Measuring Implementation Strength of Basic Emergency Obstetric and Newborn Care in 134 Health Centers of Amhara, Oromia, SNNP and Tigray Regions of Ethiopia

The Last Ten Kilometers (L10K) Project
JSI Research & Training Institute, Inc.

JSI Research & Training Institute, Inc.

PO Box: 13898, Addis Ababa, Ethiopia
Tel: +251-11-6620066
Fax: +251-11-6630919
Website: www.l10k.jsi.com

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Acronyms

AMTSL	Active Management of Third Stage of Labor
ANC	Antenatal Care
APH	Antepartum Hemorrhage
BEmONC	Basic Emergency Obstetric and Newborn Care
BMGF	Bill & Malinda Gates Foundation
CEmONC	Comprehensive Emergency Obstetric and Newborn Care
D & C	Dilatation and Curettage
E & C	Evacuation and Curettage
FMoH	Federal Ministry of Health
HIV	Human Immunodeficiency Virus
IV	Intravenous
JSI	John Snow, Inc.
L10K	The Last Ten Kilometers
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio
MVA	Manual Vacuum Aspiration
PEE	Pre-eclampsia/ Eclampsia
PHCUs	Primary Health Care Units
PMTCT	Prevention of Mother To Child Transmission
PNC	Postnatal Care
PPH	Postpartum Hemorrhage
SBA	Skilled Birth Attendant
SNNP	Southern Nations and Nationalities Peoples' Region
STIs	Sexually Transmitted Infections
USAID	United States Agency for International Development
WHO	World Health Organization

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Executive Summary

Background: The majority of maternal and neonatal deaths can be averted by the recognition of obstetric complications and use of appropriate emergency referral procedures, including efficient and well-equipped transport facilities, and by providing timely and adequate care. However, access to and utilization of proven interventions to reduce both maternal and newborn death remain low in Ethiopia, mainly due to socio-cultural factors, a limited number of skilled staff, a limited number of well-equipped and well-functioning facilities, low quality of care, and a weak referral system.

Since October 2012, The Last Ten Kilometers (L10K) Project JSI Research & Training Institute, Inc., with funds from USAID, has been supporting the government of Ethiopia to improve access to timely Basic Emergency Obstetric and Newborn Care (BEmONC) and effective care-seeking for critical maternal and newborn health conditions in selected primary health care units of Amhara, Oromia, SNNP, and Tigray regions.

A needs assessment was conducted to identify gaps and design context-based interventions in April 2013 and November 2013 for phase I and phase II health centers, respectively. This follow-up study was conducted in July 2015 to measure the implementation strength of BEmONC services and changes in the implementation of BEmONC services since the implementation of the program. Measuring the strength of program implementation is an evaluation approach which helps to understand why some programs are successful and some fail, attribute outcomes to a program, and anticipate outcomes of future programs.

Methods: The survey was a before and after quantitative cross-sectional evaluative study. Both retrospective document reviews and primary data collection were used to obtain information on implementation strength of BEmONC services in 134 health centers in Amhara, Oromia, SNNP, and Tigray regions of the country.

The researchers analyzed the data using Stata 12.1. Descriptive statistics were used to analyze the infrastructure, knowledge, services offered, and management of maternal and newborn outcomes. A t-test using the pairwise comparison of means was used to test the magnitude of change in implementation strength of BEmONC services.

Results: Facility structure indicators, including the availability of skilled providers, availability of essential drugs and equipment index score, and infrastructure index score, increased statistically significantly from the baseline. Availability of trained staff to manage complications, ambulance for emergency transport, pharmacy services, and laboratory services 24 hours a day, and seven days a week showed significant changes over survey periods. More than three-quarters of health centers had all necessary equipment, drugs, and trained provider to provide all BEmONC signal functions on the day of the visit.

Though significantly changed from the baseline, there is room for improvement in the availability of functional water lines in the maternity units and the number of available maternity beds. Essential equipment for newborn care, including suction machines, radiant heaters, and oxygen concentrators, remained the least available items.

Regional variations were observed in terms of facility readiness. There was no significant improvement in the availability of equipment index score in Amhara, infrastructure index score in Oromia, and availability of trained provider and round the clock service availability in Tigray.

Though more than 90% of health centers had access to an ambulance for transfer of emergency to and from the facility, ambulances were located outside of the health center premises in a significant proportion of health centers and it took them a mean of 47.5 minutes to arrange an ambulance for a referral. Only one-third of health centers had a referral focal person/liaison officer available at least for working days and in only one-tenth of health centers a unit that coordinates referrals was available. The adherence to referral protocols (i.e., use of referral slip, ambulance, escorting, advance call, and feedback) while referring to the hospital was suboptimal, particularly for a neonatal referral.

Statistically significant improvements were seen in the performance of BEmONC signal functions compared to baseline findings, particularly in terms of administration of parenteral antibiotics, parenteral uterotonics, parenteral MgSO4/diazepam, removal of retained conception, and assisted vaginal birth. However, neonatal resuscitation and manual removal of placenta were not changed statistically significantly from the baseline.

Provision of quality care was measured by woman-centered care, cordial reception and treatment, partograph use, and stillbirth. The data indicated that provision of quality care was improved following the implementation of BEmONC program.

Most health workers prepared almost all basic items to attend the birth on the day of the visit or at the last birth they attended except vacuum extractor and soap. Active management of the third stage of labor was practiced during attending birth on the day of the visit or at the last birth they attended in the most of the health centers in Amhara, Oromia, and Tigray regions; however, it was low in SNNP region. Likewise, administration of oxytocin was practiced routinely at almost all health centers in Amhara, Oromia, and Tigray, but in less than three-quarter of health centers in SNNP region.

Most health centers used partograph to monitor the progress of labor; however, the completeness of monitoring parameters as per the standard was low, particularly temperature and blood pressure. The lack of labor management protocols recommending the use of partograph for labor monitoring in most health centers might contribute to the low quality of completeness.

The health workers had fair knowledge of the components of antenatal care, active management of the third stage of labor, and what to monitor for a woman in labor. However, providers had low knowledge regarding which pregnant woman needs specialty care and diagnosis and management of postpartum hemorrhage including retained placenta. Likewise, health workers knew most of the steps of neonatal resuscitation; however, only one in ten were able to recall the sequential steps correctly. Also, the knowledge of providers on care for the sick newborn and low birth weight newborn were low.

Conclusions and Recommendations: The functionality of water lines in the maternity units, the availability of maternity beds, and availability of essential equipment for newborn care including suction machines, radiant heaters, and oxygen concentrators, should be given due attention.

A program of focused mentoring and supportive supervision for particular skills such as neonatal resuscitation, manual removal of placenta/removal of retained products of conception, postpartum hemorrhage management, and care for the sick and low birth weight baby should be prioritized.

All health centers should have a functioning means of communication and a functional means of emergency transport available all times, and emergency patients should be accompanied by a qualified health professional. Further, the referral system should be strengthened for timely access to EmONC services.

The completeness of partographs should be improved by introducing closer supervision, providing training, and availing partograph management protocols; otherwise the partograph cannot optimally function as a managerial tool for the prevention and diagnosis of prolonged and obstructed labor. Adequate production and supply of guidelines and job aids, particularly for infection prevention practices and labor-management protocols, are required. There is also a need for continuous training and monitoring on the utilization of guidelines and treatment protocols to enhance the performance of health care workers.

Background

The maternal mortality ratio (MMR) of Ethiopia, 497 per 100,000 live births, is among the highest in the world and well above the Millennium Development Goal (MDG) 5 target of 267 maternal deaths per 100,000 live births to be achieved by 2015 [1]. The neonatal mortality rate currently stands at 29 deaths per 1,000 live births and accounts for 43% of all under-five mortality [2].

The major complications that account for a large proportion of both maternal and neonatal deaths are due to events that happen in and around the time of labor, delivery, and early postpartum [3]. The majority of these causes of maternal death can be averted by the early recognition of complications, use of appropriate emergency referral procedures, and by providing timely and adequate care [4]. However, many women still face challenges in timely access to life-saving emergency obstetric interventions (EmONC)[1].

In Ethiopia, access to and utilization of proven interventions to reduce maternal and newborn death remains low, mainly due to socio-cultural factors, a limited number of skilled staff, a limited number of well-equipped and well-functioning facilities, low quality of care, and a weak referral system [5]. To speed up the progress towards reducing both maternal and neonatal mortality, the Federal Ministry of Health (FMoH) has been taking efforts to expand access to basic EmONC (BEmONC) care and establish referral systems for medical emergencies in rural Ethiopia. Major national efforts to improve maternal mortality currently include mobilizing communities to encourage pregnant mothers to give birth in health facilities, creating effective supportive and referral linkages within the primary health care units, staffing health centers with midwives to ensure continuous availability of BEmONC services, and the provision of ambulances to woredas to mitigate transportation barriers [6].

Since October 2012, the Last Ten Kilometers (L10K) Project, with funds from United States Agency for International Development (USAID), has been supporting the government of Ethiopia to improve access to timely BEmONC care and effective care-seeking for critical maternal and newborn health conditions in 345 primary health care units (PHCUs) of Amhara, Oromia, Southern Nations, Nationalities and People's (SNNP), and Tigray. Prior to implementation, a needs assessment was conducted to identify gaps and design context-based interventions. Based on the needs assessment findings the following interventions were designed and have been implemented with the support from L10K: 1) capacity building, 2) mentoring and monitoring through supportive supervision, 3) providing equipment and supplies where needed, and 4) strengthening referral linkages.

In 16 of the USAID | BEmONC PHCUs, the referral solutions strategy funded by the Bill & Melinda Gates Foundation (BMGF) is being implemented. This strategy implements *effective referral solutions* following a three-step change process—1) assess the local context and available referral resources, which includes a situation analysis to identify current gaps in the referral system

[1] Basic EmONC (BEmONC) services are set of life-saving functions such as the administration of antibiotics, oxytocic drugs, and anticonvulsants, as well as manual removal of retained placentas, removal of retained products of conception, assisted vaginal delivery, and neonatal resuscitation while comprehensive EmONC (CEmONC) services additionally include blood transfusion and obstetric surgery.

based on the framework[2] described by Murray and Pearson [4], and brainstorm with communities and key health system stakeholders to identify local resources; 2) use that information in the participatory design of innovations to strengthen the referral system involving demand and supply sides; and 3) implement those innovations in order to achieve active management of the referral system. The lessons learned and best practices in the referral solution PHCUs were subsequently spread to the USAID-funded BEmONC program.

To measure the implementation strength of BEmONC services and changes in the implementation of BEmONC services since the implementation of the program, this implementation study was conducted in July 2015.

Measuring the strength of program implementation is an evaluation approach which helps to understand why some programs are successful and some fail, attribute outcomes to a program, and anticipate outcomes of future programs [7].

Organizational structure and processes of service delivery are the components of measuring implementation strength identified through literature and program review [7-11]. Structural measures describe the setup or the resources of the health care system, which encompasses the people, organizations and systems of care, geographic location, and accessibility of services, knowledge and technology. On the other hand, a process measure encompasses the way in which services are delivered. Our BEmONC assessment also identifies the need for support strategies to optimize and standardize the implementation strength or intensity of BEmONC care including 1) capacity building, 2) mentoring and supportive supervision, 3) need-based provision of equipment and supplies, and 4) introduction of referral protocols to strengthen referral linkages. Thus, measuring implementation strength of BEmONC care in the context of rural facilities would include evaluation of 1) effectiveness of referrals, 2) completeness of resources available at the facility, 3) quality of care, and 5) technical inputs.

Measuring implementation strength of the critical components of BEmONC program is essential to understand which aspects of the program: 1) are more useful than others in achieving its objective; 2) need corrective measures if they are to be scaled-up; and 3) were improved (and which aspects did not) following L10K's BEmONC strengthening initiatives.

[2] *According to Murray and Pearson, a well-functioning referral system should include: a referral strategy informed by the assessment of population needs and health system capabilities; an adequately resourced referral center; active collaboration between referral levels and across sectors; formalized communication and transport arrangements; agreed setting-specific protocols for referrer and receiver; supervision and accountability for providers' performance; affordable service costs; the capacity to monitor effectiveness; and underpinning all of these, policy support.*

Objectives

- To measure the implementation strength of BEmONC services
- To assess the changes in the implementation strength of BEmONC services since the implementation of the program
- To evaluate the knowledge and competence of trained BEmONC providers at health centers
- To assess the use and quality of the partograph completion and labor management

Methods

Setting

L10K has been implementing BEmONC initiative using a phased approach to expand to 345 PHCUs, three PHCUs in each of the 115 L10K intervention woredas, with new woredas added each year, while continuing support to existing woredas. In phase I (since October 2012), L10K began supporting 42 PHCUs; in the second phase, (Since October 2013), it covered an additional 92 PHCUs and in the third phase, (Since October 2014), it has been covering an additional 211 PHCUs. This study was conducted in the 134 PHCUs in Amhara, Oromia, SNNP, and Tigray regions of Ethiopia where L10K has been implementing BEmONC initiatives during phase I and phase II. The detailed list of study zones, woredas, and health centers is presented in appendix 2.

Design

The survey was a quantitative cross-sectional evaluative study. Both retrospective document reviews and primary data collection were used to obtain information on implementation strength of BEmONC services in these four regions of the country.

Data Collection

The study employed 24 data collectors (6 each in Amhara and SNNP, 7 in Oromia, and 5 in Tigray) who had prior experience of data collection in maternal and child health surveys and had good knowledge of the local health system. They were trained for three days, with one day dedicated to field training to test the actual data collection.

Data were collected through interview, review of records, and observation (Table 1). Data collectors conducted interviews with the head of the health center and a provider working in the maternity unit to gather information on the availability of equipment and supplies, human resources, performance of BEmONC signal functions, and other maternal and newborn health services. The data collectors made observations to assess the infrastructure, provision of care, and supplies available. Document review was used to gather data on cases statistics. New data items were included in the current survey to measure the knowledge and competence of providers, to assess the quality of partograph use for labor monitoring, and to measure service utilization.

Table 1: Data sources and techniques of data collection for measuring implementation strength of BEmONC, July 2015

Domain	Components	Techniques of data collection
Functionality of health centers	Trained providers available, and currently working	Interview
	Availability of basic obstetric care services/ inputs available in the facility 24 hours a day (antibiotics, oxytocics, MgSO4, assisted delivery and removal of conceptus, ambulance, laboratory, and pharmacy)	Interview/observation
	Availability of water and electricity in the labor and postpartum rooms	Observation
	Availability of equipment and supplies used in delivery, postpartum and neonatal care	Observation
	Availability of drugs and laboratory tests	Observation

	Availability of maternity unit infrastructure- number of beds for maternity care, availability of emergency cabinet, presence of newborn corner	Observation
	Practice of infection prevention in the maternity unit (ANC, delivery and PNC)	Observation
Effective referral	Availability of functional ambulance or another vehicle for emergency transportation, access to ambulance; location of ambulance; telephone for two-way communication; direct access to ambulance by community	Interview
	Presence of referral focal person; unit/office coordinating referral	Interview/observation
	Presence of referral slips and registers	Observation
	Presence of standard protocols of referral; adherence to protocols; presence of feedback	Interview; observation of feedbacks
Provision of care: ANC care provision	Privacy maintained in the ANC room; counseling; development of birth preparedness and complication readiness plan jointly;	Observation
Delivery and PNC	Delivery room privacy; client-centered care provision;	Observation and interview
	Respectful reception and quick care;	Observation
	Presence of items to attended normal or assisted birth	Observation/interview
	Active management of the third stage of labor	Observation/ interview
Newborn care	Care given to the newborn	Observation/interview
Performance of signal functions	Use of IV antibiotics; uterotonics; Mgso4/Diazepam for treatment of eclampsia; removal of retained products of conception; manual removal of placenta; assisted vaginal birth; and neonatal resuscitation	Interview
	Readiness of health center to perform all BEmONC signal functions	Interview
Supportive supervision	Supervision visit from the higher level (woreda, zone, region, FMoH or L10K); number of supervision visits; review meetings; on-site monitoring;	Interview; document review
BEmONC trained providers' knowledge and competency	Knowledge and competence of providers	Interview
Use and quality of partograph completion	Use of partograph and timely decision on follow-up of labor	Partograph review

Service statistics	Obstetric complications managed at health center and its referral hospitals, delivery, and delivery outcomes, and number of referrals	Document review

The data collection was conducted in April 2013 (for phase I health centers) and November 2013 (for phase II health centers) for baseline and in July 2015 for follow-up study. Baseline data were collected using paper-based questionnaires and data were entered using Epi Info 7. Survey coordinators checked the completeness and accuracy of data daily and uploaded it to the server. In the follow-up survey, data were collected using an Android mobile application *SurveyCTO*[3] *collect*. The platform allowed data quality assurance through ensuring appropriate skip patterns during the interview and allowing only the entry of logical values. Data collectors entered data into the cloud using Android phones.

Standard questionnaires adapted from previous studies were used in this survey. The data collection instruments covered infrastructure, equipment and supplies, referral linkages, service utilization statistics, knowledge and competence of providers, and partograph review.

Data Analysis

The researchers exported the data into StataCorp [12] statistical package for analysis. They edited the data, recorded open-ended responses into categorical variables where necessary, and analyzed the data using Stata software. Descriptive statistics was used to analyze the infrastructure, knowledge, services offered, and management of maternal and newborn outcomes. A t-test using the pairwise comparison of means was used to test the magnitude of change in implementation strength of BEmONC services.

Ethical Clearance

Ethical review committees of the regional health bureaus granted ethical clearance. All study participants were informed about the purpose of the study and their right to opt out or to respond to questions. All study subjects provided informed verbal consent prior to any interview. The values, rights, and norms of the study subjects, the community, enumerators, and supervisors were respected.

