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Health Facility and Health Worker Baseline Assessment for Reproductive, Maternal, Neonatal, Child Health and Nutrition Services

FINAL REPORT

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Accelerating the Reduction of Maternal, Neonatal and Child Mortality

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Abbreviations

ACT	Artemisinin-based combination
AMDD	Averting Maternal Disability and Death
ANC	Antenatal care
ART	Antiretroviral therapy
ARV	Antiretroviral (drug)
BEmONC	Basic emergency obstetric and newborn care
BMI	Body mass index
BU	Boston University
CDE	Certified daily employee
CEmONC	Comprehensive emergency obstetric and newborn care
CHA	Community health assistant
CHW	Community health worker
CI	Confidence interval
CSO	Central Statistical Office
DCMO	District Community Medical Office
DHS	Demographic Health Survey
EmONC	Emergency obstetric and newborn care
EHT	Environmental heath technologist
ETAT	Emergency triage assessment and treatment
FANC	Focused antenatal care
GRZ	Government of the Republic of Zambia
IMCI	Integrated management of childhood illness
IMR	Infant mortality rate
IRB	Institutional Review Board
IQR	Interquartile range
ITN	Insecticide-treated bed net
IUD	Intrauterine device
MDG	Millennium Development Goal
MDGi	Millennium Development Goal Acceleration Initiative
MCDMCH	Ministry of Community Development, Mother and Child Health
MOH	Ministry of Health
NMR	Neonatal mortality rate
OR	Odds ratio
PMTCT	Prevention of mother to child transmission (of HIV)
RMNCH&N	reproductive, maternal, newborn, child health and nutrition
SD	Standard deviation
SMGL	Saving Mothers, Giving Life
TBA	Traditional birth attendant
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
U5MR	Under five mortality rate
WHO	World Health Organization
ZamCAT	Zambia Chlorhexidine Application Trial
ZCAHRD	Zambia Centre for Applied Health Research and Development

Executive Summary

Rationale for the baseline health facility and health worker evaluation

Continued, stronger and coordinated efforts are needed to reduce health disparities, ensure high coverage, and move Zambia closer to its MDG targets. In collaboration with UNICEF, the recently formulated national program, "Accelerating Progress towards Maternal, Neonatal and Child Morbidity and Mortality Reduction in Zambia" (also referred to as the MDG Acceleration Initiative, or MDGi) will operationalize this strategy over the next four years. The program aims to improve the availability and quality of maternal, neonatal and child health & nutrition services in 11 selected target districts in Copperbelt and Lusaka Provinces. The program will focus on strengthening service delivery at the district-level, and on building management capacity at the provincial- and national-levels. Supply-side interventions for improving the availability and quality of services will be complemented by demand-side measures implemented at the community- and household-levels.

As a prelude to the implementation of this program, we conducted a baseline assessment to determine health facility readiness and to provide input to guide program planning, monitoring and evaluation. An analysis of the results of this assessment is presented in this report for all 11 districts stratified by different levels of the health system.

Methods

The MDGi baseline health facility assessment only included public sector health facilities comprising of public Government of the Republic of Zambia (GRZ) and mission facilities; no private or other quasi-governmental health facilities such as military hospitals were assessed. For the purpose of this assessment, health facilities were categorized into five strata based on level of care: 1) hospitals (tertiary and secondary); 2) health centers designated as basic emergency obstetric and newborn care (current EmONC); 3) health centers designated for upgrading (prospective EmONC); 4) health centers currently with no BEmONC services and not designated for BEmONC services in the future (non-prospective EmONC); and 5) health posts. Using a mixture of purposive and random selection, we assessed 117 health facilities, which is nearly 50% of all eligible facilities in the target districts.

Results

The assessment was carried out over a period of 5 weeks from 13 July to 15 August 2014. Wave 1 health facilities (e.g. hospitals, current EmONC, and prospective EmONC facilities) comprised the majority (66%, n=79) of facilities assessed. The remaining 44% of the sites (n=38) were health posts and non-prospective EmONC. More than half (55%) of all facilities surveyed were in urban locations and the GRZ was the operating agency for 96.5%; only 3.5% were mission-operated. We interviewed a total of 487 health workers in the MDGi districts. A total of 487 health workers were interviewing including 243 providers of maternal and newborn health and 244 interviews providers of infant and child health & nutrition care.

In the detailed report below, there is a substantial amount of facility data on the following topics: infrastructure, human resources, EmONC capacity, availability of drugs and supplies, capacity to provide child and adolescent health care, capacity to manage child nutrition, and health service utilization volumes. Following are a few highlights of the report presented in three major sections—maternal and newborn health, child health, and child nutrition.

Basic infrastructure

The availability and flow of water was good at all hospitals with only 0.45 mean days without water in the past month. The flow of water was only problematic in non-prospective EmONC facilities with 1.38 mean days without water in the past month. The situation was worse in the current EmONC facilities with 1.67 mean days per month without water. Similar to the situation with water supply, 95% of all facilities had access to electricity, and it was currently functional in 90% of the facilities. Apart from Mpashya Mission Hospital in Rufunsa, which was supplied by a generator, all the other hospitals had current functional electricity with few power interruptions (mean of 0.55 ± 0.93 days without power supply in the last month. Facilities that were most affected by power interruptions were health posts (mean 4.5 days without electricity), and the prospective and non-prospective EmONC centers with 4.26 mean days and 4.43 mean days without power in the last month respectively; hospitals had the least gaps in power availability (mean 0.5 days per month).

