members emphasise the need for CMNH training to supplement the current maternal and newborn health content. Furthermore, post-test scores highlight areas in need of improvement, specifically, the steps involving verbal cues, rather than physical actions. In addition, the training strategy used by the CMNH programme (e.g., story-telling, role-playing, pictorial cards, etc.) has proved successful in transferring knowledge from the Master Trainer level to the Trainer level, and from the Trainer level to the Guide Team level. These same culturally appropriate training strategies may be implemented in other low-literacy contexts where written materials are impractical. Moreover, the focus on birth-to-48 hr care saves lives, and the CMNH package clearly addresses the 48-hr window and builds on the current HEW educational programme. The training cascade approach also has implications for the success of the MaNHEP project. The HEWs have transferred their knowledge and skills to local kebele guide teams comprised of vCHPs and TBAs, who are now transferring their knowledge and skills in an ongoing fashion to cohorts of pregnant women, family caregivers, and birth attendants.

Although not yet measured, the process of participating in CMNH training is thought to build trust and respect within and between frontline health worker groups, and potentially improve the overall sense of team among them in order to develop and sustain future collaboration. It is anticipated that participation in the CMNH training programme will increase HEW self-confidence in providing MNH services, thereby reigniting their interest and effort to engage in MNH work responsibilities, and ultimately breaking the cycle of limited MNH exposure and low selfconfidence. There is a dearth of literature on the themes of trust, sense of team, and confidence among health worker groups in low-resource settings; we highlight these areas as essential components of future research to improve community-level health services.

While increasing HEW self-confidence will likely lead to increased engagement in MNH work, we acknowledge that this alone will not solve the problem of low HEW-attended deliveries. Results from the MaNHEP formative work revealed that the community may not fully trust HEWs, who are young and relatively inexperienced, to provide delivery services (Hadley et al., 2010; Stephenson et al., 2011). Thus, community members do not regularly seek out the services of HEWs during birth. Therefore, the CMNH programme is embedded within a broader strategy that encourages teamwork among health worker cadres, namely HEWs, TBAs, and vCHPs. It is through this collaboration (e.g., observing HEWs working alongside TBAs when complications occur) that we feel the community may begin to develop trust in the skills and knowledge of HEWs, and eventually seek out their services in pregnancy and birth.

One limitation of this work is that pre- and post-testing of individual HEWs was not scored by the same Master Trainer in every case, which reduces the comparability of scores. To minimise this limitation, Master Trainers received training and support from CMNH consultants to maximise the consistency of scoring throughout the pre- and post-testing process. Another limitation is that we have not reported on the transfer of knowledge from the Guide Team level to the community (pregnant women, family caregivers, and birth attendants), nor have we reported on behaviour change resulting from the acquisition of new knowledge and skills of maternal and newborn care by HEWs and Guide Team members. We recognise that knowledge acquisition does not necessarily translate to behaviour change, and that it is only through behaviour change (on the part of both health providers and the community) that MNH outcomes will improve. We also acknowledge that immediate post-training scores do not capture retention of knowledge. Therefore, data on knowledge transfer to families, caregivers, and birth attendants (measured by complication audits), behaviour change (measured through the Quality Improvement strategy), 1 year post-training performance testing (to capture knowledge/skill retention), and ensuing refresher trainings based on these results, are in the process of being collected and will be reported in subsequent papers.

Conclusion

The encouraging results of the CMNH training programme discussed here represent only the beginning of a long and complex path to improving maternal and newborn health in rural Ethiopia. In order for the gains to be realised and sustained, the CMNH programme will be nested within an enabling

environment. This environment will be created through behaviour change communication aimed at increasing the demand for CMNH services at the community level, emphasising evidencebased maternal and newborn care practices, teamwork among frontline health workers, and an enhanced role of HEWs in provision of safe care during pregnancy, birth, and the early postnatal period. It will also be created through the efforts of community-level collaborative quality improvement teams, who can identify barriers to CMNH programme implementation and service delivery and who can develop and test local solutions to achieve the aim of care reaching all women and newborns, in time, every time, during the critical 48 hr window after birth. Finally, this environment will be created through advocacy and support from regional and district-level health service managers of HEWs and other frontline health workers to meet the needs of childbearing families while facility-based health services are being developed and strengthened. Ultimately, the impact of the CMNH training programme will be measured not merely by the knowledge and skill acquisition of HEWs, TBAs, and vCHPs, but that of community members and birth attendants, and the subsequent influence of these on MNH behaviour and health outcomes.

Conflict of interest

The authors have no conflicts of interest to report.

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