[3] *http://www.surveycto.com/index.html*

Findings

Health Workers Currently Working

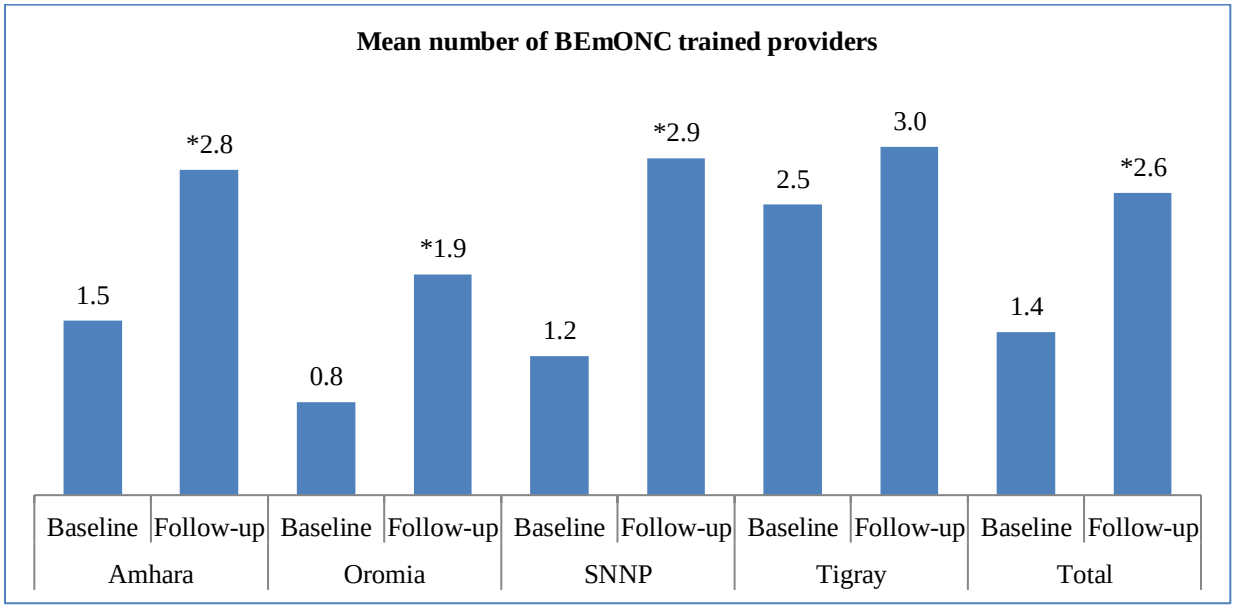
The mean number of skilled birth attendants (SBA) (i.e., midwives, nurses and health officers) currently working at health centers increased from 11.9 to 13.4. The availability of midwives and health officers had showed significant improvement in all regions while numbers of nurses, pharmacy, and laboratory professionals did not show significant change (Table 2).

Table 2: Mean number of health workers currently available in selected health centers in Amhara, Oromia, SNNP, and Tigray regions of Ethiopia.

Staffing category	Amhara		Oromia		SNNP		Tigray		Total	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Midwives	1.8	*2.5	1.8	*2.2	2.1	*2.8	2.5	*3.1	2.0	*2.6
Health officer	1.8	*2.3	1.2	*1.9	1.5	*2.3	1.0	*1.8	1.4	*2.1
Nurses	9.3	9.8	6.4	6.4	10.0	9.8	8.4	9.3	8.5	8.7
Pharmacy prof.	2.5	2.4	1.5	1.3	2.1	1.6	1.8	1.7	2.0	1.7
Laboratory prof.	2.5	2.4	1.6	1.5	2.3	2.2	1.5	1.4	2.0	1.9
SBA (Midwives, HO & Nurse)	12.9	14.6	9.4	*10.5	13.6	14.7	11.8	14.2	11.9	*13.4

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;

The mean number of BEmONC trained providers increased significantly from 1.4 at baseline to 2.6 during follow-up. The availability of trained providers had significantly increased in Amhara, Oromia, and SNNP regions. Though increased significantly from baseline, the availability of trained providers remained low in Oromia (Figure 1).



*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;

Figure 1: Mean number of BEmONC trained providers between baseline and follow-up surveys in selected health centers in Amhara, Oromia, SNNP, and Tigray regions.

Availability of Essential Drugs

Availability of individual drugs in the health centers showed significant positive changes for most drug categories except IV fluids and Nifedipine. The largest change was observed for MgSO4, which increased by 65% points (p-value<0.01) followed by hydralazine (53% points; p-value<0.01), and IV antibiotics (21%; p-value<0.01).

An essential drug availability index was calculated using the list of drugs in Table 3 below. This index expressed as a percentage of the maximum possible score, also increased significantly between baseline and follow-up survey periods (30% points). Though all regions showed significant improvement, Tigray showed much higher improvements (39% points) in the index score of essential drugs.

Table 3: Change in availability of essential drugs between baseline and follow-up surveys in selected health centers of Amhara, Oromia, SNNP, and Tigray regions of Ethiopia.

Drug	Amhara (n=37)		Oromia (n=39)		SNNP (n=38)		Tigray (n=20)		Total (n=134)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Pitocin	35.1	*100.0	23.1	*97.4	23.7	*97.4	55.0	*100.0	31.3	*98.5
IV fluids	94.6	100.0	100.0	97.4	100.0	97.4	100.0	100.0	98.5	98.5
Nifidipine	86.5	81.1	56.4	56.4	52.6	39.5	50.0	45.0	62.7	56.7
Hydralazine	46.0	*94.6	43.6	*87.2	31.6	*79.0	5.0	*95.0	35.1	*88.1
IV antibiotics	89.2	97.3	92.3	100.0	65.8	*100.0	55.0	*100.0	78.4	*99.3
IV MgSO4	5.4	*91.9	7.7	*61.5	15.8	*63.2	15.0	*95.0	10.5	*75.4
Calcium gluconate	5.4	16.2	5.1	**23.1	5.3	5.3	0.0	**20.0	4.5	*15.7
Index score of availability of essential drugs (% of maximum score)	51.7	*83.0	46.9	*74.7	42.1	*68.8	40.0	*79.3	45.8	*76.0

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

Availability of Medical Equipment

The availability of medical equipment, including vacuum extractor sets, radiant heaters, and oxygen concentrators, showed significant change. Regional variations were observed across survey periods, with SNNP showing significant improvements in most of the equipment; while, in Amhara no significant change in the availability of equipment except vacuum extractor. The availability of vacuum extractor did not significantly improve in Tigray. Likewise, availability of

oxygen concentrators, suction machines, and radiant heaters didn't show significant improvement in Oromia (Table 4).

Table 4: Change in availability of essential equipment between baseline and follow-up surveys in selected health centers of Amhara, Oromia, SNNP, and Tigray regions of Ethiopia.

Equipment	Amhara (n=37)		Oromia (n=39)		SNNP (n=38)		Tigray (n=20)		Total (n=134)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Sphygmomanometer	100.0	100.0	97.4	97.4	92.1	100.0	95.0	95.0	96.3	98.5
Vacuum extractor	43.2	*78.4	28.2	*71.8	23.7	*63.2	70.0	95.0	37.3	*74.6
Oxygen concentrator	13.5	27.0	15.4	15.4	13.2	*52.6	25.0	*70.0	15.7	*37.3
Suction machine	70.3	51.4	38.5	51.3	23.7	*55.3	50.0	**90.0	44.8	**58.2
Radiant heater	43.2	54.1	12.8	28.2	34.2	*81.6	55.0	75.0	33.6	*57.5
Ambu-bag & masks	100.0	97.3	71.8	**94.9	89.5	**100.0	100.0	100.0	88.8	*97.8
Index score of availability of essential equipment (% of maximum score)	61.7	68.0	44.0	59.8*	46.1	*75.4	65.8	*87.5	52.7	*70.6

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

Maternity Unit Amenities & Infrastructure

The maternity unit infrastructure index was formulated using items listed in table 5 below. The infrastructure index score increased 21% points between the survey periods. There was also significant regional variation, SNNP 32% point increase; Amhara 25% point increase; Tigray 20% point increase. In Oromia, there was an increase, but it was only 8.5% points and was not statistically significant.

More than 80% of health centers had a newborn corner and emergency cabinet for emergency drugs and equipment at the time of the follow-up survey. On the other hand, there was no significant improvement in the availability of light sources for vaginal procedures, easily cleaned floor tiles, and covering of delivery bed with washable plastic. The presence of functional electric lines was significantly improved in the Oromia and SNNP regions. Likewise, availability of a functional water line in the maternity unit was significantly improved in the SNNP and Tigray regions. As presented in table 5 below, currently, functional water lines were available in only 42% of maternity units of the health centers- 46% in Amhara, 21% in Oromia, 42% in SNNP and 75% in Tigray.

Table 5: Change in availability of maternity unit amenities & infrastructure between baseline and follow-up surveys in selected health centers of Amhara, Oromia, SNNP, and Tigray regions of Ethiopia.

Infrastructure	Amhara (n=37)		Oromia (n=39)		SNNP (n=38)		Tigray (n=20)		Total (n=134)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Waiting area for family or companion	56.8	78.4	59.0	**20.5	34.2	*79.0	25.0	45.0	46.3	56.7
Newborn corner	35.1	*91.9	35.9	**59.0	36.8	*92.1	75.0	90.0	41.8	*82.1
Emergency cabinet	24.3	*94.6	53.9	59.0	52.6	**92.1	95.0	100.0	51.5	*84.3
Light source for vaginal procedures	62.2	62.2	41.0	53.9	60.5	65.8	40.0	**75.0	52.2	62.7
Easily cleaned delivery floor tiles	67.6	78.4	69.2	64.1	76.3	**97.4	65.0	65.0	70.2	77.6
Delivery bed covered with washable plastic	86.5	83.8	51.3	**79.5	89.5	86.8	75.0	75.0	75.4	82.1
Functional electric system	64.9	81.1	35.9	*69.2	57.9	*86.8	70.0	95.0	55.2	*81.3
Functional water line	10.8	46.0	12.8	20.5	2.6	*42.1	15.0	*75.0	9.7	*41.8
Telephone line for two-way communication	2.7	*18.9	0.0	**10.3	0.0	*55.3	5.0	25.0	1.5	*27.6
Index score of availability of infrastructure (% of maximum score)	45.6	*70.6	39.9	48.4	45.6	*77.5	51.7	*71.7	44.9	*66.3

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

Health centers had a mean number of 2.3 couches at follow-up, a statistically significant change regarding the availability of maternity beds from the baseline (p-value<0.01) (Table 6).

Table 6: Availability of maternity beds among selected health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia.

Maternity beds	Amhara (n=37)	Oromia (n=39)	SNNP (n=38)	Tigray (n=20)	Total (n=134)

	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Delivery couches	2.0	**2.4	1.7	**2.1	1.3	*2.6	1.9	2.2	1.7	*2.3
First stage bed	0.2	*1.5	0.9	**1.6	1.7	*0.9	1.6	**2.6	1.0	*1.5
Post-partum bed	0.5	*1.4	1.0	**1.6	1.7	**2.4	2.5	3.2	1.3	*2.0

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

Infection Prevention Practices

The overall infection prevention practice index score didn't show significant improvement over time. Consistent use of personal protective barriers by staff (increased by 26%, p-value<0.01), hand washing practice of providers (46% rise, p-value<0.01), and the presence of a waste disposal system (19% increase, p-value<0.01) were among the larger changes seen (Table 7).

Table 7: Infection prevention facilities and practices among health centers in Amhara, Oromia, SNNP, and Tigray regions of Ethiopia.

Infection prevention practice	Amhara (n=37)		Oromia (n=39)		SNNP (n=38)		Tigray (n=20)		Total (n=134)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Cleanliness of the compound	75.7	91.9	76.9	71.8	86.8	92.1	80.0	90.0	79.9	85.8
Regular cleaning of delivery room	91.9	97.3	74.4	**94.9	92.1	92.1	80.0	85.0	85.1	**93.3
Availability of disinfectant and cleaning solutions	100.0	100.0	84.6	**100.0	89.5	**100.0	100.0	100.0	92.5	*100.0
Disinfectant solution prepared and used as per standard	97.3	91.9	66.7	*97.4	94.7	97.4	95.0	100.0	87.3	*96.3
Availability of puncture proof container for sharps	100.0	100.0	87.2	*94.9	97.4	97.4	90.0	100.0	94.0	*97.8
Providers practiced hand washing	48.6	*70.3	33.3	*84.6	23.7	*84.2	20.0	*75.0	32.8	*79.1
Quality mechanism for standard sterilization	54.1	**81.1	59.0	74.4	68.4	84.2	80.0	80.0	63.4	*79.9

Waste disposal system in place (Leak proof containers, waste sorted, incinerator, placenta pit)	67.6	*91.9	82.1	94.9	73.7	**94.7	80.0	**100.0	75.4	*94.8
Staffs consistently used personal protective barrier	40.5	*75.7	53.9	*87.2	68.4	*92.1	80.0	80.0	58.2	*84.3
Index score of infection prevention practice (% of maximum score)	85.3	88.9	82.9	88.9	93.6	92.7	83.9	90.0	86.7	90.1

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

24 hours a day, seven days a week (24/7) Service Availability

Availability of trained staff to manage complications, ambulance for emergency transport, pharmacy services, and laboratory services all times showed significant changes between surveys in all regions except Tigray (Table 8).

Table 8: Availability of round the clock services in selected health of Amhara, Oromia, SNNP, and Tigray regions.

Service availability	Amhara (n=37)		Oromia (n=39)		SNNP (n=38)		Tigray (n=20)		Total (n=134)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Trained staff on duty to manage obstetric complications	40.5	*91.9	71.8	*100.0	34.2	*81.6	80.0	90.0	53.7	*91.0
Ambulance service	59.5	*91.9	64.1	74.4	36.8	*97.4	65.0	90.0	55.2	*88.1
Pharmacy service	83.8	**100.0	82.1	92.3	39.5	50.0	30.0	40.0	62.7	**74.6
Laboratory service	62.2	*94.6	71.8	79.5	47.4	47.4	10.0	35.0	53.0	**67.9

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

At the time of the follow-up survey visit, parenteral antibiotics were available round the clock in more than 97% of facilities across all regions. Intravenous oxytocic drugs were available round the clock in all health centers of all regions except in SNNP. Parenteral MgSO4 for the treatment of pre-eclampsia or eclampsia (PEE) was available round the clock in the majority of health centers in Amhara and Tigray but in less than two-thirds of health centers in Oromia and SNNP (Table 9).

Manual removal of placenta was being performed all times at 95% of health centers in Amhara and SNNP; and all health centers in Oromia and Tigray regions (Table 9).

Assisted vaginal delivery was available at 87% of health centers in Amhara, 72% of health centers in Oromia, 68% of health centers in SNNP, and 95% of health centers in Tigray regions. Neonatal resuscitation was available round the clock in all health centers evaluated, except in two health centers of Oromia where it is available during the daytime only (n=1) or not available at all (n=1) (Table 9).

Table 9: Round the clock availability of maternal and neonatal health care services in selected health centers of Amhara, Oromia, SNNP and Tigray regions of Ethiopia.

Services	Amhara (n=37)	Oromia (n=39)	SNNP (n=38)	Tigray (n=20)	Total (n=134)
Parenteral antibiotics	36(97.3)	38(97.4)	37(97.4)	20(100.0)	131(97.8)
IV Oxytocic drugs	37(100.0)	39(100.0)	35(92.1)	20(100.0)	131(97.8)
Parenteral MgSO4	35(94.6)	24(61.5)	25(65.8)	19(95.0)	103(76.9)
Manual removal of placenta	35(94.6)	39(100.0)	36(94.7)	20(100.0)	130(97.0)
Removal of retained products of conception	33(89.2)	34(87.2)	38(100.0)	19(95.0)	124(92.5)
Assisted vaginal delivery	32(86.5)	28(71.8)	26(68.4)	19(95.0)	105(78.4)
Neonatal resuscitation with bag and mask	37(100.0)	37(94.9)	38(100.0)	20(100.0)	132(98.5)

Performance of BEmONC Signal Functions

The performance of BEmONC signal functions increased by 15% points overall between surveys (p-value<0.01). The overall performance of BEmONC signal functions in the last three months varied among regions. Amhara, Oromia, and Tigray showed statistically significant improvement in the performance of mean BEmONC signal functions; however, SNNP didn't show significant improvement between survey periods (Figure 2).

The use of IV antibiotics significantly increased, by 28% as compared to baseline. The most commonly performed BEmONC signal function was the use of uterotonics and all four regions improved on this measure. The use of uterotonics only increased a little (5%), but this was statistically significant (p-value<0.01). However, there were no statistically significant changes in the performance of manual removal of placenta (p-value>0.05) and neonatal resuscitation (p-value>0.05) (Table 10).

Likewise, a statistically significant differences were observed in the number of health centers using MgSO4 or diazepam and the number of health centers performing assisted vaginal delivery (P-value<0.05). MgSO4 or diazepam for treatment of PEE was least available in SNNP and Oromia. Health centers used MgSO4 was used for the treatment of PEE in 55% and 49% of health centers in Tigray and Amhara regions, respectively. Assisted vaginal birth was most available in Amhara while only 30% of health centers in SNNP were performing this function.

Table 10: Percentage of health centers performing a particular BEmONC signal functions in the past three months during baseline and follow-up

Signal function	Amhara (n=37)		Oromia (n=39)		SNNP (n=38)		Tigray (n=20)		Total (n=134)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
IV antibiotics	27.0	*81.1	53.9	**79.5	57.9	65.8	65.0	85.0	49.3	*76.9
IV uterotonics	97.3	97.3	94.9	100.0	94.7	100.0	75.0	90.0	92.5	**97.8
IV Magso4/Diazepam	10.8	*48.7	5.1	*30.8	2.6	15.8	25.0	85.0	9.0	*35.1
Removal of retained products of conception	67.6	75.7	48.7	69.2	63.2	68.4	45.0	75.0	57.5	**71.6
Manual removal of placenta	89.2	78.4	66.7	76.9	57.9	68.4	80.0	80.0	72.4	75.4
Assisted vaginal birth	59.5	78.4	15.4	*69.2	10.5	29.0	30.0	60.0	28.4	*59.0
Neonatal resuscitation	75.9	75.7	61.5	76.9	89.5	73.7	90.0	95.0	77.6	78.4
Mean percentage of functions	61.0	*76.4	49.5	*71.8	53.8	60.2	58.8	**77.1	55.2	*70.6

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

Overall, three health centers (2%) at baseline and 25 (19%) health centers at follow-up performed all seven BEmONC functions in the previous three months. In the follow-up survey, 11 (30%) of health centers in Amhara, 6 (15%) in Oromia, two (5%) in SNNP, and 6 (30%) in Tigray performed all of the seven signal functions in the previous three months. The detailed rankings of the performance of BEmONC signal functions by the health center in the four regions studied are presented in Appendix 3.