Our assessment of communication systems for emergency referrals revealed that 95% of the facilities had a cell phone signal. Staff in 86% of these facilities owned personal cell phones but the policy for reimbursing staff for cell phone use was however very weak. Only 10% of the facilities had a reimbursement policy in place. Fifty percent (50%) of the current EmONC and 36% of the prospective EmONC health facilities had functional motorized transport (ambulances or an equivalent). Notably very few had functional stretchers with the exception of hospitals (69%).

Maternal and Newborn Health

Infrastructure for provision of maternal and neonatal health care services

Labor and delivery services are provided in 75% of facilities surveyed including 100% of hospitals (Arthur Davidson, the pediatric hospital in Ndola was excluded), 76% of health centers, and 58% of health posts. All comprehensive and basic EmONC facilities had either separate or combined labor and delivery rooms. However, seven facilities, one hospital and six current EmONC sites mainly in Lusaka and Masaiti Districts, did not have enough delivery space. Pregnant women in these facilitates delivered on the floor and often had to share beds. The seven facilities were: University Teaching Hospital (UTH), George, Mtendere, Chipata and Kanyama in Lusaka District and Kambowa and Chinondo in Masaiti District on the Copperbelt.

Maternity waiting homes were available in 6% of facilities: 12% of health posts; 3% of health centers; and 17% of hospitals. While 70% of health facilities had formal written protocols for referring patients, only 46% would notify the accepting facility of the referral and only 41% routinely received feedback on the outcome of the patient who had been referred.

Service provision

Focused antenatal care is provided in 88% of health facilities overall: 58% of health posts; 93% of health centers; and 92% of hospitals. Postnatal care is provided in 87% of all health facilities: 63% of health posts; 79% of health centers; and 92% of hospitals. Health facilities with delivery services discharge mothers within 6-24 hours post-partum in the majority of cases (86%); a few discharge mothers <6 hours after delivery (16%) or after more than 24 hours (1%).

Ultrasound was only available in a limited number of health facilities, primarily hospitals. Partographs are used routinely in 64% of facilities: 33% of health posts; 59% of health centers; and 100% of hospitals. Routine infection prevention measures are practiced in 64% of facilities: 94% of health posts; 87% of health centers; and 100% of hospitals. However, functioning incinerators are available in only 37% of facilities: 26% of health posts; 28% of health centers; and 92% of hospitals.

While obstetric surgery (e.g., caesarean section; dilation and curettage) is offered in all hospitals other than Arthur Davidson, repair of obstetric fistula was only available in 42% of hospitals. Another notable service gap was for cervical screening (Pap smear) which was only done in 62% of hospitals and 47% of EmONC health centers. By contrast, diagnosis and treatment of STI was available in nearly all facilities, including 84% of health posts to 100% of EmONC health centers. Family planning, PMTCT, and logistics management services were commonly available at study facilities.

Rapid HIV testing in the maternity ward was done in 62% of health facilities with the lowest levels of performance in health posts and non-EmONC health centers. There were notable gaps in the delivery of ARVs to HIV-exposed newborns in labor wards, ranging from only 18% in health centers without inpatient facilities to 100% of hospitals. Community HIV testing (52%) and social support groups (56%) were less commonly provided services. Generally health centers provided community outreach services more commonly than health posts.

EmONC site distribution and provision of signal functions

In the 11 MDGi districts there are 42 designated EmONC sites (12 hospitals with C-EmONC and 30 health centers with B-EmONC). Their distribution varies significantly across the districts and is skewed towards the most densely populated locations, ranging from 0 in Chilanga to 14 in Lusaka. As a result, the districts with the fewest hospitals and health centers are also those with the lowest levels of EmONC availability. One district (Kitwe) currently meets the minimum national standard (1 C-EmONC and 4 B-EmONC sites per district), and one district (Lusaka) exceeds the minimum standard, while all other districts are below the minimum standard. Furthermore, EmONC tends to be concentrated at the hospital level, as 10 of 12 hospitals (83%) which are designated as C-EmONC sites currently provide all 9 signal functions while 0 of 30 health centers which are designated as B-EmONC sites provide all 7 signal functions. Among current EmONC centers, 63% had recently used parenteral antibiotics, 93% uterotonics, 67% anticonvulsants, 83% had performed neonatal resuscitation, and 70% had removed retained products of conception. In contrast, only 57% had performed manual removal of placenta and just 7% had done assisted vaginal deliveries.

Skilled birth attendance

Enrolled midwives are the health worker cadre who most commonly conducts deliveries (72%) followed by enrolled nurses (36%), certified midwives (36%), and registered nurses (24%). Unskilled birth attendants including TBAs and untrained birth assistants conduct deliveries in 18% and 8% of facilities, respectively. This is mainly at the lower levels of the health system—health posts and non-EmONC health centers.

Assessment of health worker knowledge and practices for maternal health care

While more than half of surveyed health workers were familiar with the major aspects of focused antenatal care (with higher levels of knowledge in hospitals), very few knew about all six aspects. Similarly, when asked about which women require a special care plan, most health workers mentioned women with 5+ deliveries and a history of severe obstetric complications but few mentioned pregnancy interval, previous stillbirths or neonatal deaths, and previous instrumental delivery.

Surveyed health workers tended to be familiar with the signs that suggest a woman is in labor although only about 30% were able to spontaneously name all four signs. When asked about what observations they make as they monitor progress of a woman in labor, most health workers mentioned uterine contractions, cervical dilation, fetal heart beat, and maternal vital signs; degree of molding, color of amniotic fluid, and descent of the head were less commonly described. Health workers in hospitals had better levels of knowledge on the progress of labor and nearly all would register these observations on a partograph.