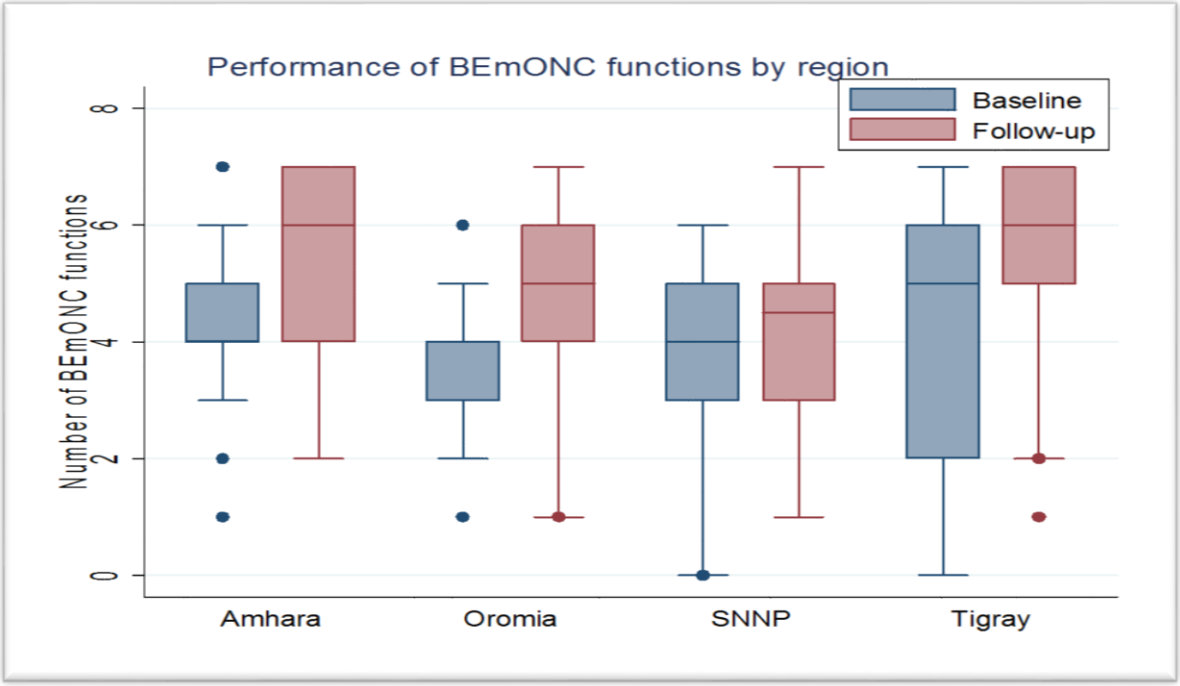


Figure 2: Overall performance of BEmONC signal functions in the last three months at selected health centers in Amhara, Oromia, SNNP, and Tigray regions of Ethiopia.

Readiness to Perform all BEmONC Signal Functions on the Day of the Visit

The reasons mentioned for not performing BEmONC signal functions in the past three months were no indication (25%), no supplies and equipment (6%), and lack of trained providers (2%).

Overall assessment of the readiness to perform signal functions on the day of visit revealed that a trained provider to perform signal functions was available in 93% of health centers. In Amhara, there was a trained person to perform signal functions in 89% of health centers while in four health centers there was no trained provider to perform signal functions. In other regions, there was a trained person in almost all health centers surveyed. All the drugs needed to perform signal functions were available in 97% of health centers in Amhara and 95% of health centers in Tigray. However, all drugs were available at only 76% of health centers in Oromia and 82% of health centers in SNNP. Most of the health centers in Amhara (87%), SNNP (82%), and Tigray (90%) but around half (56%) in Oromia had all equipment required to perform signal functions (Figure 3).

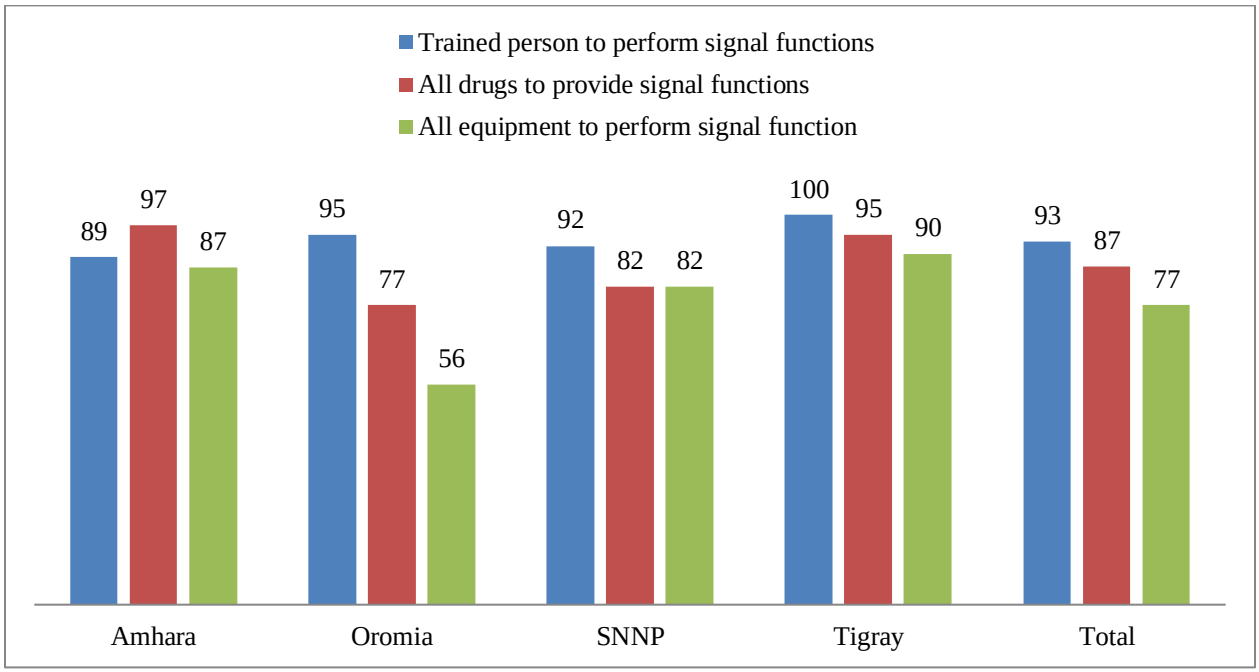


Figure 3: Readiness to perform all BEmONC signal functions on the day of visit at selected health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Quality of care: Woman-centered Care, Partograph Use, and Stillbirth Rate

Woman-centered cares such as cultural practices like coffee ceremony and allowing mothers to choose the birth position generally showed significant improvement. However, in Tigray, mothers were actually less likely to be allowed to choose birth position. Cordial reception and treatment of mother showed a significant improvement from previous practices (P-value<0.01). Likewise, use of partograph for follow-up of birth showed significant improvement over survey periods, and stillbirth rate was reduced significantly from the baseline (Table 11).

Table 11: Change in quality of care among health centers from November 2013 through June 2015 in Amhara, Oromia, SNNP, and Tigray regions July 2015.

Parameters	Amhara (n=37)		Oromia (n=39)		SNNP (n=38)		Tigray (n=20)		Total (n=134)	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Delivery room privacy kept	56.8	*100.0	64.1	66.7	84.2	**100.0	60.0	75.0	67.2	*86.6
Mothers allowed to choose position	48.7	*83.8	38.5	*71.8	36.8	*89.5	65.0	40.0	44.8	*75.4

Family member allowed to companion	67.6	73.0	38.5	*74.4	63.2	*89.5	70.0	**95.0	58.2	*81.3
Cultural practices allowed (e.g. coffee, etc.)	54.1	70.3	28.2	*100.0	39.5	*89.5	70.0	**95.0	44.8	*88.1
Treated cordially	62.2	*97.3	84.6	*100.0	97.4	100.0	55.0	*90.0	77.6	*97.8
Used partograph for follow up of birth	48.7	*100.0	35.9	*74.4	79.0	**97.4	90.0	95.0	59.7	*91.0
Stillbirth rate	2.8	2.2	2.8	1.4	2.3	*0.5	2.0	1.5	2.4	**1.4

*Statistically significant difference (p-value<0.01) between baseline and follow-up surveys;
**statistically significant difference (p-value<0.05) between baseline and follow-up surveys.

Maternal and Newborn Health Services Provision

Antenatal Care Services

Privacy was maintained in the antenatal care (ANC) room in most of the health centers; all health centers in Amhara and SNNP, 87% in Oromia, and 95% in Tigray. Child birthing issues were discussed in less than half (46%) of health centers in Amhara region while they were discussed in the majority of health centers in Oromia (92%), SNNP (90%) and Tigray (85%). PMTCT was discussed during ANC visit in three-quarters of health centers in Amhara and in the majority of health centers in other regions.

Birth preparedness and complication readiness were discussed in almost all (94%) health centers. Among the components of birth preparedness and complication readiness, health workers commonly discussed danger signs of labor, and place of birth. The least discussed components of birth preparedness and complication readiness was a potential blood donor, which was addressed in only 24% of health centers in Amhara, 56% of health centers in Oromia, 61% of health centers in SNNP, and 40% of health centers in Tigray (Table 12).

Table 12: Antenatal care services among selected health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Service	**Amhara (n=37)**	**Oromia (n=39)**	**SNNP (n=38)**	**Tigray (n=20)**	**Total (n=134)**
Privacy maintained in the ANC room	37(100.0)	34(87.2)	38(100.0)	19(95.0)	128(95.5)
Components of ANC discussed					
Nutrition counseling	33(89.2)	37(94.9)	38(100.0)	18(90.0)	126(94.0)

Birth preparedness complication readiness	34(91.2)	38(97.4)	38(100.0)	19(95.0)	129(96.3)
Child birthing	17(45.9)	36(92.3)	34(89.5)	17(85.0)	104(77.6)
PMTCT	28(75.7)	38(97.4)	36(94.7)	19(95.0)	121(90.3)
Syphilis	10(27.0)	23(58.8)	30(78.9)	16(80.0)	79(59.0)
Other sexually transmitted infections (STIs)	15(40.5)	29(74.4)	26(68.4)	10(50.0)	80(59.7)
Malaria	17(45.9)	30(76.9)	31(81.6)	8(40.0)	86(64.2)
Birth preparedness and complication readiness plans discussed					
Danger signs in labor	34(91.2)	39(100.0)	38(100.0)	18(90.0)	129(96.3)
Place of birth	30(81.1)	36(92.3)	38(100.0)	19(95.0)	123(91.8)
Emergency transportation	24(64.9)	39(100.0)	35(92.1)	19(95.0)	117(87.3)
Money	26(70.3)	31(79.5)	37(97.4)	16(80.0)	110(82.1)
Supplies needed for birth	17(45.9)	35(89.4)	38(100.0)	19(95.0)	109(81.3)
Support person	18(48.6)	31(79.5)	37(97.4)	13(65.0)	99(73.9)
Potential blood donor	9(24.3)	22(56.4)	23(60.5)	8(40.0)	62(46.3)

Delivery Care

As depicted in table 13 below, health workers prepared most of the basic items to attend the birth.

Active management of the third stage of labor (AMTSL) was practiced in the most of the health centers in Amhara, Oromia, and Tigray regions; however, it was low in SNNP region. All health centers in Amhara, Oromia, and Tigray and almost all, 36 (95%), of health centers in SNNP administered prophylactic uterotonics to laboring women. Controlled cord traction was performed in all health centers of Oromia, almost all health centers in Amhara and Tigray, and 79% of health centers in SNNP. Routine oxytocin administration was implemented in less than three-quarters of health centers in Amhara while it was performed in almost all health centers in the other regions.

About 80% of health centers provided essential newborn cares immediately after delivery for the last birth they attended. The most common cares given for the newborn were drying the baby, wrapping with dry clothes, and application of tetracycline (Table 13).

Table 13: Delivery services provided at the health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Delivery service/practices	Amhara (n=37)	Oromia (n=39)	SNNP (n=38)	Tigray (n=20)	Total (n=134)
Items prepared to attend birth					
Gloves	37(100.0)	39(100.0)	37(97.4)	20(100.0)	133(99.3)
Gauze	37(100.0)	39(100.0)	37(97.4)	19(95.0)	132(98.5)
Emergency drugs including uterotonics	37(100.0)	39(100.0)	36(94.7)	20(100.0)	132(98.5)
Cord tie	36(97.3)	39(100.0)	37(97.4)	19(95.0)	131(97.8)
Sufficient sterilized delivery sets	35(94.6)	37(94.9)	38(100.0)	20(100.0)	130(97.0)
Disinfectant	35(94.6)	39(100.0)	36(94.7)	15(75.0)	125(93.4)
Clean cloths	36(97.3)	37(94.9)	28(73.7)	18(90.0)	119(88.8)
Newborn resuscitation set	27(73.0)	34(87.2)	32(84.2)	19(95.0)	112(83.6)
Sterile blade/forceps	37(100.0)	29(80.6)	28(73.7)	17(85.0)	111(82.8)
Eye ointment	30(81.1)	29(80.6)	32(84.2)	18(90.0)	109(81.3)
Soap	26(70.3)	26(66.7)	24(63.2)	12(60.0)	88(65.6)
Vacuum extractor	18(48.6)	27(69.2)	12(31.6)	14(70.0)	71(53.0)
Mean number (percentage) score out of 12 points	1.6(88.1)	10.6(88.5)	9.9(82.7)	10.6(87.9)	10.4(86.6)
Active Management of Third Stage of Labor (AMTSL)					
Prophylactic uterotonics administered	37(100.0)	39(100.0)	36(94.7)	20(100.0)	132(98.5)
Controlled cord traction	36(97.3)	38(97.4)	30(78.9)	20(100.0)	124(92.5)
Uterine massage	36(97.3)	39(100.0)	35(92.1)	19(95.0)	129(96.3)
Applied all three AMTSL	36(97.3)	38(97.4)	25(65.8)	19(95.0)	118(88.1)
Routine oxytocin administration	27(73.0)	39(100.0)	36(94.7)	20(100.0)	122(91.0)
Performed breech delivery in the last 3 months	18(48.6)	22(56.4)	13(34.2)	11(55.0)	64(47.7)

Care given to newborn during the last birth attended					
Dry the baby and wrap with dry clothes	31(83.8)	37(94.8)	30(79.0)	20(100.0)	118(88.1)
Apply Tetracycline eye ointment	31(83.8)	37(94.9)	21(55.3)	19(95.0)	108(80.6)
Keep with the mother in skin-to-skin contact	29(78.4)	32(82.1)	33(86.8)	20(100.0)	114(85.1)
Weigh the baby	27(73.0)	24(61.5)	34(89.5)	19(95.0)	104(77.6)
Give immunization	29(78.4)	38(97.4)	21(55.3)	17(85.0)	105(78.4)
Give vitamin K	24(64.9)	24(61.5)	28(73.7)	19(95.0)	95(70.9)
Mean number (percentage) score out of 6 points	4.6(77.0)	4.9(82.1)	4.4(73.2)	5.7(95.0)	4.8(80.1)

Deliveries and Delivery Outcomes

Retrospective 12-months of service statistics was collected from health centers and its referral hospitals. Data from referral hospitals was limited to cases from the intervention health centers. Accordingly, delivery coverage was 53% with wide regional variation; Oromia (66%), SNNP (50%), Tigray (53%), and Amhara (44%).

Stillbirth rate was found to be 2% at health centers and 6.6% at referral hospitals. A third (25) of the total early neonatal deaths reported at surveyed health centers occurred in Oromia region while half (44) of the total early neonatal deaths at hospital occurred in Amhara region. A total of 31 maternal deaths were identified from the health centers and their referral hospitals over the last 12 months (Table 14).

Table 14: Utilization of maternal and newborn care at health centers and its referral hospitals in Amhara, Oromia, SNNP and Tigray regions of Ethiopia during July 2014 to June 2015.

Variables	Amhara	Oromia	SNNP	Tigray	Total
Delivery coverage (among expected births)	44.1	65.7	49.8	53.0	53.3
Stillbirth rates (among total births)					
Health center	1.5	1.4	0.6	1.2	1.9
Hospital	4.5	7.6	8.2	6.5	6.6
Number of early neonatal deaths					
Health center	21	25	17	13	76

Hospital	44	5	24	15	88
Institutional maternal death rate (among all births in the facility)					
Health center	8(0.05)	13(0.06)	1(0.00)	1(0.01)	23(0.03)
Hospital	3(0.27)	0(0.00)	3(0.35)	2(0.20)	8(0.21)

Abortion complications accounted for about 40% of obstetric complications managed at health centers and their referral hospitals. Abortion complications, hemorrhage, and obstructed labor were the most common obstetric complications seen at intervention PHCUs (Figure 4).

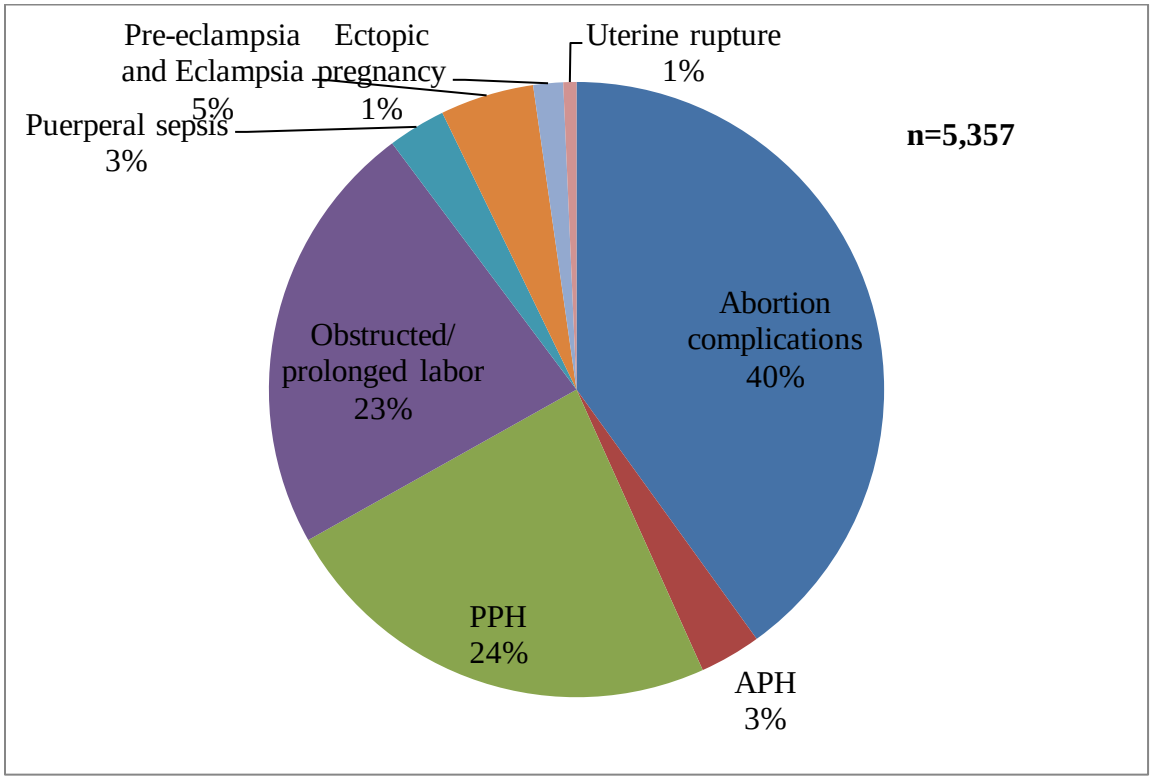


Figure 4: Type of obstetric complications managed at health centers and their referral hospitals during July 2014 to June 2015.

Referral Services

Table 15 presents the implementation and availability of effective referral services among health centers. More than 90% of health centers had access to an ambulance for emergency cases to transfer to and from the facility. An ambulance was located within the health center premises in 19 (51%) health centers in Amhara, 12 (31%) health centers in Oromia, 17 (45%) health centers in SNNP, and 8 (40%) health centers in Tigray regions. In other cases, ambulances were located at the other health center, district health office, or the woreda administration. In the majority of the cases where ambulances were outside the facility, it takes 30-60 minutes to arrange an ambulance for referral in all four regions.

In about a third of health centers in Amhara (38%), Oromia (39%), and Tigray (30%), and in more than half (55%) of them in SNNP, a functional landline telephone was available for an emergency

call. A small proportion of health centers in Amhara (19%), Oromia (10%), and Tigray (25%), and more than half (55%) of them in SNNP had a telephone in the maternity unit for two-way communication. Direct access to an ambulance by the community was present in the majority (87%) of health centers in Oromia and SNNP while in Amhara and Tigray it was possible in 70% and 50% of the health centers, respectively.

Only in one-third (34%) of health centers, a referral focal person/liaison officer was available at least for working days and in only one-tenth (12%) of health centers a unit that coordinates referrals (office, office materials like communication methods-telephone, email etc.) was available.

A little more than half of the health centers had standard referral protocols (for who to refer, when and where) on the day of the visit. Out of these, in 89% of cases, health centers providers were oriented on their use.

Table 15: Availability of equipment for effective referral system among selected health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Referral activity	**Amhara (n=37)**	**Oromia (n=39)**	**SNNP (n=38)**	**Tigray (n=20)**	**Total (n=134)**
Access to an ambulance for emergency	36(97.3)	37(94.9)	37(97.4)	18(90)	128 (95.5)
Ambulance located in facility premises	19 (52.8)	12(30.8)	17(45.0)	8(44.4)	56(43.8)
Time taken to arrange ambulance (in minutes) (mean 47.5 minutes) [if ambulance outside facility]					
< 30 minutes	6(35.3)	9(36.0)	10(50.0)	3(30.0)	28(38.9)
≥ 30 minutes	11(64.7)	16(64.0)	10(50.0)	7(70.0)	44(61.1)
Functional landline telephone	14(37.8)	15(38.5)	21(55.3)	6(30.0)	56(41.8)
Functional cellular phone	28(82.4)	33(84.6)	20(52.6)	16(80)	97(72.4)
Telephone in the maternity area for two-way communication	7(18.9)	4(10.3)	21(55.3)	5(25.0)	37(27.6)
Direct access to ambulance by community	26(70.3)	34(87.2)	33(86.8)	10(50.0)	103(76.9)
Presence of referral focal person	8(21.6)	20(51.3)	13(34.2)	5(25.0)	46(34.3)
Unit coordinating referrals(office + supplies)	3(8.1)	7(17.9)	3(7.9)	3(15.0)	16(11.9)

Standard protocol (for who to refer, when and where) for referral	6(16.2)	24(61.5)	30(78.9)	13(65.0)	73(54.5)
Orientation of providers to use referral protocol	6(100.0)	22(91.7)	25(83.3)	12(92.3)	65(89.0)
Referral slip	35(94.6)	33(84.6)	36(94.7)	19(95.0)	123(91.8)
Referral-out register	29(78.4)	23(62.2)	29(76.3)	20(100.0)	101(75.4)
Referral-in register	18(48.7)	25(64.1)	32(82.1)	15(75.0)	90(67.2)
Service directory	18(48.7)	15(38.5)	6(15.8)	15(75.0)	54(40.3)

Nearly a quarter of mothers referred from health post/community to the health centers arrived with referral slip in Amhara (24%), Oromia (23%), and SNNP (21%), but only about a tenth (13%) of maternal referrals in Tigray arrived at the health center with a referral slip.

About half of the mothers referred from health center to hospital in the last 12 months used an ambulance and were sent with referral slips. On the other hand, escorting to hospital, advance call to hospital, and feedback (from receiving hospitals) were low. An advance call during maternal referral to hospitals was relatively better in Tigray region. In Amhara (3%), Oromia (0.2%), and SNNP (1%) advance calls for maternal referral to the hospital were very low.

Adherence to referral protocols for neonatal referrals was relatively low compared to maternal referrals (Table 16).

Table 16: Adherence to referral protocols among maternal and newborn referrals from the health center to the hospital during July 2014 to June 2015 in Amhara, Oromia, SNNP and Tigray regions, July 2015.

Variables	Amhara	Oromia	SNNP	Tigray	Total
Adherence to referral protocols among maternal referral into the health center					
Referral slip	24.0	23.3	21.3	12.7	21.1
Ambulance	25.3	48.9	16.4	40.1	32.7
Advance call	19.2	1.5	14.4	32.5	14.4
Escorting	19.4	35.3	9.9	35.8	24.4
Provided feedback	17.7	3.0	8.5	17.9	10.4

Adherence to referral protocols among newborn referral into the health center					
Referral slip	8.5	1.7	22.9	3.8	10.5
Ambulance	11.0	0.7	22.7	5.8	10.3
Advance call	7.6	0.0	22.7	5.5	10.0
Escorting	7.6	0.7	22.4	6.1	10.1
Received feedback	7.9	0.2	22.2	4.0	9.8
Adherence to referral protocols among maternal referral out to hospital					
Slip	54.1	63.1	34.0	79.6	54.9
Ambulance	52.5	74.8	17.7	80.1	52.4
Advance call	2.7	0.2	1.1	44.4	9.0
Escorting	19.5	69.9	5.3	76.9	37.0
Received feedback	28.2	5.0	3.6	47.9	19.3
Adherence to referral protocols among newborn referral out to hospital					
Slip	39.2	17.2	6.3	63.8	31.2
Ambulance	2.0	6.6	1.5	63.5	14.0
Advance call	0.7	0.0	0.0	44.3	8.1
Escorting	37.0	3.5	0.8	46.6	22.7
Received feedback	37.5	2.0	0.0	44.9	22.1

Supportive Supervision

About two-thirds (68%) of health centers in Amhara, 56% in Oromia, 68% in SNNP, and 85% in Tigray received supportive supervision from a higher level in the month of the survey. Almost all health centers received mentoring and follow-up visits from L10K, with a mean number of 2.5 and 2.7, respectively, in the last 12 months (Table 17).

Table 17: Supportive supervision and mentoring practices at health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Activity	Amhara (n=37)	Oromia (n=39)	SNNP (n=38)	Tigray (n=20)	Total (n=134)
Time of last supervision from the higher level					
This month	25(67.6)	22(56.4)	26(68.4)	17(85.0)	90(67.2)
In the last 3 months	11(29.7)	9(23.1)	12(31.6)	3(15.0)	35(26.1)
More than 3 months ago	1(2.7)	8(20.5)	0(0)	0(0.0)	9(6.7)
Number of supportive supervisions received in the last 3 months					
No supervision	1(2.7)	2(5.1)	0(0.0)	0(0.0)	3(2.2)
1	8(21.6)	6(15.4)	6(15.8)	4(20.0)	24(17.9)
2	7(18.9)	8(20.5)	7(18.4)	6(30.0)	28(20.9)
3	12(32.4)	8(20.5)	11(28.9)	8(40.0)	39(29.1)
4+	8(21.6)	7(17.9)	14(36.8)	2(10.0)	31(23.1)
Number of review meetings within the PHCUs in the last 3 months					
No review meeting	1(2.7)	5(12.8)	3(7.9)	1(5.0)	10(7.5)
1	2(5.4)	6(15.4)	4(10.5)	1(5.0)	13(9.7)
2	6(16.2)	2(5.1)	6(15.8)	6(30.0)	20(14.9)
3	23(62.2)	23(58.8)	23(60.5)	12(60.0)	81(60.5)
4+	5(13.5)	3(7.7)	2(5.3)	0(0.0)	10(7.5)
Number of on-site mentoring from L10K in the last 12 months					
No mentoring provided	2(5.4)	2(5.1)	1(2.6)	1(5.0)	6(4.5)
1	9(24.3)	9(23.1)	13(34.2)	3(15.0)	34(25.4)

2	6(16.2)	5(12.8)	12(31.6)	5(25.0)	28(20.9)
3	12(32.4)	8(20.5)	6(15.8)	5(25.0)	31(23.1)
4+	8(21.6)	15(38.5)	6(15.8)	6(30.0)	35(26.1)
Follow-up visits received from L10K in the last 12 months					
No follow-up visits	1(2.7)	1(2.6)	3(7.9)	0(0.0)	5(3.7)
1	9(24.3)	8(20.5)	12(31.6)	3(15.0)	32(23.9)
2	8(21.6)	8(20.6)	13(34.2)	1(5.0)	30(22.4)
3	11(29.7)	10(25.6)	6(15.8)	2(10.0)	29(21.6)
4+	8(21.6)	12(30.8)	4(10.5)	13(65.0)	37(27.6)

Providers' Knowledge and Competency for Maternal and Newborn Care

Basic Characteristics and Experience of BEmONC Trained Health Workers

A total of 131 health workers trained on BEmONC, one in each health center, were interviewed and observed to evaluate their knowledge and competency. Of these, 4% were health officers, 194% were midwives and the remaining 2% were nurses. About two-thirds (65%) of health workers had more than two years experiences.

Based on skills applied in the last three months, 92% of the providers attended normal labor; 98% administered Oxytocin, and 70% administered antibiotics. About a quarter (26%) of health workers provided $MgSO_4$/Diazepam for the treatment of PEE, 60% of providers performed removal of retained products of conception, and 63% performed manual removal of retained placenta.

Other skills applied included vacuum extraction (43%), assisting breech delivery (40%), manual vacuum aspiration (44%), and AMTSL (98%). Abdominal aortic compression, bimanual compression of the uterus, provision of MgSO4, and manual vacuum aspiration were the least applied skills (Table 18).

Table 18: BEmONC trained provider knowledge and competency among professionals in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

	Amhara (n=35)	**Oromia (n=38)**	**SNNP (n=38)**	**Tigray (n=20)**	**Total (n=131)**
Mean number of deliveries attended in the last month	22.3	29.9	16.0	13.0	21.3

Skills applied in the last 3 months					
Assisting normal delivery	34(97.1)	30(79.0)	37(97.4)	19(95.0)	120(91.6)
Administration of Oxytocin	35(100.0)	38(100.0)	37(97.4)	19(95.0)	129(98.5)
Administration of antibiotics	26(74.3)	29(76.3)	20(52.6)	17(85.0)	92(70.2)
MgSO4/Diazepam administration	13(37.1)	11(29.0)	2(5.3)	8(40.0)	34(26.0)
Removal of retained products	23(65.7)	22(57.9)	21(55.3)	13(65.0)	79(60.3)
Manual removal of retained placenta	25(71.4)	26(68.4)	17(44.7)	15(75.0)	83(63.4)
Vacuum extraction	20(57.1)	21(55.3)	5(13.2)	10(50.0)	56(42.8)
Assisting breech delivery	14(40.0)	19(50.0)	9(23.7)	10(50.0)	52(39.7)
Manual Vacuum Aspiration	15(42.9)	16(42.1)	18(47.4)	8(40.0)	57(43.5)
AMTSL	35(100.0)	37(97.4)	38(100.0)	19(95.0)	129(98.5)
Bi-manual compression of the uterus	8(22.9)	15(39.5)	6(15.8)	4(20.0)	33(25.2)
Abdominal aortic compression	1(2.9)	12(31.6)	6(15.8)	3(15.0)	22(16.8)
Episiotomy & Tear repair	32(91.4)	33(86.8)	36(94.7)	16(80.0)	117(89.3)
Newborn resuscitation	27(77.1)	35(92.1)	25(65.8)	19(95.0)	106(80.9)
Partograph use	35(100.0)	33(86.8)	37(97.4)	18(90.0)	123(93.9)
Mean number (percentage of maximum score) out of 15 points	**9.3(61.8)**	**9.7(64.4)**	**8.3(55.1)**	**9.9(66.0)**	**9.2(61.3)**

Reasons for not Applying Skills for Maternal and Neonatal Care

The major reason presented for not applying BEmONC skills in the last three months was the absence of cases. However, a few providers said that lack of supplies was hindering them from performing the skills. Some described fear as a reason for not applying the skill (Table 19).

Table 19: Reasons for not applied skills in BEmONC services among health workers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Reasons for missing the skills	No case	No supply	Afraid of doing it	Other
Assisting normal delivery	6	6	0	0
Administration of Oxytocin	1	1	0	0
Administration of antibiotics	36	1	0	2
MgSO4/Diazepam administration	84	14	0	3
Removal of retained Products	44	3	4	3
Manual removal of retained placenta	45		1	2
Vacuum extraction	48	25	2	5
Assisting breech delivery	75	1	1	3
Manual Vacuum Aspiration	45	15	4	17
AMTSL	2	0	0	0
Bimanual compression of the uterus	93	0	3	2
Abdominal aortic compression	102	0	5	4
Episiotomy & Tear repair	14	0	0	0
Newborn resuscitation	23	1	0	1
Partograph use	1	6	0	1

Knowledge and Competency in Pregnancy, Labor and Delivery Care

Respondents mentioned about two-third of the components of focused ANC care. The main components mentioned were the need for a minimum of four consultations (82%), ensuring that a woman has a birth plan (66%), preventing illness and promoting health (63%), detecting existing illnesses and managing complications (70%), and teaching the danger signs (91%). Promotion of breastfeeding was seldom mentioned as a component of focused ANC care.

When asked about the group of women needing a special care plan during their ANC visits, less than 3 (out of 7 possible answers) were mentioned. More than three-quarters of respondents answered women who have had a cesarean and history of severe obstetric complications.

The next question was "What do you monitor when a woman is in labor?", evaluating the worker's ability to recognize a woman in labor and know what to monitor. Respondents mentioned more than two-third of signs of labor and 71% of the items to monitor during labor. Rapture of the membrane was the least mentioned sign of labor. On the other hand, urine output, ketone and

protein status, the degree of molding, and color of amniotic fluid were the least frequent items monitored.

Table 20: Knowledge of BEmONC care of health workers providing BEmONC care at health centers in Amhara, Oromia, SNNP, and Tigray regions of Ethiopia, July 2015.

Practice	Amhara (n=35)	Oromia (n=38)	SNNP (n=38)	Tigray (n=20)	Total (n=131)
Knowledge of focused ANC care					
Minimum of 4 consultations	23(65.7)	35(92.1)	35(92.1)	14(70.0)	107(81.7)
Ensure woman has birth plan	26(74.3)	23(60.5)	28(73.7)	10(50.0)	87(66.4)
Prevent illness and promote health	17(48.6)	28(73.7)	19(50.0)	19(95.0)	83(63.4)
Detect existing illnesses and manage complications	20(57.1)	26(68.4)	29(76.3)	17(85.0)	92(70.2)
Teach the danger signs	31(88.6)	32(84.2)	38(100.0)	18(90.0)	119(90.8)
Promote breastfeeding	15(42.9)	9(23.7)	6(15.8)	2(10.0)	32(24.4)
Mean number (percentage of maximum score) out of 6 points	3.8(62.9)	4.0(67.1)	4.1(68.0)	4.0(66.7)	4.0(66.2)
Knowledge of which women are at risk or needing special care plan					
Women who have had a cesarean	21(60.0)	30(79.0)	36(94.7)	14(70.0)	101(77.1)
Women with 5 or more deliveries	4(11.4)	15(39.5)	9(23.7)	3(15.0)	31(23.7)
Previous stillbirth	8(222.9)	18(47.4)	14(36.8)	5(25.0)	45(34.4)
Previous neonatal death	7(20.0)	15(39.5)	6(15.8)	10(50.0)	38(29.0)
Previous instrumental delivery	6(17.1)	10(26.3)	6(15.8)	2(10.0)	24(18.3)
History of severe obstetric complications	29(82.9)	30(79.0)	25(65.8)	16(80.0)	100(76.3)
Previous obstetric fistula repair	1(2.9)	6(15.8)	3(7.9)	3915.0)	13(9.9)
Mean number (percentage) score out of 7 points	2.2(31.0)	3.3(46.6)	2.6(37.2)	2.7(37.9)	2.7(38.4)

How do you know when a pregnant woman is in labor?					
Regular uterine contractions	30(85.7)	37(97.4)	31(81.6)	20(100.0)	118(90.1)
Dilation of the cervix	30(85.7)	35(92.1)	35(92.1)	20(100.0)	120(91.6)
Discharge of blood and mucus	27(77.1)	19(50.0)	29(76.3)	10(50.0)	85(64.9)
Ruptured membranes	7(20.0)	21(55.3)	6(15.8)	7(35.0)	41(31.3)
Mean number (percentage) score out of 4 points	2.7(67.1)	2.9(73.7)	2.7(66.4)	2.9(71.3)	2.8(69.5)
What do you monitor when a woman is in labor?					
Fetal heartbeat	34(97.1)	36(94.7)	36(94.7)	20(100.0)	126(96.2)
Color of amniotic fluid	13(37.1)	22(57.9)	16(42.1)	13(65.0)	64(48.9)
Degree of molding	18(51.4)	16(42.1)	14(36.8)	7(35.0)	55(42.0)
Dilatation of the cervix	33(94.3)	31(81.6)	38(100.0)	19(95.0)	121(92.4)
Descent of the head	24(68.6)	28(73.7)	24(63.2)	17(85.0)	93(71.0)
Uterine contractions	24(68.6)	33(86.8)	28(73.7)	19(95.0)	104(79.4)
Maternal blood pressure	32(91.4)	34(89.4)	37(97.4)	18(90.0)	121(92.4)
Maternal temperature	25(71.4)	27(71.1)	29(76.3)	18(90.0)	99(75.6)
Maternal pulse	26(74.3)	30(79.0)	31(81.6)	19(90.0)	106(80.9)
Urine output, ketone and protein status	10(28.6)	11(29.0)	16(42.1)	8(40.0)	45(34.4)
Mean number (percentage) score out of 10 points	6.8(68.3)	7.1(70.5)	7.1(70.9)	7.9(79.0)	7.1(71.3)
What are the steps of AMTSL?					
Immediate oxytocin/ergometrine (within 1 minutes)	35(100.0)	38(100.0)	38(100.0)	20(100.0)	131(100.0)
Controlled cord traction	33(94.3)	38(100.0)	35(92.1)	20(100.0)	126(96.2)
Uterine massage	33(94.3)	35(92.1)	31(81.6)	20(100.0)	119(90.8)

Mean number (percentage) score out of 3 points	2.9(96.2)	2.9(97.4)	2.7(91.2)	3.0(100.0)	2.9(95.7)
What signs do you look for when a woman arrives or develops severe bleeding after birth?					
Signs of shock (dizziness, low blood pressure)	28(80.0)	31(81.6)	31(81.6)	18(90.0)	108(82.4)
Amount of external blood	19(54.3)	19(50.0)	11(29.0)	7(35.0)	56(42.8)
Signs of anemia	14(40.0)	27(71.1)	13(34.2)	7(35.0)	61(46.6)
Damage to the genital tract	11(31.4)	17(44.7)	25(65.8)	15(75.0)	68(51.9)
Whether the uterus is contracted	14(40.0)	21(55.3)	32(84.2)	13(65.0)	80(61.1)
Retained products or retained placenta	12(34.3)	24(63.2)	36(94.7)	17(85.0)	89(67.9)
Full bladder	1(2.9)	4(10.5)	3(7.9)	4(20.0)	12(9.2)
Mean number (percentage) score out of 7 points	2.8(40.4)	3.8(53.8)	4.0(56.8)	4.1(57.9)	3.6(51.7)
What do you when a woman develops heavy bleeding after delivery?					
Rapid evaluation	17(48.6)	21(55.3)	10(26.3)	6(30.0)	54(41.2)
Massage the fundus	18(51.4)	24(63.2)	30(79.0)	16(80.)	88(67.2)
Give Ergometrine or oxytocin (IV or IM)	21(60.0)	30(79.0)	30(79.0)	17(85.0)	98(74.8)
Begin IV fluids	35(100.0)	34(89.5)	36(94.7)	19(95.0)	124(94.7)
Empty full bladder	5(14.3)	9(23.7)	3(7.9)	5(25.0)	22(16.8)
Take blood for hemoglobin and cross-matching	8(22.9)	7(18.4)	4(10.5)	8(40.0)	27(20.6)
Examine woman for lacerations	15(43.9)	20(52.6)	28(73.7)	18(90.0)	81(61.8)
Manually remove retained products	19(54.3)	23(60.5)	35(92.1)	14(70.0)	91(69.5)

Bimanual compression of aorta	7(20.0)	14(36.8)	24(63.2)	5(25.0)	50(38.2)
Refer	18(51.4)	20(52.6)	11(29.0)	15(75.0)	64(48.9)
Mean number (percentage) score out of 10 points	4.7(46.6)	5.3(53.2)	5.6(55.5)	6.2(61.5)	5.3(53.4)
What do you do when a woman who just gave birth has a retained placenta?					
Empty the bladder	8(22.9)	10(26.3)	4(10.5)	9(45.0)	31(23.7)
Controlled cord traction	20(57.1)	24(63.2)	13(34.2)	15(75.0)	72(55.0)
Give or repeat oxytocin	23(65.7)	25(65.8)	27(71.1)	18(90.0)	93(71.0)
Do manual removal of the placenta	31(88.6)	34(89.5)	36(94.7)	17(85.0)	118(90.1)
Administer IV fluids	31(88.6)	32(84.2)	35(92.1)	13(65.0)	111(84.7)
Monitor vital signs for shock and act	8(22.9)	18(47.4)	12(31.6)	6(30.0)	44(33.6)
Check that uterus is well contracted	4(11.4)	12(31.6)	28(73.7)	10(50.0)	54(41.2)
Determine blood type and cross-match	2(5.7)	4(10.5)	2(5.3)	1(5.0)	9(6.9)
Refer	13(37.1)	13(34.2)	7(18.4)	10(50.0)	43(32.8)
Mean number (percentage) score out of 9 points	4.0(44.4)	4.5(50.3)	4.3(48.0)	5.0(55.0)	4.4(48.8)

Respondents were able to identify most of the steps of AMTSL.