When asked about steps to take during the active management of the third stage of labor, most health workers mentioned the need to use oxytocin or ergometrine. In contrast, slightly fewer mentioned uterine massage and cord traction. Knowledge of signs of heavy bleeding in a pregnant woman was good for signs of shock and anemia but poor for most other signs. Only a very small proportion of health workers spontaneously mentioned all seven signs. Similarly, very few health workers were able to describe all eight actions that should be taken for a woman with heavy postpartum bleeding, although a majority mentioned the use of uterotonics, IV fluids, examining for lacerations, and referral.

Regular formal supervisory meetings are held in 69% of hospitals and 84% of health posts. However, 47% of health workers in hospitals reported that they never had any technical support or direct supervision of their work. Many health workers had not had any supervision in the preceding 3 months.

Supplies and equipment for maternal health care

Tracer drugs crucial for maternal, newborn and child health are missing in most of the health facilities. Many antibiotics, with the exception of amoxicillin and gentamicin, were out of stock. For example, many facilities did not have injectable ampicillin, ceftriaxone, clindamycin or parenteral metronidazole in stock or had had stock outs in the preceding year. Magnesium sulfate was available in most higher level health facilities (hospitals, EmONC health centers). Parenteral artesunate (the newly recommended first line treatment for severe malaria) was available in 8% of health facilities, mostly hospitals. Partograph availability increased progressively through higher levels of the health system.

EmONC supplies, including assisted delivery kits, autoclaves, autoclave supplies, sphygmomanometers, and clean delivery kits, were generally available at designated EmONC sites. However, assisted delivery kits were available in only 17% of health centers designated as BEmONC sites.

Family planning supplies were often not available with the exception of oral contraceptives (available in 86% of facilities) and injectable contraceptives (available in 79% of facilities).

Newborn care infrastructure and services

Only 62% of hospitals had neonatal intensive care units (NICU). The five hospitals that did not have NICUs included Nchanga North Hospital (Chingola District), Mpanshya Mission Hospital (Rufunsa District), Chongwe District Hospital, Kafue District Hospital, and Kamuchanga District Hospital (Mufulira District). The newborn register was missing in many facilities, even current EmONC health centers and hospitals.

Overall only 57% of all facilities had performed neonatal resuscitation in the last 12 months ranging from 12% of health posts to 92% of hospitals. Encouragement of immediate breastfeeding was common (92% of all facilities) whereas Helping Babies Breathe and Kangaroo Mother Care were performed in 60% and 50% of health facilities. Use of corticosteroids in pre-term labor, intensive care for pre-term babies, and injectable antibiotics for neonatal sepsis was low across health facilities, with the exception of hospitals. Similarly the provision of oxygen for acutely ill newborns varied from 0% in non-EmONC health centers to 60% of EmONC centers and 100% of hospitals. There were also gaps in the delivery of ARVs to HIV-exposed newborns in labor wards, ranging from only 18% in non-EmONC health centers to 100% of hospitals.

Assessment of health worker knowledge and practices for maternal health care

About 90% of health workers knew about the importance of keeping a baby warm, but only 60% of them knew about early breastfeeding initiation within 30 minutes of delivery and only 1% of them were familiar with newborn danger signs. However, most of them would initiate antibiotics and/or refer newborns with suspected sepsis. There were many gaps in knowledge of the steps necessary for

neonatal resuscitation except at higher levels of the health system. Very few health workers were able to describe appropriate treatment for umbilical cord infections and there were some important gaps in service provision for newborns at all levels of the health system, including treatment of umbilical cord infections, eye infections, jaundice, and neonatal sepsis.

Neonatal health care supplies

As noted above, amoxicillin was generally available whereas injectable ampicillin was in stock in only 7% of health posts and not in any non-EmONC or EmONC health centers. Another notable gap was towels for drying newborns. The availability of gentamicin ranged from a low of 63% in non-EmONC health centers to 97% in hospitals. Second line injectable antibiotics such as amikacin were only available in hospitals (77%). Cotrimoxazole suspension for infants was generally available at higher levels of the health system but less commonly in health posts and non-EmONC health centers.

Fetal stethoscopes were usually available, even in health posts (78%). The availability of neonatal resuscitation packs varied widely from 17% in health posts to 85% of hospitals. Other notable gaps included masks for ventilator bags and masks for neonatal resuscitation, incubators, and towels for drying newborns after birth.

Child Health

Child health services

Provision of child health services is quite limited in the facilities assessed. Only two hospitals and none of the health centers and health posts had a pediatric intensive care unit. Pediatric care for children with HIV/AIDS was available at 32% of health posts, 69% of health centers, and 77% of hospitals. Integrated Management of Childhood Illness (IMCI) services were provided at a majority of health posts and health centers (63% and 88%, respectively) and around half of hospitals. Emergency care with triage assessment and treatment (ETAT) was provided 68% of health posts, 78% of health centers, and 54% of hospitals.

The extended program on immunization (EPI) was provided in 84% of health posts, nearly all health centers (99%), but just over half of hospitals (58%). Around one-quarter of health posts (29%) and half of health centers (52%) and hospitals (58%) had a separate room or area designated specifically for immunizations. Thirty-nine percent of health posts, 96% of health centers, and 62% of hospitals had a working refrigerator for vaccine storage.

Training in child care services

Most personnel providing basic child health services had not received any training in the last two years. One health post had an enrolled nurse trained in IMCI. For health centers, the proportion having staff trained in IMCI was low: 22% had a trained enrolled nurse, 13% a trained registered nurses, and 18% a trained clinical officer. Among the hospitals surveyed, only 23% and 15% had a clinical officer and a doctor trained in IMCI, respectively. The situation is similar for malaria case management. None of the study health posts had staff with training in malaria case management in the last two years. A small number of clinicians at health centers were trained in malaria case management: 16% of health centers had a trained enrolled nurse; 11% had a trained clinical officer; and an additional small percentage had a trained registered nurse, midwife, or doctor. For hospitals, only 23% had a doctor trained in malaria case management and 15% had an enrolled nurse trained.

Health worker assessment

While more than half of health workers in all cadres (50% of doctors; 64% of clinical officers; 78% of registered nurses; 54% of enrolled nurses; 64% of registered midwives and 53% of enrolled midwives) knew that convulsion was a danger sign in sick children, fewer knew that “vomiting

everything" was a danger sign: 25% of doctors; 32% of clinical officers; 42% of registered nurses; 24% of enrolled nurses; 33% of registered midwives; and 29% of enrolled midwives. Knowledge of all the four IMCI danger signs was also quite low: 4% of registered nurses; 15% of enrolled midwives; 16% of registered midwives; 18% of clinical officers; 19% of enrolled nurses and 25% of doctors.

Knowledge on how to diagnose malaria in a child was high: 100% of doctors; 96% of clinical officers; 92% of registered nurses; 89% of enrolled nurses; 96% of registered midwives; and 92% of enrolled midwives. Knowledge of how to treat malaria in a child was also high: 88% of doctors; 96% of clinical officers; 92% of registered nurses; 96% of enrolled nurses; 100% of registered midwives and 92% of enrolled midwives. Knowledge on treatment of non-severe pneumonia was quite good but not so good for treatment of severe pneumonia and non-bloody diarrhea with severe dehydration. When health workers were presented with two case studies of children presenting with i) diarrhea and ii) cough and fever, they performed poorly in classification and management of the cases.

Child Nutrition

Diagnosing malnutrition at health facilities

The first challenge in dealing with malnutrition in Zambia is making sure that service providers at health facilities can accurately diagnose the condition. When considering diagnosis and treatment for child malnutrition, it is important to differentiate between acute malnutrition (both severe and moderate) and chronic malnutrition. Diagnosing acute malnutrition depends largely on anthropometric measurement, including mid-upper arm circumference (MUAC) and weight-for-height Z-score. Most, though not all, health facilities included in the study sample had both a weighing scale and MUAC tapes at the time of the survey. However, only 17% of health posts and 63% of health centers had boards to measure children's lengths or heights (all hospitals had height boards). The lack of height boards at primary care facilities is especially alarming for diagnosis of chronic malnutrition, which requires an assessment of height-for-age Z-score to determine stunting status.

Treating malnutrition at health facilities

Children diagnosed with acute malnutrition require immediate treatment with therapeutic feeding. At present, only a few facilities within Zambia provide therapeutic feeding services: 16% of health posts; 41% of health centers; and 92% of hospitals. In many cases, children with acute malnutrition are referred to 'feeding centers' where they can receive the required feeding treatment. However, expanding access to therapeutic feeding might improve uptake of the service for children that need it. For chronic malnutrition, the main treatment involves educating mothers to improve feeding practices at the home. Education services on infant and young child feeding practices are provided at 42% of health posts; 66% of health centers; and 77% of hospitals. Finally, micronutrient supplements, important for the growth and development of all children, are available at 32% of health posts; 56% of health centers; and 77% of hospitals.

Provider training in malnutrition diagnosis and services

The availability of nutrition diagnostics and services does not tell the whole story; it is also important to consider the skills of the clinicians. Fewer than half of study clinicians were able to correctly interpret a hypothetical scenario that tested their knowledge about child malnutrition symptoms. Furthermore, while the majority of clinical staff at study facilities had received training in the treatment of severe acute malnutrition at some point in their careers, very few had received related training in the preceding two years. Similarly, few clinicians had received training in infant and young child feeding practices in the preceding two years. Despite this lack of recent training, the majority of clinicians were able to correctly interpret hypothetical scenarios related to the management of severe acute malnutrition.

Conclusions and recommendations

This baseline assessment has revealed that most of the health facilities surveyed do not provide the optimal maternal, newborn, or child health services required and that the personnel have not received the needed training to provide these services. Consequently the health workers' knowledge and skills to effectively diagnose and manage common childhood illnesses are low.

There are numerous gaps in infrastructure at different levels of the health system and across facilities of the same type. For facilities to perform effectively the MDGi program should address these gaps but such interventions should be facility type specific and should be appropriately tailored to the services being provided at the health facility. Among these improvements should be: increased availability of electricity in heath posts and prospective and non-prospective EmONC facilities that provide delivery services; strengthened back up power supplies at all current EmONC sites and hospitals; and expanded access to adequate sources of water for all health facilities.

There is a need to increase laboratory capacity for both candidate and current EmONC facilities. There is also a need to determine why there are stock outs in essential medications and supplies at the health facilities and put in place appropriate interventions to address any barriers. The drug supply for both candidate and current EmONC facilities needs to be strengthened, especially for essential drugs and important 2nd line agents for potentially life-threatening illnesses like pregnancy complications, puerperal and neonatal sepsis. Blood transfusion capacity needs to be improved across all types of health facilities that provide transfusions.

The program needs to address gaps in adequate staff coverage, especially at lower levels of the health system. While there are some deficits in training, there are major deficiencies in supervision, especially the frequency of higher quality technical supportive supervision. MDGi should invest in clinical mentoring as a means of providing high quality supportive supervision with the potential to result in long-term improvements in knowledge and behaviors of health care workers. In addition, infection prevention knowledge and practices require attention.

There is a need to strengthen EmONC capacity and postnatal care in all health facilities that conduct deliveries, especially those that are designated EmONC health centers. Similarly, relevant health staff members need to be instructed in the use of partographs to monitor labor and implement quality improvement interventions in the appropriate use of partographs.