The last questions were related to the diagnosis and management of post-partum hemorrhage (PPH). Respondents were able to provide just over half of the possible answers for the signs of severe bleeding and what to do when a woman develops severe bleeding. The most frequent answers were “signs of shock” and “begin IV fluid” for the signs of severe bleeding and what to do for a woman with severe bleeding, respectively. Less than half of the possible answers were mentioned regarding the management of retained placenta. “Do manual removal of placenta” and “administer IV fluids” were the most frequent answers, and “determine blood type and cross-match” and “empty bladder” were the least frequent.

Knowledge of Newborn Care

The knowledge and competency of providers on newborn care, care of an infected newborn, care of low birth weight baby, and neonatal resuscitation were assessed and are depicted in the table below. Most of the health workers recalled care for the umbilical cord and ophthalmic prophylaxis. The least recalled newborn care components were observation for color and evaluation of the newborn.

The sign of infection described by most of the providers were hypothermia/hyperthermia, restless or irritability, and difficult or fast breathing. For initial care for the newborn most providers mentioned referral, starting antibiotics, and continuing breastfeeding. The most commonly described care for low birth weight newborns was making sure the baby is warm. Ensuring infection prevention was the least described necessary care of low birth weight newborns. Finally, the knowledge and competence of providers of newborn resuscitation were assessed. Providers mentioned 61% of the potential correct responses. However, only 10% of providers were able to identify the correct sequential order of steps in neonatal resuscitation. Likewise, about two-third of the steps for resuscitating a neonate using bag and mask, but only 10% of providers knew the correct order (Table 21).

Table 21: Knowledge of immediate newborn care and newborn resuscitation among selected health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Type of care	Amhara (n=35)	Oromia (n=38)	SNNP (n=38)	Tigray (n=20)	Total (n=131)
What immediate care did you give to the newborn at last delivery you attended?					
Clean the baby's mouth before the shoulder comes out	19(54.3)	33(86.8)	23(60.5)	12(60.0)	87(66.4)
Clean the baby's mouth, face, and nose	19(54.3)	33(86.8)	18(47.4)	17(85.0)	87(66.4)
Ensure the baby is breathing	16(45.7)	26(68.4)	15(39.5)	18(90.0)	75(57.3)
Ensure the baby is dry	25(71.4)	28(73.7)	27(71.1)	19(95.0)	99(75.6)
Observe for color	9(25.7)	18(47.4)	3(7.9)	12(60.0)	42(32.1)
Ensure baby is kept warm (skin-to-skin)	26(74.3)	32(84.2)	25(65.8)	17(85.0)	100(76.3)
Administer prophylaxis for the eyes	27(77.1)	26(68.4)	34(89.5)	18(90.0)	105(80.2)
Weigh the baby	27(77.1)	30(79.0)	20(52.6)	19(95.0)	96(73.3)

Care for the umbilical cord	28(80.0)	29(76.3)	36(94.7)	16(80.0)	109(83.2)
Initiate breastfeeding	23(65.7)	24(63.2)	29(76.3)	16(80.0)	92(70.2)
Provide Vitamin K	27(77.1)	24(63.2)	29(76.3)	19(95.0)	99(75.6)
Provide immunization	19(54.3)	24(63.2)	33(86.8)	10(50.0)	86(65.7)
Evaluate the newborn	4(11.4)	7(18.4)	6(15.8)	3(15.0)	20(15.3)
Mean number (percentage) score out of 13 points	7.7(59.1)	8.9(67.6)	7.8(60.3)	9.8(75.4)	8.4(64.4)
Signs and symptoms of newborn infection					
Less movement (poor muscle tone)	13(37.1)	15(39.5)	11(29.0)	11(55.0)	50(38.2)
Poor or no breastfeeding	21(60.0)	26(68.4)	27(71.1)	18(90.0)	92(70.2)
Hypothermia or hyperthermia	30(85.7)	27(71.1)	27(71.1)	5(25.0)	89(67.9)
Restlessness or irritability	14(40.0)	19(50.0)	24(63.2)	16(80.0)	73(55.7)
Difficulty breathing or fast breathing	18(51.4)	22(57.9)	11(29.0)	16(80.0)	67(51.2)
Deep jaundice	10(28.6)	5(13.2)	11(29.0)	5(25.0)	31(23.7)
Severe abdominal distention	2(5.7)	5(13.2)	0(0.0)	6(30.0)	13(9.9)
Mean number (percentage) score out of 7 points	3.1(44.1)	3.1(44.7)	2.9(41.7)	3.9(55.0)	3.2(45.3)
Initial care for the infected newborn					
Explain the situation to the mother	7(20.0)	7(18.4)	4(10.5)	2(10.0)	20(15.3)
Continue to breastfeed or give breast milk that has been expressed with NG tube if necessary	13(37.1)	16(42.1)	12(31.6)	11(55.0)	52(39.7)
Keep airways open	5(14.3)	8(21.1)	1(2.6)	3(15.0)	17(13.0)
Begin antibiotics	27(77.1)	23(60.5)	30(79.0)	13(65.0)	93(71.0)

Refer	23(65.7)	33(86.8)	24(63.2)	15(75.0)	95(72.5)
Mean number (percentage) score out of 5 points	2.1(42.9)	2.3(45.8)	1.9(37.7)	2.2(44.0)	2.1(42.3)
Care for the low birth weight baby					
Make sure the baby is warm/Kangaroo mother care	31(88.6)	37(97.4)	38(100.0)	18(90.0)	124(94.7)
Provide extra support to the mother to establish breastfeeding	17(48.6)	26(68.4)	26(68.4)	11(55.0)	80(61.1)
Monitor ability to breastfeed	16(45.7)	21(55.3)	8(21.1)	14(70.0)	59(45.0)
Monitor baby for the first 24 hours	7(20.0)	10(26.3)	6(15.8)	5(25.0)	28(21.4)
Ensure infection prevention	3(8.6)	2(5.3)	1(2.6)	5(25.0)	11(8.4)
Mean number (percentage) score out of 5 points	2.1(42.3)	2.5(50.5)	2.1(41.6)	2.7(53.0)	2.1(46.1)
How to diagnose birth asphyxia?					
Depressed breathing	31(88.6)	36(94.7)	38(100.0)	20(100.0)	125(95.4)
Floppiness	10(28.6)	11(29.0)	17(44.7)	11(55.0)	49(37.4)
Heart rate below 100 beats per minute	17(48.6)	19(50.0)	6(15.8)	3915.0)	45(34.4)
Central cyanosis (blue tongue)	17(48.6)	27(71.1)	19(50.0)	12(60.0)	75(57.3)
Mean number (percentage) score out of 4 points	2.1(53.6)	2.4(61.2)	2.1(52.6)	2.3(57.5)	2.2(56.1)
Steps of neonatal resuscitation					
Call for help	7(20.0)	11(29.0)	4(10.5)	6(30.0)	28(21.4)
Wrap or cover baby, except for face and upper portion of chest	20(57.1)	29(76.3)	24(63.2)	13(65.0)	86(65.7)

Explain to mother condition of baby	6(17.1)	13(34.2)	7(18.4)	6(30.0)	32(24.4)
Position baby's head so neck is slightly extended	32(91.4)	28(73.7)	31(81.6)	14(70.0)	105(80.2)
Suction mouth then nose	28(80.0)	34(89.5)	36(94.7)	16(80.0)	114(87.0)
Start ventilation using bag and mask	32(91.4)	31(81.6)	36(94.7)	17(85.0)	116(88.6)
Mean number (percentage) score out of 6 points	3.6(59.5)	3.8(64.0)	3.6(60.5)	3.6(60.0)	3.7(61.2)
Steps mentioned in sequential order	0(0.0)	6(15.8)	5(13.2)	2(10.0)	13(9.9)
If resuscitating with bag and mask or tube and mask, what do you do?					
Place mask so it covers baby's chin, mouth, and nose	20(57.1)	33(86.8)	25(65.8)	18(90.0)	96(73.3)
Ensure appropriate seal has been formed between mask, nose, mouth, and chin	19(54.3)	29(76.3)	17(44.7)	16(80.0)	81(61.8)
Ventilate 1 or 2 times and see if chest is rising	28(80.0)	30(79.0)	24(63.2)	8(40.0)	90(68.7)
Ventilate 40 times per minute for 1 minute	24(68.6)	26(68.4)	33(86.8)	17(85.0)	100(76.3)
Pause and determine whether baby is breathing spontaneously	13(37.1)	21(55.3)	31(81.6)	7(35.0)	72(55.0)
Mean number (percentage) score out of 5 points	3.0(59.4)	3.7(73.2)	3.4(68.4)	3.3(66.0)	3.4(67.0)
If the baby is breathing and no sign of respiratory difficulty, what do you do?					
Keep baby warm	28(80.0)	37(97.4)	34(89.5)	13(65.0)	112985.5)

Initiate breastfeeding	23(65.7)	33(86.8)	37(97/4)	19(95.0)	112(85.5)
Continue monitoring the baby	15(42.9)	23(60.5)	6(15.8)	8(40.0)	52(39.7)
Mean number (percentage) score out of 3 points	1.9(62.9)	2.4(81.6)	2.0(67.5)	2.0(66.7)	2.1(70.2)
If baby does not begin to breathe, or if breathing is < 30 per minute, **what do you do?**					
Continue to ventilate	26(74.3)	27(71.1)	34(89.5)	15(75.0)	102(77.9)
Administer oxygen, if available	12(34.3)	11(29.0)	13(34.2)	5(25.0)	41(31.3)
Assess the need for special care	7(20.0)	15(39.5)	4(10.5)	6(30.0)	32(24.4)
Explain to the mother what is happening	9(25.7)	8(21.1)	19(50.0)	1(5.0)	37(28.2)
Intubate per adrenal resuscitation guidelines	6(17.1)	1(2.6)	0(0.0)	0(0.0)	7(5.3)
Refer the newborn	25(71.4)	33(86.8)	29(76.30	14(70.0)	101(77.1)
Mean number (percentage) score out of 6 points	2.4(40.5)	2.5(41.7)	2.6(43.4)	2.1(34.2)	2.4(40.7)

Knowledge of Abortion Care

Table 22 presents questions about abortion. Health workers provided about half of the possible abortion complications. Sepsis and bleeding were the most frequently mentioned complications of unsafe abortion while genital and abdominal injuries were the least mentions complications. Frequently mentioned treatments for unsafe or incomplete abortion included begin IV fluids, begin IV antibiotics, and do Manual Vacuum Aspiration (MVA) or curettage.

Regarding information provision to a woman with an abortion, counseling and provision of family planning were the most frequent answers, while information on how to prevent reproductive tract infection/HIV and social support were the least mentioned items (Table 22).

Table 22: Knowledge of abortion care among health workers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Characters	Amhara (n=35)	Oromia (n=38)	SNNP (n=38)	Tigray (n=20)	Total (n=131)

Immediate complications of an unsafe abortion					
Sepsis	23(65.7)	34(89.5)	32(84.2)	18(90.0)	107(81.7)
Bleeding	29(82.9)	34(89.5)	34(89.5)	19(95.0)	116(88.6)
Genital injuries	5(14.3)	15(39.5)	9(23.7)	11(55.0)	40(30.5)
Abdominal injuries	6(17.1)	7(18.4)	5(13.2)	1(5.0)	19(14.5)
Shock	13(37.1)	19(50.0)	16(42.1)	15(75.0)	63(48.1)
Mean number (percentage) score out of 5 points	2.2(43.4)	2.9(57.4)	2.5(50.5)	3.2(64.0)	2.6(52.7)
What do you do for a woman with abortion?					
Do a vaginal exam	12(34.3)	25(65.8)	14(36.8)	11(55.0)	62(47.3)
Assess vaginal bleeding	7(20.0)	21(55.3)	11(29.0)	13(65.0)	52(39.7)
Assess vital signs	10(28.6)	21(55.3)	8(21.1)	13(65.0)	52(39.7)
Begin IV fluids	27(77.1)	33(86.8)	33(86.8)	19(95.0)	112(85.5)
Begin antibiotics	18(51.4)	31(81.6)	35(92.1)	16(80.0)	100(76.3)
Do MVA or D&C or E&C	26(74.3)	20(52.6)	37(97.4)	14(70.0)	97(74.1)
Provide counseling	5(14.3)	10(26.3)	7(18.4)	9(45.0)	31(23.7)
Refer	15(42.9)	21(55.3)	4(10.5)	11(55.0)	51(38.9)
Mean number (percentage) score out of 8 points	3.4(42.9)	4.8(59.9)	3.9(49.0)	5.3(66.3)	4.3(53.1)
Information given to patients treated for an incomplete or unsafe abortion					
Information on how to prevent reproductive tract infection/HIV	14(40.0)	12(31.6)	6(15.8)	9(45.0)	41(31.3)
Information about when a woman can conceive again	19(54.3)	18(47.4)	10(26.3)	7(35.0)	54(41.2)

Counseling on family planning and services	24(68.6)	30(79.0)	35(92.1)	16(80.0)	105(80.2)
Provide family planning methods	20(57.1)	30(79.0)	37(97.4)	14(70.0)	101(77.1)
Information on social support	1(2.9)	10(26.3)	3(7.9)	5(25.0)	19(14.5)
Information about the consequences of an unsafe abortion	11(31.4)	19(50.0)	19(50.0)	9(45.0)	58(44.3)
Mean number (percentage) score out of 6 points	2.5(42.4)	3.1(52.2)	2.9(48.2)	3.0(50.0)	2.9(48.1)

Use and Quality of Partograph Completion and Labor Management

Partograph review was carried out to assess the use and quality of partograph completion and labor management. For this purpose, data collectors were instructed to review three recently used partographs in each health center. The criteria for inclusion of partographs for review included partographs from cases in which 1) the woman was at term, 2) cervical dilatation was less than 8 cm at first exam, 3) fetus was in vertex presentation, 4) fetal heartbeat present at first exam, and 5) woman was without obstetric complications at first exam.

The partograph review revealed that 129 (91%) of health centers used the World Health Organization (WHO) modified partograph to follow labor and delivery progress. Among 12 health centers not using partographs, the major reasons mentioned by respondents were a lack of partograph, 7 (58%), staff didn't have time to fill, 4 (33%), and staff not trained to perform, 1 (8%). More than a third (38%) of the health centers has labor management protocols that recommend the use of partographs to follow labor.

From the 129 health centers using the partograph, 366 partographs were produced for review. The admission cervical dilatation was charted correctly on the alert line in 344 (94%) partographs and could be used for further analysis.

As presented in figure 5 below, women stayed in labor for a mean of 4.2 hours before delivery and most (81%) of them remained in labor for less than 6 hours.

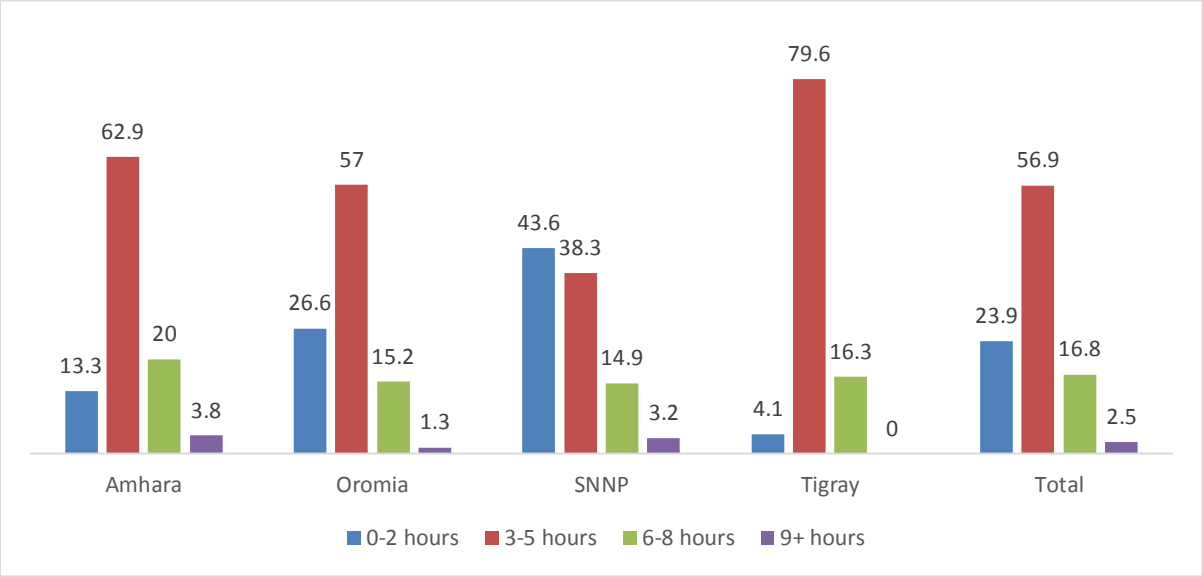


Figure 5: Time elapsed between admission and time of delivery by region, July 2015

According to the modified WHO partograph, the mothers' temperature should be monitored every two hours; cervical dilation and blood pressure should be monitored every four hours, and maternal pulse should be monitored every 30 minutes.