For child and adolescent health, there is a need to expand clinician training in IMCI, malaria case management, infant and young child feeding, and treatment of severe acute malnutrition. There needs to be an increase in the availability of family planning counseling and contraceptives for adolescents, expansion of clinician training in IMAI, and improved access to adolescent ART. Finally, this assessment has revealed three key findings in terms of nutrition screening and management. First, the anthropometric tools required to correctly diagnose child malnutrition are not available at a large number of health facilities. In particular, the height boards needed to measure weight-for-height and height-for-age are absent from a large number of primary care facilities. As a result, it is likely that a large proportion of chronic malnutrition goes undiagnosed in Zambian children. Second, therapeutic feeding services are not available at a significant number of health facilities. While referrals to facilities with these services may serve as a short-term solution, expanding access to therapeutic feeding will likely increase access and uptake for children with acute malnutrition. Third, while nearly all clinicians have been trained at one time to diagnose and treat malnutrition, very few had received recent training. Increasing in-service training programs should improve the quality of nutrition services throughout Zambia.

BACKGROUND

Maternal, newborn, child health and nutrition in Zambia

Zambia is a large, landlocked, sparsely populated, sub-Saharan nation of 750,000 square km. Of Zambia's 13 million inhabitants, over 60% reside in rural areas and two-thirds live below the poverty line. The total fertility rate is 5.3 overall (CSO 2014). The 2010 census of population and housing estimated Zambia's maternal mortality ratio (MMR) at 483 deaths per 100,000 live births (CSO, 2012), but recent estimates place the country's MMR at 280 deaths per 100,000 live births (WHO, 2014a) and 398 deaths per live births (CSO 2014). The 2013 Millennium Development Goal (MDG) Progress Report notes that although maternal mortality in Zambia has been decreasing, the decline is insufficient to reach the 2015 target of 162.3 deaths per 100,000 live births (UNDP, 2013a). According to this report, interventions that have been successful and need to be scaled up include provision of and access to emergency obstetric care, improved referral systems, improved use of contraception for birth spacing, prevention of early marriages, and the deployment of more trained midwives and birth attendants.

Under-five, infant, and neonatal mortality rates (U5MR, IMR, and NMR) were 119, 70, and 34 deaths per 1,000 live births, respectively, in the 2007 Zambian Demographic Health Survey (DHS) (CSO, 2009). The preliminary findings from the 2013-2014 DHS suggest substantial improvement was U5MR has decreased to 75 deaths per 1,000 live births, IMR to 45 deaths per 1,000 live births, and NMR 24 deaths per 1,000 live births. These mortality rates remain unacceptably high, and despite probable progress over time, they indicate the need for enhanced action to improve maternal and child survival. Despite major efforts to reach the MDGs, many health and development indicators remain low (summarized in Figures 1, 2, and 3), and disparities persist.

The major causes of child mortality in Zambia are malaria, respiratory infections, diarrhea, malnutrition, and anemia. Malnutrition has been on the increase, due to worsening poverty and increasing food insecurity, as well as suboptimal infant and young child feeding practices. According to available statistics, 70% of the population is food insecure and 40% of children are stunted; 15% of children are underweight and 6% wasted. These rates are among the highest in the region. There is also a general critical deficiency of micronutrients (iodine, iron, zinc, and vitamin A) among both children and expecting mothers.

Skilled health workers at health institutions in Zambia attended only 47% of births in 2007 (Figure 1). This has figure has improved with the most recent preliminary DHS findings revealing that 67% of deliveries occur in health facilities with 64% performed by a skilled birth attendant. Most communities in rural areas have limited access to health care. It is currently estimated that in urban areas approximately 99% of households are located within 5 km of a health facility, compared to 50% in rural areas. Further, sociocultural factors compound geographical barriers to care such that many children are taken late to health facilities and pregnancy is not given special care (Figure 2). Knowledge about postnatal care is low and awareness of appropriate infant and young child feeding practices is low (Figure 3). Potentially preventable infectious diseases, chronic and acute malnutrition, and limited access to quality health care all contribute to Zambia's high maternal, newborn, and childhood death indicators.

Figure 1: Current coverage for maternal interventions and nutritional status in Zambia *(Source: 2007 DHS)*

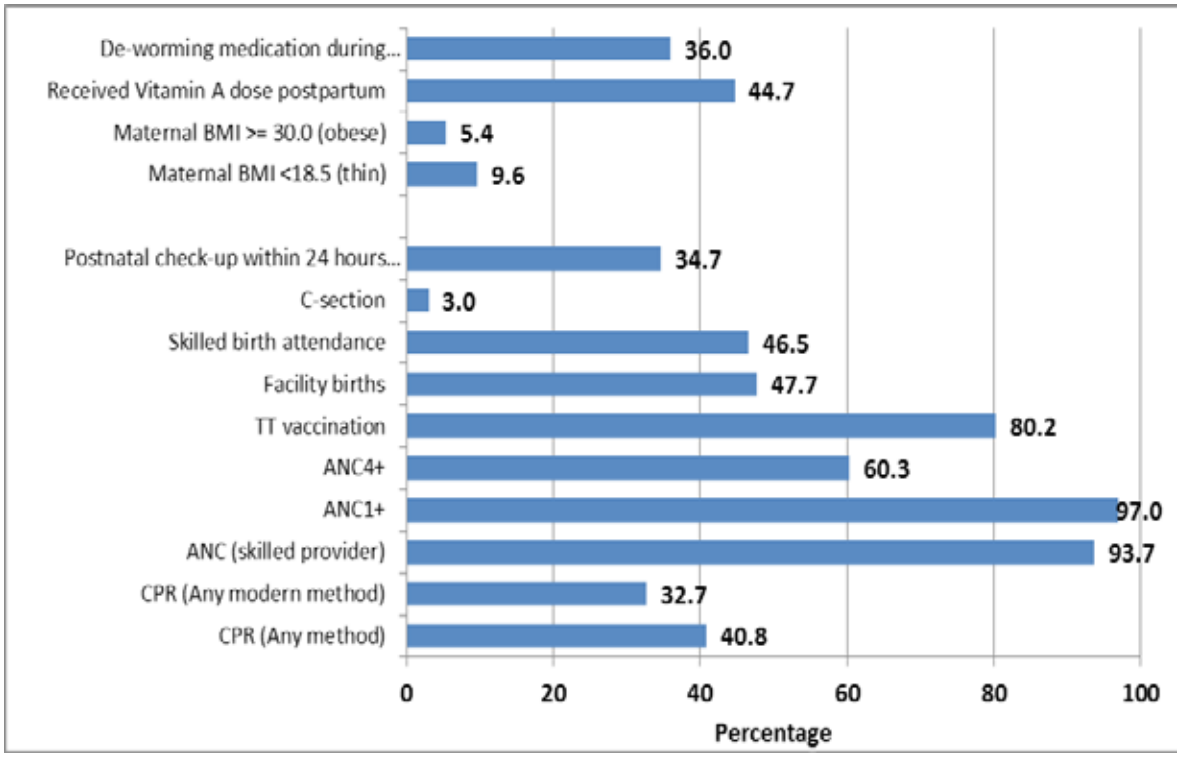


Figure 2: Immunization and care seeking rates for common childhood illnesses (Source: 2007 DHS)

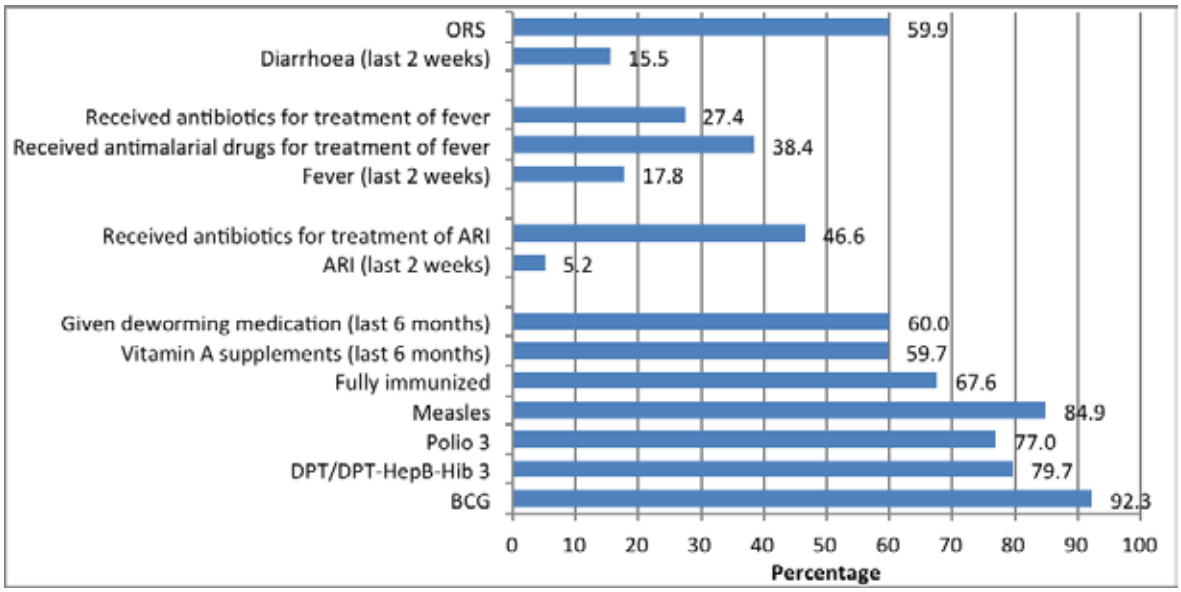
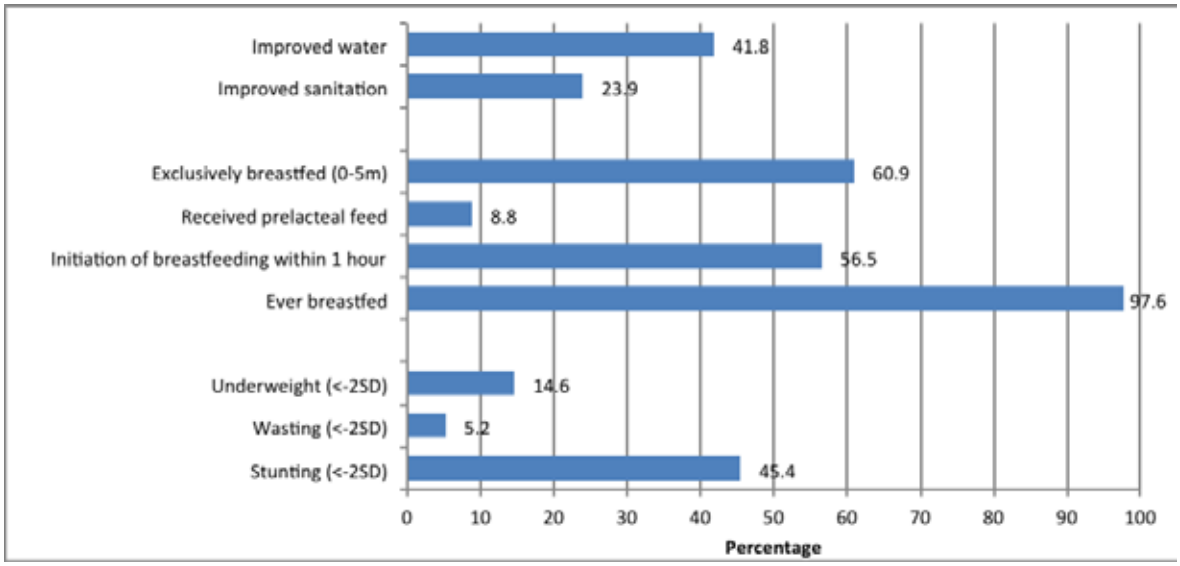