Vaginal examination was carried out, at least, every 4 hours (i.e., to the standard) in 47% of mothers overall; 56% in Oromia, 51% in Tigray, 44% in Amhara, and 42% in SNNP. As presented in table 23 below, the frequency of key measurements increased as the time in labor increased. The regression analysis also showed frequency of vaginal examination increases the longer the women were in labor (Coef. =0.15; p-value <0.01). Likewise, the maternal temperature was recorded at least every two hours for only 4% of laboring mothers overall; 8% in Tigray, 5% in Amhara, 3% in SNNP, and 2% in Oromia. The analysis of data showed that the frequency of temperature recording increases as the number of hours the women stayed in labor (coef. =0.07, p-value <0.05). However, a quarter of women did not have their temperature recorded even once regardless of the number of hours they were in labor in the facility (Table 23).

Table 23: Percent of women with partographs and times that key measurements were taken and recorded, by hours between first exam and delivery

Parameters	0-2 hours	3-5 hours	6-8 hours	9+ hours	Total
Blood pressure					
0	0(0.0)	2(1.1)	0(0.0)	0(0.0)	2(0.6)
1	56(71.8)	53(28.5)	13(23.6)	4(50.0)	126(38.5)
2	22(28.2)	123(66.1)	27(49.1)	1(12.5)	173(52.9)
3+	0(0.0)	8(4.3)	15(27.3)	3(37.5)	26(8.0)
Temperature					

0	16(20.5)	50(27.5)	17(31.5)	3(37.5)	86(26.7)
1	46(59.0)	35(19.2)	10(18.5)	3(37.5)	94(29.2)
2	14(18.0)	72(39.6)	10(18.5)	2(25.0)	98(30.4)
3+	2(2.6)	25(13.7)	17(31.5)	0(0.0)	44(13.7)
Maternal pulse					
0	7(9.0)	10(5.4)	3(5.5)	1(12.5)	21(6.4)
1	12(15.4)	6(3.2)	2(3.6)	0(0.0)	20(6.1)
2	8(10.3)	10(5.4)	2(3.6)	1(12.5)	21(6.4)
3	8(10.3)	9(4.8)	3(5.5)	0(0.0)	20(6.1)
4+	43(55.1)	151(81.2)	45(81.8)	6(75.0)	245(74.9)
Vaginal examination					
1	25(32.1)	13(7.0)	1(1.8)	0(0.0)	39(12.0)
2	51(65.4)	149(80.5)	20(36.4)	5(62.5)	225(69.0)
3+	2(2.6)	23(12.4)	34(61.8)	3(37.5)	62(19.0)

Blood pressure of laboring mothers was also checked and recorded at least every 4 hours in 23% of mothers, and the frequency of recordings increases as the longer the women were in labor (Coef.=0.15; p-value <0.01). Blood pressure was not checked /not recorded at all for only 2 mothers.

In addition, in 57% of the mothers, their pulse was monitored at least every 30 minutes)= as specified by the standard, but with significant regional variations- this value was 84% in Oromia, 74% in Tigray, 43% each in Amhara and SNNP. The frequency of recordings increases the longer the women were in labor (Coef. =0.98; p-value <0.01). However, 6% of women had no pulse recorded.

In almost all of laboring mothers followed by partograph, fetal heartbeat was checked at least hourly in 340 (99%) of them. Descent, 270 (79%) and state of membrane and color of liquor, 280 (81%) were checked in the majority of labors followed.

Most mothers (87%) delivered on or left of the alert line and the remaining 13% delivered in the referral zone (i.e., 12% between the alert and action lines and 1% beyond the action line).

Most deliveries were spontaneous vaginal deliveries. A small fraction, 8(2%), of deliveries were managed through vacuum extraction performed as a result of cephalo-pelvic disproportion (n=2), fetal distress (n=1), or other reasons (n=5), such as the mother is weak to push with energy to expel

newborn. Almost all, 338 (98%), outcomes to the baby were recorded and were normal live births, 335 (97%), with one stillbirth (Table 24).

Table 24: Progress of labor followed with partograph among health centers in Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015

Parameters	Amhara	Oromia	SNNP	Tigray	Total
Temperature					
Not recorded	33(30.6)	23(28.1)	30(28.6)	1(2.0)	87(25.3)
Substandard	64(62.8)	57(69.5)	72(68.6)	44(89.8)	237(70.1)
Monitored to standard (checked at least every 2 hourly)	5(4.9)	2(2.4)	3(2.9)	4(8.2)	14(4.1)
Blood pressure					
Not recorded	0(0.0)	1(1.2)	1(1.0)	0(0.0)	2(0.6)
Substandard	88(81.5)	63(76.8)	76(72.4)	36(73.5)	263(76.4)
Monitored to standard (measured at least every 4 hourly)	20(18.5)	18(22.0)	28(26.7)	13(26.5)	79(23.0)
Vaginal examination					
Substandard	61(56.5)	36(43.9)	61(58.1)	24(49.0)	182(52.9)
Monitored to standard (examined at least every 4 hourly)	47(43.5)	46(56.1)	44(41.9)	25(51.0)	162(47.1)
Maternal pulse					
Not recorded	6(5.6)	3(3.7)	12(11.4)	1(2.0)	22(6.4)
Substandard	56(51.9)	10(12.2)	48(45.7)	12(24.5)	126(36.6)
Monitored to standard (measured at least every 30 minutes)	46(42.6)	69(84.2)	45(42.9)	36(73.5)	196(57.0)
Fetal heart rate observed at least at hourly intervals	105(97.2)	81(98.8)	99(94.3)	49(100.0)	334(97.1)
Contraction assessed at least hourly	108(100.0)	81(98.8)	103(98.1)	48(98.0)	340(98.8)
Descent checked and recorded between first exam and delivery	90(83.3)	69(84.2)	63(60.0)	48(98.0)	270(78.5)

State of the membranes or color of the liquor recorded	91(8.3)	68(82.9)	84(80.0)	37(75.5)	280(81.4)
Time of delivery filled in	76(70.4)	74(90.2)	89(84.8)	45(91.8)	284(82.6)
First dilatation charted on the alert line	108(97.3)	82(94.3)	105(94.6)	49(86.0)	344(94.0)
Percent delivered on;					
On or left of the alert line	90(53.3)	72(57.8)	98(93.3)	38(77.6)	298(86.6)
Between the alert and action lines	17(15.7)	10(12.2)	5(4.8)	10(20.4)	42(12.2)
On or to the right of the action line	1(0.9)	0(0.0)	2(1.9)	1(2.0)	4(1.2)
Type of delivery					
Spontaneous vaginal delivery	106(98.2)	78(95.1)	102(97.1)	46(93.9)	332(96.5)
Vacuum assisted	2(1.9)	1(1.2)	2(1.9)	3(6.1)	8(2.3)
No information	0(0.0	3(3.7)	1(1.0)	0(0.0	4(1.2)
Augmentation used	1(0.9)	0(0.0)	(0.0)	2(4.1)	3(0.9)
Outcome for the baby					
Normal live birth	106(98.2)	78(95.1)	102(97.1)	49(100.0)	335(97.4)
Live birth with distress	2(1.9)	0(0.0)	0(0.0)	0(0.0)	2(0.6)
Stillbirth	0(0.0)	1(1.2)	0(0.0)	0(0.0)	1(0.3)
No information	0(0.0)	3(3.7)	3(2.9)	0(0.0)	6(1.7)

Discussion

Using the baseline and follow-up surveys to measure changes in the implementation of BEmONC care, we found that both the elements of facility structure and the process of care increased significantly between survey periods.

Facility structure indicators including the availability of skilled providers, availability of essential drugs and equipment index score, and infrastructure index score all increased significantly from the baseline. This is mainly due to the support from L10K, which has been allowing health centers to improve their readiness in terms of properly utilizing revenue generated and providing essential supplies and equipment based on gaps. Availability of trained staff to manage complications, ambulance for emergency transport, pharmacy services, and laboratory services all times showed significant changes over survey periods.

However, no significant improvement was seen in the availability of light sources for vaginal procedures, use of easily cleaned floor tiles, and covering the delivery bed with washable plastic. Though significantly changed from the baseline, there is room for improvement in the availability of functional water lines in the maternity unit. A lack of essential equipment for newborn care remains concerning, with suction machines, radiant heaters, and oxygen concentrators the least available items. This may be due to lack of attention to newborn care. Likewise, the availability of maternity beds, though significantly improved, was not comparable to numbers of facility deliveries [13].

Regional variations were observed in terms of facility readiness. There was no significant improvement in the availability of equipment index score in Amhara, infrastructure index score in Oromia or availability of trained providers and round the clock service availability in Tigray. In Tigray, the need for BEmONC training was not determined to be a priority during the initial needs assessment. As a result, we didn't provide BEmONC training; instead, on-site mentoring was carried out to enhance the skills of the health care providers.

Statistically significant improvements compared to baseline findings were seen in the performance of BEmONC signal functions, particularly in terms of administration of parenteral antibiotics, IV uterotonics, administration of parenteral MgSO4/diazepam, removal of retained products of conception, and assisted vaginal birth. The significant changes in performance of signal functions could be the result of significant improvements in the availability of supplies and trained providers. Neonatal resuscitation was not changed significantly from the baseline, which might be due to lack of essential equipment for newborn care documented in this study.

Provision of quality care was measured by client-centered care, cordial reception and treatment, partograph use, and stillbirth incidence. The data indicated that provision of quality care was improved following the implementation of BEmONC program. This might be the training, mentoring, and the close supervisions provided to health centers.

Most health centers used partographs to monitor the progress of labor; however, the completeness of monitoring parameters as per the standard was low, particularly temperature and blood pressure, though better than other studies in Ethiopia have shown [14]. The lack of labor management protocols recommending the use of partographs for labor monitoring in most health centers might contribute to the low level of completeness.

Health workers commonly administered oxytocin and provided active management of the third stage of labor in, while the least performed BEmONC skills were the administration of MgSO4/diazepam, bimanual compression of the uterus, and abdominal aortic compression. The

health workers had fair knowledge on components of ANC care, AMTSL, and what to monitor for a woman in labor. However, providers had low knowledge regarding which pregnant women need specialty care or accurate diagnosis and management of PPH including retained placenta. Likewise, health workers knew most of the steps of neonatal resuscitation; however, only one in ten were able to recall the sequential steps correctly. Also, the knowledge of providers on care for the sick newborn and low birth weight newborn was low. Low attention given during BEmONC training or lack of case to practice after training might be the reasons for low knowledge retention.

Conclusions and Recommendations

More than three-quarters of health centers had all the necessary equipment, drugs, and trained providers to provide all BEmONC signal functions on the day of the visit. However, functional water lines in the labor and delivery rooms, equipment for newborn care, and infection prevention measures need to be further addressed.

Health centers performed a mean of 5 BEmONC signal functions. Health centers that performed low numbers of BEmONC signal functions, namely Ataye, Muger, and Yelamagej in Amhara; Idoro Tobera and Onga, and Limu Genet in Oromia; Chito, Kitie, and Tumiticha in SNNP; and Egela and Zana in Tigray, need close follow-up and support to upgrade their performance.

Focused mentoring and supportive supervision for particular skills to reinforce the skills of providers and improve the quality of intrapartum care should be prioritized. Specific skills that should be trained and supported include neonatal resuscitation, manual removal of placenta/removal of retained products of conception, PPH management, and care for the sick and low birth weight baby.

All health centers should have a functioning means of communication and a functional means of emergency transport available 24/7, and emergency patients should be accompanied by a qualified health professional. As such, the referral system should be strengthened for timely access to EmONC services.

The completeness of partographs should be improved by introducing closer supervision, providing training, and availing partograph use protocols; otherwise the partograph cannot optimally function as a managerial tool for the prevention and diagnosis of prolonged and obstructed labor. Adequate production and supply of guidelines and job aids particularly for infection prevention practices and labor-management protocol are also required. There is also a need for continuous training and monitoring of the utilization of guidelines and treatment protocols to enhance the performance of health care workers.

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Appendix

Appendix 1: Measuring Implementation Strength of BEmONC Care Assessment Tool

Questionnaire ID (includes Woreda & HC code) [_____|_____| _____|

Part I: Health Facility Assessment			
Section I: Facility Identification			
101	Area Identification	Region Name _____ Zone Name_____ Woreda _____ _____ Health center Name____ _____ _ Name of data collector_____	
102	Date of visit	[_____|_____| _____| DD |MM |YY	
103	Catchment population of the HC (2007 EFY)	_____	
104	How many health extension workers are in the catchment area?	_____	
105	Distance to the nearest referral hospital with surgical care (CEmONC facility)	…….....kms	
106	How long does it take to reach to the nearest hospital by car? (in minutes)	……..minutes	

SN	Prompt	Response	Remark
Section II: Functioning health facility			
201	How many providers are currently working in this facility?	Midwives (all types)…….. [____|____] Health officers…… [____|____] Nurses (all types)……..… [____|____]	

		Pharmacy (all types)…….. [____|____] Laboratory (all types) ……[____|____]	
202	How many of the providers are trained on BEmONC?	Midwives (all types)…….. [____|____] Health officers……..… [____|____] Nurses (all types)……..… [____|____]	
203	How many of the providers are trained on BEmONC from L10K?	Midwives (all types)…….. [____|____] Health officers……..… [____|____] Nurses (all types)……..… [____|____]	
204	Of the providers currently working in the maternity unit, how many providers are on duty on the day of the visit?	Midwives (all types)…….. [____|____] Health officers……..… [____|____] Nurses (all types)……..… [____|____] Pharmacy (all types)…….. [____|____] Laboratory (all types) ……[____|____]	

205	Are the following basic obstetric care services/ inputs available in the facility 24 hours a day? **Please specify the availability of 24/7 service (1=Round the clock 2= Day time only 3= Other 4= Not available)**		**24/7**	**Day tim**	**C e**	**N A**
		Parenteral antibiotics……	1	2	3	4
		IV Oxytocic drugs (Oxytocin, Ergometrine)…	1	2	3	4
		Parenteral MgSO4……..	1	2	3	4
		Parenteral diazepam……...	1	2	3	4
		Manual removal of placenta…….	1	2	3	4
		Removal of retained products…….	1	2	3	4
		Assisted vaginal delivery…….	1	2	3	4
		Neonatal resuscitation with bag and mask….	1	2	3	4
		Trained staff on duty to manage obstetric complications……	1	2	3	4
		Trained staff on call to manage obstetric complications……...	1	2	3	4
		Ambulance service…….	1	2	3	4

		Pharmacy service……..	1	2	3	4
		Laboratory service……	1	2	3	4
206	Is the electric system currently functioning in the labour, delivery and post-partum rooms?	Yes……1 No……..2				
207	Is the water system currently functioning in the labour, delivery and post-partum rooms?	Yes……1 No……..2				
208	Which of the following functional equipment and supplies are available at this facility? **Please specify (1=Yes 2=No)** **RECORD OBSERVATION**	**Yes No** Sphygmomanometer…….1 2 Oxygen concentrator …….1 2 Surgical Gloves……1 2 Vacuum extractor (sets)……1 2 Suction machine……1 2 Suction catheter……..1 2 Radiant heater……..1 2 Ambu bag & masks……1 2 MVA set or E&C/ D&C set……1 2				
209	Which of the following drugs are available at this facility? **Please specify (1=Yes 2=No)** **RECORD OBSERVATION**	**Yes No** IV uterotonics ……1 2 IV fluids……1 2 Nifidipine……..1 2 Hydralazine……..1 2 Canula……1 2 IV antibiotics……1 2 IV MgSO4……1 2 IV Diazepam……..1 2 Calcium gluconate……1 2 IV analgesics……..1 2				
210	Which of the following laboratory tests are available at the facility? **Please specify (1=Yes 2=No)**	**Yes No** Hgb/HCT……1 2 Blood Group……1 2 U/A……..1 2 VDRL……..1 2 HIV test for PMTCT…….1 2				
211	Is maternity waiting area/ homes available in or around the facility?	Yes……1 No……..2				
212	How many functional maternity beds are available? **RECORD OBSERVATION**	Delivery couches ……_____ 1st stage beds ……_____ Post-partum beds……_____				
213	Is emergency cabinet available?	Yes……1				

	Observe for proper cabinet and availability of emergency drugs like IV fluids, Pitocin, canula, Diazepam/MgSO4, IV antibiotics and adrenalin	No……..2	
214	Is instrument set ready for assisted vaginal birth (vacuum extractor)? **Observe the availability of vacuum set and suction machine in labour room**	Yes……1 No……..2	
215	Is a newborn corner available? **Observe the availability of ambu bag and masks, oxygen concentrator, radiant heater and suction machine**	Yes……1 No……..2	
216	Is there light source for vaginal procedure in labor floor?	Yes……1 No……..2	
217	Are the following conditions available in the maternity unit? **Specify (1=Yes 2=No)**	**Yes No** Waiting area for family or companion……1 2 Enough physical space ……..…..1 2 Good illumination and ventilation ……....1 2 Easily washable delivery floor…….……1 2 Delivery bed covered with washable plastic ……...1 2	
218	Is toilet available for mothers?	Yes……1 No……..2	
219	Is there a shower in functioning condition that is available for mothers?	Yes……1 No……..2	
220	Observe how infection prevention in the maternity unit (ANC, delivery and PNC) is practiced **Specify (1=Yes 2=No)**	**Yes No** Compound is clean……1 2 Cleaning regularly done after attending birth……..…… 1 2 Soap available at all sinks .……..…..…1 2 Housekeeping staff has personal protective barriers ……. 1 2 Disinfectant and cleaning solutions area available ……..1 2 Disinfectant solution prepared and used as per standard ……..……...1 2 Instrument processing area and sets are available……..…..… .1 2	

		Puncture proof container for sharps is available……... 1 2 Providers practice hand washing…….1 2 Quality mechanism for standard of sterilization[4]……...1 2 Guideline and job aid for IP is available…..1 2 Waste disposal system in place (Leak proof containers, waste is sorted, incinerator, placenta pit)…….……..……...…1 2 Staff consistently uses personal protective barrier (PPB)……..…….1 2	
Section III: Effective referral			
301	Does this facility have a ***functional ambulance*** or other vehicle for emergency transportation?	Yes…….1 No……..2	
302	Does this facility have access to an ambulance or other vehicle for emergency?	Yes…….1 No……..2	**→304**
303	Is the ambulance located in your facility premises?	Yes…….1 No……..2	**→304**
304	If ambulance is not always available, how long does it take to arrange it? **RECORD IN MINUTES**	[ ] minutes	
305	Does this facility have a functioning land line telephone that is available to call outside at all times?	Yes…….1 No……..2	
306	Does this facility have a functioning cellular telephone or a private cellular phone?	Yes…….1 No……..2	
307	Is telephone available in the maternity area for two way communication?	Yes…….1 No……..2	
308	Does the community have direct access to an ambulance or to a direct call system?	Yes…….1 No……..2	
309	Is a referral focal person/liaison officer available at least for working days?	Yes…….1 No……..2	

[4] autoclave calibrated regularly , steam sterilizer function indicator monitored regularly

310	Is there a unit that coordinates referrals (office, office materials like communication methods-telephone, email etc) **RECORD OBSERVATION**	Yes……1 No……..2	
311	Are standard protocols (for who to refer, when and where) available? **RECORD OBSERVATION**	Yes……1 No……..2	If **NO**, skip to 313
312	If yes, are providers oriented on their use?	Yes……1 **No……..2**	
313	Does the HC have standardized referral slips and registers in place? **RECORD OBSERVATION**	**Yes No** Referral slip……..1 2 Referral out register……..1 2 Referral in register……..1 2 Service directory ……..1 2	
314	Do the HPs have standardized referral slips and referral-out registers in place?	**Yes No** Referral slip……..1 2 Referral out register……..1 2	
315	Are standard protocols (for who to refer, when and where) available at HPs?	Yes……1 No……..2	
316	If yes, are HEWs oriented on their use?	Yes……1 **No……..2**	

317	How often do the HEWs adhere to aspects of referral protocols while referring MNH cases to HC? **Please specify (1=Always 2=Sometimes 3=Rarely 4=Never)**		**Always**	**Sometimes**	**Rarely**	**Never**
		Sending with referral slip……	1	2	3	4
		Escorting & care during transfer……	1	2	3	4
		Arrange and Used ambulance……	1	2	3	4
		Pre-referral management……	1	2	3	4
		Received feedback……	1	2	3	4

318	Is there a system for this facility to receive a feedback from the receiving facility/referral hospital?	Yes ……1 No……2	

319	If so, which system? **CIRCLE ALL THAT APPLY**	Verbal……..1 Section of referral form filled out and sent back……2 Separate counter-referral form……3 Blank slip of paper……4 Telephone……..5	
Section IV: Provision of care			
	ANC care observation		
401	Is privacy maintained in the ANC room? (Area for counseling and examination, curtain or partition on examination areas...)	Yes……1 No……..2	
402	Counseling provided on the following topics **1= Mentioned (M) 2=Not Mentioned (NM)**	**M NM** Nutrition……..1 2 Birth preparedness complication readiness...1 2 Child birthing……..1 2 PMTCT……1 2 Syphilis……1 2 Other STIs……1 2 Malaria……1 2	
403	Is birth preparedness and complication readiness plan developed jointly? **(Yes=1 No=2)**	**Yes No** Place of birth……..1 2 Emergency transportation……1 2 Money……..1 2 Supplies needed for birth…….1 2 Support person……..1 2 Potential blood donor……..1 2 Danger signs in labour……1 2	
	Delivery, PNC and newborn care (Observation and interview)		
404	Observe for delivery room privacy, that is a room with partition or curtains and client is not exposed unduly	Privacy kept……1 Privacy not kept……..2	
405	Is client centered care provided?	**Yes No** Mothers allowed to choose position…….1 2 Family member allowed to companion……1 2 Cultural practices allowed (e.g. coffee, etc).. 1 2	

406	The provider receives and treats the laboring mother cordially, and conducts a quick check at the first contact	Yes……1 No ……2	
407	Observe for items prepared to attended birth ***If observation is not applicable please ask:*** Which items did you prepare during the last birth that you attended. ***Probe: What else?***	**Yes No** Disinfectant ……..1 2 Gloves……..1 2 Gauze……1 2 Emergency drugs including uterotonic drug……..……1 2 Clean cloths……1 2 Sterile blade/forceps……1 2 Cord tie……..1 2 Soap……1 2 Eye ointment……1 2 Sufficient sterilized delivery sets… …1 2 Vacuum extractor….1 2 Newborn resuscitation set…….1 2	
408	Observe the practice of third stage of active management (Pitocin , CCT and massage) ***If observation is not applicable ask:*** At the last birth attended did you administer prophylactic uterotonics, uterine massage and controlled cord traction for the prevention of PPH? **CIRCLE ALL THAT APPLY**	Administered prophylactic uterotonics……..1 Uterine massage……2 Controlled Cord Traction (CCT)……..3	
409	Does this facility routinely administer Oxytocin injection immediately after birth to all women for the prevention of post-partum haemorrhage?	Yes.....1 No……2	
410	At the last birth attended, what care did you give the newborn? **Prove: What else?** **CIRCLE ALL THAT APPLY**	Dry the baby and wrap with dry clothes…1 Keep with the mother in skin-to-skin contact.....2 Apply Tetracycline eye ointment……3 Give immunization……4 Weigh the baby……..5 Other, specify _____	
411	Has a breech delivery been performed in the last 3 months?	Yes.....1 No……..2	**Skip to 413**
412	If a breech delivery was NOT performed in the last 3 months, why?	availability of human resources……1 training issues……..2	

	CIRCLE ALL THAT APPLY	supplies/equipment/drugs……..3 management issues…….4 policy issues……..5 no indication……6 Other, Specify…….88 _____				
	Performance of signal functions					
413	Which of the following signal functions performed in this facility in the last 3 or 12 months?	**Last 3 months**		**Last 12 months**		Reasons for missir 1=no case 2=no supply 3=no trained provider
		Yes (1)	**No (0)**	**Yes (1)**	**No (0)**	
413a	Use of IV antibiotics	1	0	1	0	
413b	Use of uterotonics	1	0	1	0	
413c	Use of Magso4/Diazepam for treatment of PEE	1	0	1	0	
413d	Removal of retained products of conception	1	0	1	0	
413e	Manual removal of placenta	1	0	1	0	
413f	Assisted vaginal birth	1	0	1	0	
413g	Neonatal resuscitation	1	0	1	0	
414	Which drug did you use to treat pre-eclampsia/eclampsia?	MgSO4……1 Diazepam……..2 Both……3				
415	On the day of the visit, is the health center ready to perform all BEmONC signal functions? **Please specify (1=Yes 2=No)**	**Yes No** Trained provider available to provide signal functions……....1 2 All dugs available (IV antibiotics, MgSO4, uterotonics) to provide signal functions…...1 2 All equipment available to perform signal functions…….1 2				
Section V: Supportive supervision						
501	When was the last time this facility received a supervision visit from the higher level (WorHO, ZHD, RHB, MOH or L10K)?	This month……1 In the last 3 months……..2 More than 3 months ago……3 Don't know……..99				

502	How many supportive supervision visits has this facility provided to cluster HPs in the last 3 months?	[_____|_____]	
503	How many supportive supervision visits have you received in the last 3 months from WorHO, ZHD, RHB or MOH?	[_____|_____]	
504	How many review meetings have been held within PHCUs (HEWs and Health Center staffs) in the last 3 months?	[_____|_____]	
505	How many on-site mentoring visits have been received from L10K in the last 12 months?	[_____|_____]	
506	How many follow-up visits have been received from L10K in the last 12 months?	[_____|_____]	
	Part II: BEmONC Trained Provider Knowledge and Competency *Now I am going to ask you about your knowledge and application of BEmONC skills learnt during the BEmONC training and/or mentoring.* *Are you willing to participate? Yes ……..1 No……2 →* ***Part III***		
601	What is your professional classification?	Health officer .....1 Midwife .....2 Nurse .....3 Other (*specify)* _____88	
602	How many years has it been since you received your professional qualification?	|__|__| years	
603	How many deliveries did you attend last month?	|__|__|__|	
604	Have you applied the following skills in the last 3 months? **Read each item**	**Yes No[5]** Assisting normal deliver……1 2 Administration of Oxytocin……..1 2 Administration of antibiotics……1 2 MgSO4/Diazepam administration……1 2	*Reasons:* ***1. No cases,*** ***2. No supply*** ***3. Afraid*** ***4. other (specify)***

[5] *If 'No' write reasons: 1. No cases, 2. No medicine/ supply, 3. Afraid of doing it, 4. Other*

		Removal of retained products……..1 2 Manual removal of retained placenta…1 2 Vacuum extraction……1 2 Assisting breech delivery……..1 2 Manual Vacuum Aspiration……1 2 AMTSL……..…1 2 Bi-manual compression of the uterus…..1 2 Abdominal aortic compression……1 2 Episiotomy & Tear repair……1 2 Newborn resuscitation……1 2 Partograph use……1 2	
605	What are the primary aspects of focused antenatal care? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Minimum of 4 consultations……1 Ensure woman has birth plan……..2 Prevent illness and promote health ……3 Detect existing illnesses and manage complications……..…….4 Teach the danger signs ……5 Promote breastfeeding……...6	
606	Which women require a special care plan? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Women who have had a cesarean……1 Women with 5 or more deliveries……2 Previous stillbirth……4 Previous neonatal death……..5 Previous instrumental delivery……6 History of severe obstetric complications……7	

		Previous obstetric fistula repair……..8	
607	How do you know when a pregnant woman is in labor? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	Regular uterine contractions……..1 Dilation of the cervix…….2 Discharge of blood and mucus…….3 Ruptured membranes……...4	
608	For a woman in labor, what observations do you make as you monitor her progress? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	Fetal heartbeat……..1 Color of amniotic fluid……..2 Degree of molding……3 Dilatation of the cervix……4 Descent of the head……..5 Uterine contractions……6 Maternal blood pressure……..7 Maternal temperature…….8 Maternal pulse……9 Urine output, ketone and protein status…10	
609	Where do you register these observations? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	On a partograph……1 In the patient's clinical record……2 On a piece of paper……3	
610	What are the actions taken during active management of the third stage of labor? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	Immediate oxytocin/ergometrine (within 1 minutes)……..…1 Controlled cord traction……..…..2 Uterine massage……3	
611	The last time you delivered a baby, what immediate care did you give the newborn?	Clean the baby's mouth before the shoulder comes out……...……1	

	CIRCLE ALL SPONTANEOUS ANSWERS **<u>Probe</u>: What else?**	Clean the baby's mouth, face, and nose ……2 Ensure the baby is breathing…….3 Ensure the baby is dry……..4 Observe for color……5 Ensure baby is kept warm (skin-to-skin)....…6 Administer prophylaxis for the eyes……7 Weigh the baby……8 Care for the umbilical cord……9 Initiate breastfeeding ……..…10 Provide Vitamin K…….....11 Provide immunization……12 Evaluate the newborn.....13	
612	When a woman arrives at the facility with heavy bleeding or develops severe bleeding after giving birth, what signs do you look for? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Signs of shock (dizziness, low blood pressure) ……1 Amount of external blood……2 Signs of anemia……3 Damage to the genital tract……4 Whether the uterus is contracted……5 Retained products or retained placenta……...6 Full bladder……7	
613	When a woman develops heavy bleeding after delivery, what do you do? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Rapid evaluation……1 Massage the fundus……..2 Give ergometrine or oxytocin (IV or IM)……...3 Begin IV fluids……4 Empty full bladder……5	

		Take blood for hgb and cross-matching ….6 Examine woman for lacerations……..7 Manually remove retained products……8 Bimanual compression of aorta……9 Refer……..10	
614	When a woman who just gave birth has a retained placenta, what do you do? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Empty the bladder……1 CCT……2 Give or repeat oxytocin……..3 Do manual removal of the placenta……4 Administer IV fluids……5 Monitor vital signs for shock and act……6 Check that uterus is well contracted……7 Determine blood type and cross-match…….8 Refer……9	
615	What are the signs and symptoms of infection, or sepsis, in the newborn? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Less movement (poor muscle tone)……1 Poor or no breastfeeding……..2 Hypothermia or hyperthermia……3 Restlessness or irritability……4 Difficulty breathing or fast breathing……5 Deep jaundice……6 Severe abdominal distention……7	

616	When the newborn presents signs of infection, what initial steps do you take? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	Explain the situation to the mother ……1 Continue to breastfeed or give breast milk that has been expressed with NG tube if necessary……..2 Keep airways open……3 Begin antibiotics……4 Refer……5	
617	When a newborn weighs less than 2.5kgs, what special care do you provide? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	Make sure the baby is warm/KMC…….. 1 Provide extra support to the mother to establish breastfeeding……2 Monitor ability to breastfeed……...……3 Monitor baby for the first 24 hours……..……4 Ensure infection prevention……5	
618	What are the immediate complications of an unsafe abortion? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	Sepsis……..1 Bleeding……2 Genital injuries……..3 Abdominal injuries……4 Shock……5	
618	When you see a woman with complications from an unsafe or incomplete abortion, what do you do? **CIRCLE ALL SPONTANEOUS ANSWERS** **Probe: What else?**	Do a vaginal exam……..1 Assess vaginal bleeding……2 Assess vital signs……3 Begin IV fluids……4 Begin antibiotics……5 Do MVA or D&C or E&C…...……6 Provide counseling……7	

		Refer…….. 8	
619	What information do you give patients who were treated for an incomplete or unsafe abortion? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Information on how to prevent reproductive tract infection/HIV……..1 Information about when a woman can conceive again……..2 Counseling on family planning and services..... .....3 Provide FP methods……4 Information on social support……..5 Information about the consequences of an unsafe abortion…….6	
620	Please describe how you would diagnose birth asphyxia. **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Depressed breathing……..1 Floppiness……..2 Heart rate below 100 beats per minute……3 Central cyanosis (blue tongue)……4	
621	Please describe the sequential steps of neonatal resuscitation. **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Call for help……..1 Wrap or cover baby, except for face and upper portion of chest……2 Explain to mother condition of baby……3 Position baby's head so neck is slightly extended……..…….. 4 Suction mouth then nose……5 Start ventilation using bag and mask……6	

622	Were the steps mentioned in sequential order? **DO NOT ASK; RECORD OBSERVATION**	Yes……..1 No……..……..2	
623	If resuscitating with bag and mask or tube and mask, what do you do? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Place mask so it covers baby's chin, mouth, and nose…….1 Ensure appropriate seal has been formed between mask, nose, mouth, and chin……..2 Ventilate 1 or 2 times and see if chest is rising..3 Ventilate 40 times per minute for 1 minute…..4 Pause and determine whether baby is breathing spontaneously……5	
624	If baby is breathing and there is no sign of respiratory difficulty (intercostal retractions or grunting), what do you do? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Keep baby warm……..1 Initiate breastfeeding……2 Continue monitoring the baby……3	
625	If baby does NOT begin to breathe or if breathing is less than 30 breaths per minute, or if there is intercostal retraction or grunting, what do you do? **CIRCLE ALL SPONTANEOUS ANSWERS** **<u>Probe</u>: What else?**	Continue to ventilate……1 Administer oxygen, if available……2 Assess the need for special care……..3 Explain to the mother what is happening……4 Intubate per adrenal resuscitation guidelines…5 Refer the newborn……..6	

Part III: Partograph Review (Health center)

Instructions: Ask to see the partographs in use at the facility, and then ask the person in charge of the maternity the questions below. Make sure you are given copies of completed partographs to verify that the partograph is actually used in the facility.

SN	Prompt	Response	Remark
701	Do you use a partograph in this facility?	Yes ..... 1 No……2	**→703**
702	Why do you not use the partograph in this facility? **Specify (M=Mentioned NM= Not Mentioned)**	**M NM** Staff are not trained……1 2 No supplies (no blank partographs)……..1 2 Staff do not have time……1 2 Use of the partograph is not mandatory/not policy……..1 2 Other *(specify)*…….88 _____	**Skip to Part IV**
703	Is there a labor management protocol for a woman using a partograph? ***(ask and then confirm by observation of poster/chart on the wall)***	Yes ..... 1 No……2	

Now; Look through recent records and select three recent partographs filled out by different providers, if possible. Also ask for the case notes and/or patient records for these partographs. The partographs should belong to women with the following characteristics: ***at term, <8cm dilatation at first exam, vertex presentation, fetal heart present at first exam, and without obstetric complications at first exam. S***elect only partographs that start with the active phase of labor. If the answer to Item 705 is "Not assessable," do not select another partograph to replace this one. There is one column for each partograph. Complete the codes/answers for each question, answering all the questions for one partograph, and then go to the second partograph, and the third partograph.