Figure 3: Access to improved water and sanitation, and breastfeeding and nutritional status of under-5 children in Zambia (Source: 2007 DHS)



Health indicators in Lusaka and Copperbelt Provinces

There are wide national disparities in population health in Zambia hidden behind national averages. The country is divided into ten provinces, including Lusaka and Copperbelt Provinces. The latter two are predominantly urban with a growing middle class but at the same time they have large urban compounds where many residents live in severe poverty with limited access to improved water and sanitation. The reproductive, maternal, neonatal and child health indicators in these two provinces are in general better than the national averages. For example, in 2010, the U5MR and IMR in Copperbelt Province were 66 and 53 deaths per 1,000 live births, respectively, compared to the national averages of 76 and 62 deaths per 1,000 live births, respectively. The U5MR and IMR for Lusaka in 2010 were 68 and 47 deaths per 1,000 live births, respectively (2010 Census, CSO). The total fertility rate (TFR) in 2010 was 5.9, while the rates for the Copperbelt and Lusaka Provinces were 5 and 4.6 respectively (CSO, 2012).

The above indicators remain far from the 2015 MDG targets. Tables 1 and 2 summarize these indicators in relation to the MDG provincial targets for Copperbelt (UNDP, 2013b) and Lusaka Provinces (UNDP, 2013c).

Table 1: MDG 4 and 5 Indicators for Copperbelt Province

Indicator	Target	2010 value*
Under-five mortality rate (deaths per 1,000 live births)	48	66
Infant mortality rate (deaths per 1,000 live births)	23	53
Immunization against measles among 1 year olds (%)	100	91
Prevalence of underweight children under five years (%)	11.4	14.9
Prevalence of stunting among children under five (%)	--	44
Maternal mortality ratio (deaths per 100,000 live births)	162.3	474
Births attended by skilled personnel (%)	--	75.3
Antenatal coverage (%)	--	70

Source: UNDP, 2013b

Table 2: MDG 4 and 5 Indicators for Lusaka Province

Indicator	Target	2010 value*
Under-five mortality rate (deaths per 1,000 live births)	47	68
Infant mortality rate (deaths per 1,000 live births)	25	47
Immunization against measles among 1 year olds (%)	100	100
Prevalence of underweight children under five years (%)	11	7.9
Prevalence of underweight children under five years (%)	--	37
Maternal mortality ratio (deaths per 100,000 live births)	162.3	357
Births attended by skilled personnel (%)	--	77.5

**Source: UNDP, 2013c*

Zambia has continued to experience chronic food and nutrition security problems with 40% of children under 5 years old suffering from stunting, of whom 17% have severe stunting (CSO, 2014). There is a gender difference with boys under 5 years old more likely to be stunted than girls (48% vs. 42%) (CSO et al., 2009). The highest levels of stunting are encountered in Luapula Province, where 63% of children under 5 years old are stunted, whereas stunting rates are lowest in Southern and Western Provinces (both ~36%); even these levels reflect widespread stunting. The levels of stunting in Lusaka and Copperbelt Provinces are in-between these extremes (37% and 44%, respectively) but are still unacceptably high.

Although child nutrition in Zambia improved throughout the 1990s, since 1999 the situation has deteriorated. There are multiple contributing factors, including: poverty (affecting about 75% of the rural population); low levels of maternal education (34% of women aged 15-49 years have not completed primary schooling); recurrent episodes of infectious diseases early in life that lead to anorexia, weight loss, and micronutrient deficiencies; and health system limitations that result in the ineffective implementation of programs for management of children with acute malnutrition. Consequently, many Zambian children suffer from one or more forms of malnutrition, including low birth weight, wasting, stunting, underweight, and micronutrient deficiencies.

Rationale for the baseline health facility and health worker assessment

Continued, stronger and coordinated efforts are needed to reduce health disparities, ensure high coverage, and move Zambia closer to its MDG targets.

The Ministry of Community Development, Mother & Child Health (MCDMCH) is spearheading these efforts and has developed a strategy (or Roadmap) that builds upon successes to date in order to continue improving reproductive, maternal, newborn, child health and nutrition (RMNCH&N). In collaboration with UNICEF, the recently formulated national program, “Accelerating Progress towards Maternal, Neonatal and Child Morbidity and Mortality Reduction in Zambia” (also referred to as the MDG Acceleration Initiative, or MDGi) will operationalize this strategy over the next four years. The program aims to improve the availability and quality of maternal, neonatal and child health & nutrition services in 11 selected target districts in Copperbelt and Lusaka Provinces. The program will focus on strengthening service delivery at the district-level, and at

building management capacity at the provincial- and national-levels. Supply-side interventions for improving the availability and quality of services will be complemented by demand-side measures implemented at the community- and household-levels.

As a prelude to the implementation of this program, we conducted a baseline assessment to determine health facility readiness and to provide input to guide the program planning, monitoring and evaluation.