No.	Item	Case 1	Case 2	Case 3
704	What was the woman's dilatation when the partograph was started? **(write number of centimeters)**			
705	Was the first dilatation charted on the alert line? **Specify (1= Yes 2= No)** ***(if "No," end the review for this case; partograph is not assessable)***			

706	How many hours and minutes elapsed between first exam and delivery? **(refer to the case notes/patient record if necessary)** **(write number of hours and minutes)**	___ ____ hrs min	___ ____ hrs min	___ ____ hrs min
707	How many times was the woman's temperature checked and recorded between first exam and delivery (including first exam and delivery)?			
708	How many times was blood pressure checked and recorded between first exam and delivery (including first exam and delivery)?			
709	How many times was the mother's pulse checked and recorded between first exam and delivery (including first exam and delivery)?			
710	Was the fetal heart rate observed at least at hourly intervals? **Specify (1= Yes 2= No)**			
711	Were contractions assessed at least hourly? **Specify (1= Yes 2= No)**			
712	How many times was a vaginal examination carried out and recorded between first exam and delivery (including first exam and delivery)?			
713	Was the descent checked and recorded between first exam and delivery? **Specify (1= Yes 2= No)**			
714	Was the state of the membranes or color of the liquor recorded? **Specify (1= Yes 2= No)**			
715	According to the partograph, when did the woman deliver? **1.** On or left of the alert line 2. Between the alert and action lines 3. On or to the right of the action line **→ skip to 717** **(Each cell should be completed with the code 1, 2, or 3)**			
716	If she delivered on or to the right of the action line, how many hours and minutes to the right of the action line? **(write number of hours and minutes;** **99 = No information)**	___ ____ hrs min	___ ____ hrs min	___ ____ hrs min

717	Was augmentation used? **Specify (1= Yes 2= No)** **If 2 (No) → skip to 719**			
718	If augmentation was used, when? 1. On the alert line 2. Between the alert and action lines 3. On or beyond the action line			
719	Was time at delivery filled in? **(refer to the case notes/patient record if necessary)** **Specify (1= Yes 2= No)**			
720	What type of delivery did she have? **(refer to the case notes/patient record if necessary)** 1. Spontaneous vertex delivery **→ skip to 722** 2. Vacuum extraction or forceps delivery 3. Cesarean delivery **→ skip to 722** 4. Other (specify by writing in cell) **→ skip to 722** 9. No information **→ skip to 722**			
721	If delivery by forceps or vacuum, state reason. **(refer to the case notes/patient record if necessary)** 1. Cephalopelvic disproportion (CPD) 2. Fetal distress 3. Other (specify by writing in cell)			
722	What was the outcome for the baby? **(refer to the case notes/patient record if necessary)** 1. Normal live birth 2. Live birth with distress 3. Stillbirth 9. No information			

	Part IV: Service utilization at health center in the last 12 months												
SN	**Data elements**	**Jul'14**	**Aug'14**	**Sep'14**	**Oct'14**	**Nov'14**	**Dec'14**	**Jan'15**	**Feb'15**	**Mar'15**	**Apr'15**	**May'15**	**Jun'15**
1	Number of urgent maternal referral cases received (managed & referred) during the reporting month												
1.1	Self referral												
1.2	Arrived with referral slip												
1.3	Used Ambulance												
1.4	Called ahead												
1.5	Escorted												
1.6	Provided feedback												
2	Number of infants 0 - 2 months referral cases received (managed & referred) during the reporting month												
2.1	Self referral												
2.2	Arrived with referral slip												
2.3	Used Ambulance												
2.4	Called ahead												
2.5	Escorted												
2.6	Provided feedback												
3	Median time interval between HP and health center (in minutes)												
4	Number urgent referrals reached designated hospital												
5	Total Number of deliveries attended												
5.1	Assisted deliveries with vacuum extraction												
6	Number of Live births												
7	Number of Stillbirths												
8	Number of early neonatal deaths												
9	No. of neonatal deaths												

10	No. of sick young infants managed												
11	No. of young infant deaths												
12	No. of maternal deaths												
13	**Obstetric complications managed at health center**												
13.1	Abortion complications												
13.2	PPH												
13.3	Obstructed/ prolonged labor												
13.4	Retained placenta												
13.5	Puerperal sepsis												
14	Total number of obstetric emergencies who have been given a ride/transportation in the past one year?												
14.1	From community to HC												
14.2	From HC to hospital												
15	Total number of newborn emergencies who have been given a ride/transportation in the past one year?												
15.1	From community to HC												
15.2	From HC to hospital												
16	Total number of non-obstetric emergencies who have been given a ride/transportation in the past one year?												
16.1	From community to HC												
16.2	From HC to hospital												
Service utilization of the woreda in the last 12 months													
17	Total number of obstetric emergencies who have been given a ride/transportation in the past one year in the woreda?												
17.1	From community to HC												
17.2	From HC to hospital												

18	Total number of newborn emergencies who have been given a ride/transportation in the past one year in the woreda?												
18.1	From community to HC												
18.2	From HC to hospital												
19	Total number of non-obstetric emergencies who have been given a ride/transportation in the past one year in the woreda?												
19.1	From community to HC												
19.2	From HC to hospital												

	Part V: Service utilization at referral hospitals in the last 12 months ***Steps to screen*** 1. *Identify women who get care at hospital from the hospital registers (i.e., delivery, abortion, gyn/obs IPD, OT and neonatal/ pediatrics IPD registers).* 2. *Identify cases that came from L10K intervention PHCUs by using patient identifiers (medical record number and address).* 3. *Then review those cases that came from intervention PHCUs and complete the questionnaire accordingly*												
	Name of hospital:_____												
SN	**Data elements**	**Mar'14**	**Apr'14**	**May'14**	**Jun'14**	**Jul'14**	**Aug'14**	**Sep'14**	**Oct'14**	**Nov'14**	**Dec'14**	**Jan'15**	**Feb'15**
1	Number of urgent maternal referral cases received (& managed) during the reporting month												
1.1	Self referral												
1.2	Arrived with referral slip												
1.3	Arrived in an Ambulance												
1.4	Called ahead												
1.5	Were escorted												
1.6	Hospital staff provided feedback												
2	Number of infants 0 - 2 months referral cases received (managed & referred) during the reporting month												
2.1	Self referral												
2.2	Arrived with referral slip												
2.3	Used Ambulance												
2.4	Called ahead												
2.5	Escorted												
2.6	Provided feedback												
3	Median time interval between health center and hospital (in minutes)												
4	Total Number of deliveries attended												

4.1	Assisted deliveries (with vacuum extractor)												
4.2	Caesarean section												
5	Number of Live births												
6	Number of Stillbirths												
7	Number of early neonatal deaths												
8	No. of neonatal deaths												
9	No. of sick young infants managed												
10	No. of young infant deaths												
11	No. of maternal deaths												
12	**Obstetric complications managed at the hospital**												
12.1	Abortion complications												
12.2	APH												
12.3	PPH												
12.4	Obstructed/ prolonged labor												
12.5	Retained placenta												
12.6	Puerperal sepsis												
12.7	Severe pre-eclampsia/ eclampsia												
12.7.1	Ante-partum PEE												
12.7.2	Intra-partum PEE												
12.7.3	Post-partum PEE												
12.8	Ectopic pregnancy												
12.9	Uterine rupture												

Appendix 2: List of Zones, Woredas, and Health Facilities Studied

Region	Zone	Woreda	Health Center
Amhara	East Gojjam	Aneded	Amber HC
			Jama HC
		Awobel	Lumame HC
		Baso Liben	Yejube HC
			Yelamagej HC
		Dejen	Dejen HC
		Enemay	Bichena HC
		Hulet Ejunese	Muger HC
			Sede HC
		Shebel Berenta	Yedwa HC
	North Gondar	Alefa	Shahura HC
		Chilga	Aykel HC
			Negadie Bahir HC
		Debark	Dibibahir HC
		Dembia	Koladiba HC
			Robit HC
		Gondar Zuria	Enfraze HC
			Maksegnit HC
		Takusa	Delgi HC
		Wogera	Ambagiworgis HC
	North Shoa	Angolella Tera	Chacha HC
			Tsegereda HC
		Baso Worena	Goshe Bado HC
			Keyt HC
		Ephratana Gidem	Ataye HC
		Kewot	Abayatir HC
		Moretna Jeru	Enewari HC
		Siadebirna Wayu	Deneba HC
			Wayu HC
		Tarmaber	Debre Sina HC
	West Gojjam	Burie Zuria	Alefa HC
		Dembecha	Dembecha HC
			Wad HC
		Quarit	Genete abo HC
			Quarite HC
		Womberima	Shindi HC
			Wogedad HC
Oromia	East Wollega	Gutogida	Lugo HC
			Uke HC

		Harolimu	Haro HC
		Limu	Arkumbe HC
			Gelila HC
		Sasiga	Galo HC
			Jimata HC
	Illu Ababora	Ale	Gore HC
			Onga HC
		Bilo Nopa	Nopa HC
		Bure	Bure HC
		Chora	Abdala HC
			Kumbabe HC
		Gechi	Chara HC
			Gehci HC
		Hurumu	Hurumu HC
		Yayo	Yayo HC
	Jimma	Chora Botor	Bege HC
		Dedo	Sheki HC
		Goma	Limu Shaye HC
		Gumay	Toba HC
		Limu Kosa	Ambuye HC
			Limu Genet HC
		Limu Seka	Atnago HC
		Nono Benja	Nano HC
		Ommo-nada	Asendabo HC
			Nada HC
		Seka-chekorssa	Buyo Kechema HC
		Shabe Sombo	Shebe HC
			Sombo HC
		Sokoru	Sokoru HC
	West Wollega	Ghimbi	Dalo Sawa HC
		Kiltu Kara	Agamsa Bala HC
		Kiltu Kara	Kiltu-Kara HC
		Kondala	Gaba Dafino HC
		Mana Sibu	Idoro Tobera HC
		Mana Sibu	Mendi HC
		Nedjo	Amuma Yambel HC
		Nedjo	Wara Jiru HC
SNNP	Bench Maji	Debub Bench	Deberework HC
			Kitie HC
		Semien Bench	Biri HC
		Sheko	Gizmerte HC

			Sheko HC
	Gamogofa	Arba Minch Zuria	Lante HC
			Shele HC
		Mirab Abayea	Wajefo HC
	Gedio	Dilla Zuria	Chichu HC
			Tumiticha HC
		Gedeb	Gedeb HC
		Kochire	Chelelektu HC
		Wonago	Haseharo HC
			Wonago HC
		Yergachefe	Chito HC
	Kafa	Bita	Bitta HC
		Chena	Koda HC
			Wacha HC
		Decha	Modiyo HC
		Gewata	Konda HC
		Gimbo	Uffa HC
			Wush Wush HC
	Konta SW	Konta	Ameya HC
	Sheka	Masha	Degele HC
			Yena HC
		Yeki	Bechi HC
			Kubito HC
	Silite	Alicho Werero	Kuwakatoo HC
		Dalocha	Dalocha HC
			Ebot Tirora HC
		Hulberg	Bilawanja HC
			Hulbarag HC
		Mirab Azernet	Lera HC
		Misrak Azernet	Kilto HC
		Sankura	Alemgebya HC
		Silti	Kibet HC
			Mernahariya HC
	Yem sw	Yem	Saja HC
Tigray	Central	Ahferom	Egela HC
			Feresmai HC
		Kola Tembein	Guya HC
			Tsetsera HC
		Laelay Maichew	Mahberedego HC
		Tahtay Maychew	Edegaberhe HC
			Wukromaray HC

		Werei Leke	Nebelet HC
			Tsedia HC
	Eastern	Ganta Afeshum	Bizet HC
	North West	Laelay Adiabo	Adidaero HC
			Adinebrid HC
		Medebay Zana	Selekleka HC
			Zana HC
		Tahtay Koraro	Beles HC
	South East	Enderta	Romanat HC
		Hintola Wajirat	Debub HC
		Samre Sehart	Gijet HC
	Southern	Ofla	Hashenge HC
			Maymaedo HC

Appendix 3: Performance of BEmONC signal functions by health center

The performance of BEmONC signal functions in selected health centers of Amhara, Oromia, SNNP and Tigray regions of Ethiopia, July 2015.

Region	Health Center	Use of IV antibiotics	Use of uterotonics	Use of Magso 4/Diazepam	Removal of retained products of conception	Manual removal of placenta	Assisted vaginal birth	Neonatal resuscitation	Total signal functions performed	% performance
Amhara	Aykel	1	1	1	1	1	1	1	7	100.0
	Bichena	1	1	1	1	1	1	1	7	100.0
	Delgi	1	1	1	1	1	1	1	7	100.0
	Dembecha	1	1	1	1	1	1	1	7	100.0
	Enewari	1	1	1	1	1	1	1	7	100.0
	Enfraze	1	1	1	1	1	1	1	7	100.0
	Genete abo	1	1	1	1	1	1	1	7	100.0
	Koladiba	1	1	1	1	1	1	1	7	100.0
	Negadie Bahir	1	1	1	1	1	1	1	7	100.0
	Quarit	1	1	1	1	1	1	1	7	100.0
	Yejube	1	1	1	1	1	1	1	7	100.0
	Chacha	1	1	0	1	1	1	1	6	85.7
	Dejen	1	1	0	1	1	1	1	6	85.7
	Deneba	1	1	1	1	1	0	1	6	85.7
	Jama	1	1	0	1	1	1	1	6	85.7
	Keyt	1	1	0	1	1	1	1	6	85.7

	Lumame	1	1	1	1	1	0	1	6	85.7
	Maksegnit	1	1	1	1	1	0	1	6	85.7
	Sede	1	1	0	1	1	1	1	6	85.7
	Shahura	1	1	0	1	1	1	1	6	85.7
	Wogedad	1	0	1	1	1	1	1	6	85.7
	Yedwa	1	1	1	0	1	1	1	6	85.7
	Alefa	0	1	0	1	1	1	1	5	71.4
	Ambagiworgis	1	1	0	0	1	1	1	5	71.4
	Bure	1	1	0	1	1	0	1	5	71.4
	Debre Sina	1	1	0	1	0	1	1	5	71.4
	Tsegereda	1	1	0	1	1	1	0	5	71.4
	Wayu	1	1	0	1	1	1	0	5	71.4
	Abayatir	0	1	1	0	1	0	1	4	57.1
	Goshe Bado	0	1	1	0	0	1	1	4	57.1
	Wad	1	1	0	1	0	1	0	4	57.1
	Amber	0	1	0	1	0	1	0	3	42.9
	Dibibahir	1	1	0	0	1	0	0	3	42.9
	Gedeb	0	1	0	1	1	0	0	3	42.9
	Robit	1	1	0	0	0	0	1	3	42.9
	Shindi	1	1	0	0	0	1	0	3	42.9
	Ataye	0	1	0	0	1	0	0	2	28.6
	Muger	0	1	0	1	0	0	0	2	28.6
	Yelamagej	0	1	0	0	0	1	0	2	28.6

Oromia	Haro	1	1	1	1	1	1	1	7	100.0
	Hurumu	1	1	1	1	1	1	1	7	100.0
	Kumbabe	1	1	1	1	1	1	1	7	100.0
	Lugo	1	1	1	1	1	1	1	7	100.0
	Mendi	1	1	1	1	1	1	1	7	100.0
	Shebe	1	1	1	1	1	1	1	7	100.0
	Ambuye	1	1	1	0	1	1	1	6	85.7
	Atnago	1	1	0	1	1	1	1	6	85.7
	Bege	1	1	0	1	1	1	1	6	85.7
	Gaba Dafino	1	1	0	1	1	1	1	6	85.7
	Gehci	1	1	0	1	1	1	1	6	85.7
	Kiltu-Kara	1	1	1	1	1	1	0	6	85.7
	Limu Shaye	1	1	0	1	1	1	1	6	85.7
	Nada	1	1	0	1	1	1	1	6	85.7
	Nopa	1	1	1	1	1	0	1	6	85.7
	Sheki	1	1	0	1	1	1	1	6	85.7
	Sombo	1	1	0	1	1	1	1	6	85.7
	Wara Jiru	1	1	0	1	1	1	1	6	85.7
	Abdala	1	1	0	1	1	0	1	5	71.4
	Amuma Yambel	1	1	0	1	0	1	1	5	71.4
	Asendabo	0	1	0	1	1	1	1	5	71.4
	Galo	1	1	1	1	1	0	0	5	71.4
	Gelila	0	1	1	1	1	1	0	5	71.4

	Koda	1	1	0	1	1	0	1	5	71.4
	Nano	1	1	0	1	1	1	0	5	71.4
	Sokoru	0	1	0	1	1	1	1	5	71.4
	Uke	1	1	1	0	0	1	1	5	71.4
	Agamsa Bala	1	1	0	0	1	0	1	4	57.1
	Arkumbe	1	1	0	0	0	1	1	4	57.1
	BuyoKechema	1	1	0	0	1	0	1	4	57.1
	Dalo Sawa	1	1	0	0	0	1	1	4	57.1
	Toba	1	1	0	1	0	0	1	4	57.1
	Chara	1	1	0	0	1	0	0	3	42.9
	Gore	0	1	0	1	0	1	0	3	42.9
	Jimata	1	1	0	0	0	1	0	3	42.9
	Yayo	0	1	0	0	1	0	1	3	42.9
	Idoro Tobera	0	1	0	0	0	0	1	2	28.6
	Onga	0	1	0	0	1	0	0	2	28.6
	Limu Genet	0	1	0	0	0	0	0	1	14.3
SNNP	Bitta	1	1	1	1	1	1	1	7	100.0
	Dalocha	1	1	1	1	1	1	1	7	100.0
	Alemgebya	1	1	1	1	1	0	1	6	85.7
	Hulbarag	1	1	0	1	1	1	1	6	85.7
	Lera	1	1	1	1	1	0	1	6	85.7
	Saja	1	1	0	1	1	1	1	6	85.7
	Sheko	1	1	0	1	1	1	1	6	85.7

	Uffa	1	1	0	1	1	1	1	6	85.7
	Wacha	1	1	1	0	1	1	1	6	85.7
	Ameya	1	1	0	1	1	0	1	5	71.4
	Bilawanja	1	1	0	1	1	0	1	5	71.4
	Deberework	1	1	0	1	1	0	1	5	71.4
	Haseharo	1	1	0	1	1	0	1	5	71.4
	Kibet	1	1	0	1	0	1	1	5	71.4
	Kubito	1	1	0	1	1	0	1	5	71.4
	Lante	1	1	1	1	0	0	1	5	71.4
	Modiyo	1	1	0	1	1	0	1	5	71.4
	Wush Wush	1	1	0	1	1	0	1	5	71.4
	Bechi	0	1	0	1	1	0	1	4	57.1
	Biri	1	1	0	0	0	1	1	4	57.1
	Chelelektu	1	1	0	1	1	0	0	4	57.1
	Konda	1	1	0	0	0	1	1	4	57.1
	Kuwakatoo	1	1	0	1	1	0	0	4	57.1
	Mernahariya	0	1	0	1	1	0	1	4	57.1
	Wonago	0	1	0	1	1	0	1	4	57.1
	Degele	0	1	0	1	1	0	0	3	42.9
	Gizmerte	1	1	0	0	0	1	0	3	42.9
	Wajefo	0	1	0	0	1	0	1	3	42.9
	Yena	0	1	0	1	1	0	0	3	42.9
	Chichu	0	1	0	0	0	0	1	2	28.6
	Ebot Tirora	1	1	0	0	0	0	0	2	28.6

	Kilto	0	1	0	0	0	0	1	2	28.6
	Shele	0	1	0	0	0	0	1	2	28.6
	Chito	0	1	0	0	0	0	0	1	14.3
	Kitie	0	1	0	0	0	0	0	1	14.3
	Tumiticha	0	1	0	0	0	0	0	1	14.3
Tigray	Debub	1	1	1	1	1	1	1	7	100.0
	Edegaberhe	1	1	1	1	1	1	1	7	100.0
	Mahberedego	1	1	1	1	1	1	1	7	100.0
	Selekleka	1	1	1	1	1	1	1	7	100.0
	Tsetsera	1	1	1	1	1	1	1	7	100.0
	Wukromaray	1	1	1	1	1	1	1	7	100.0
	Adidaero	1	0	1	1	1	1	1	6	85.7
	Bizet	1	1	0	1	1	1	1	6	85.7
	Guya	1	1	0	1	1	1	1	6	85.7
	Hashenge	1	1	1	1	1	0	1	6	85.7
	Nebelet	1	1	1	1	1	1	0	6	85.7
	Tsedia	1	1	0	1	1	1	1	6	85.7
	Adinebrid	1	1	1	0	1	0	1	5	71.4
	Beles	0	1	0	1	1	1	1	5	71.4
	Feresmai	1	1	0	1	1	0	1	5	71.4
	Gijet	1	1	0	1	1	0	1	5	71.4
	Romanat	1	1	1	0	0	0	1	4	57.1
	Maymaedo	1	1	0	0	0	0	1	3	42.9

	Egela	0	1	0	0	0	0	1	2	28.6
	Zana	0	0	0	0	0	0	1	1	14.3
	Total (n=134)	103	131	47	96	101	79	105		