METHODS

The goal of this baseline assessment was to determine the capacity of health facilities to deliver RMNCH&N services, identify RMNCH&N needs and gaps, develop actionable recommendations for the inception phase of the program, and generate informative information for planning. The assessment also aimed to develop a tool kit (instruments, data management and analysis plan, etc.) and protocol for collection of baseline data against which the program can measure change over the course of the project and incorporate in the monitoring and evaluation plan to optimize quality and overall process improvement throughout the program.

Objectives

The specific objectives of the assessment were to:

1. Determine baseline health facility capacity, service availability and quality, infrastructure needs, and health care provider skills for delivery of RMNCH&N services.

2. Analyze and document the type and quality of basic and referral RMNCH&N services provided at the health facilities and hospitals of the 11 target districts in Lusaka and Copperbelt Provinces to inform the MDGi program design.

3. Identify gaps (e.g. infrastructure, human resources, medical equipment, supplies, and pharmaceutical products) in relation to current best practices for RMNCH based on international guidelines (PMNCH, 2011) in order to inform the design and strategies for the MDGi RMNCH&N implementation plan.

4. Provide benchmarks to track progress over the program implementation period and measure impact as per set targets.

Study site

The study was conducted in the 11 selected target districts in Copperbelt and Lusaka Provinces, with a total population of approximately 3.8 million people residing in predominantly urban and peri-urban areas. These include the following districts in Lusaka Province: Lusaka, Chongwe, Chilanga, Kafue, and Rufunsa; and in the Copperbelt Province: Ndola, Chingola, Kitwe, Luanshya, Masaiti, and Mufulira Districts. These districts are characterized by a high concentration of public and private sector health service delivery options and a broad array of health care providers.

Despite a greater level of urbanization in many districts in Lusaka and Copperbelt Provinces, data collected during the 2007 DHS suggest that key measures, including neonatal, infant, and child mortality, are similar or worse than national levels. Women in Lusaka and Copperbelt have slightly lower fertility rates than the national average: 4.1 and 4.8 children, respectively, compared with 6.2 or more children in other parts of the country (CSO et al., 2009). More than 75% of deliveries in Lusaka and Copperbelt Provinces occur at facilities with a skilled birth attendant as compared to the national average, which is below 50%.

Despite potentially greater access to a broad variety of health care services relative to more rural areas of Zambia, inhabitants of Lusaka and Copperbelt Provinces suffer from major disparities among different socioeconomic groups. The segments of the population that have the lowest socioeconomic status tend to live in compounds that are characterized by high population densities. These neighborhoods have substantial limitations in terms of essential basic and emergency health and nutrition services, adequate water and sanitation facilities, and adequate quality education options for children. The unhealthy living conditions are further exacerbated by poor work conditions with a resultant increased risk for morbidity and mortality from communicable and non-communicable diseases. Thus, the target populations are at high risk and would stand to greatly benefit from the delivery of more effective nutrition services, increased availability of high quality maternal, newborn, and child health services, improved coverage of reproductive health services especially for adolescents and young adults, and increased knowledge and demand for high quality health and education services.

Design and development of data collection tools

We conducted a cross-sectional comprehensive health facility and health worker survey to identify needs and gaps in public sector health facilities in 11 study districts. We worked in close collaboration with the MCDMCH and the Ministry of Health (MOH).

The survey instruments were adapted from a variety of tools that have been used internationally and locally in Zambia. These include the following: the United Nations (UN) and Averting Maternal Disability and Death (AMDD) tool “Monitoring Emergency Obstetric Care: A Handbook” (WHO et al., 2009); Pathfinder International Health Facility Assessment Tools; Measure Evaluation Manual (Sampling Manual and Tools for Health Facility Assessments); WHO Service Availability and Readiness Assessment (SARA) methodology; the Zambia Chlorhexidine Application Trial (ZamCAT) health facility and health worker survey; the Saving Mothers, Giving Life (SMGL) health facility assessment tool; a survey used recently for the evaluation of fever case management of children under five years old in Southern Province; the WHO Integrated Management of Childhood Illness guidelines (WHO, 2014b); WHO Emergency Triage Assessment and Treatment strategy (Gove et al., 1999); and the most recent version of the Zambian MOH Option B+ facility assessment tool (Zambia MOH, 2013).

The health facility assessment tool consists of several modules including i) identification of facilities providing RMNCH & N services; ii) human resources providing RMNCH & N services with emphasis on staff complement (e.g. specialists such as obstetricians; general physicians; clinical officers; midwives; and nurses), basic qualifications, trainings (including refreshers and certification), supervision; iii) infrastructure, equipment, essential medicines and medical supplies related to RMNCH & N service delivery; iv) facility case summaries for adolescent and postnatal reproductive health care, basic and EmONC maternal & newborn cases, and child health & nutrition cases; v) EmONC signal functions for basic and comprehensive and functionality of referral related services (labs, etc.); vi) partograph review; vii) caesarian delivery review; viii) maternal death review; ix) neonatal death review; x) referral and transport services for obstetric, neonatal, child and other patients; xi) waiting times/workflow for C-sections and in the context

of maternal and neonatal death reviews; xii) Option B+ site readiness assessment. The health worker survey tool will contain two modules: i) provider knowledge and competency for maternal and newborn health and nutrition care that meets nationally approved standards of care; and ii) provider knowledge and competency for infant and young child health and nutrition care that meets nationally approved standards of care.

Sampling procedure and sample size

The MDGi baseline health facility assessment only included public sector health facilities comprising of public (GRZ) and mission facilities; no private or other quasi-governmental health facilities such as military hospitals were assessed. For the purpose of this assessment, health facilities were categorized into five strata based on level of care: 1) hospitals (tertiary and secondary); 2) health centers with basic EmONC (BEmONC); 3) health centers designated for upgrading (prospective EmONC); 4) health centers currently with no BEmONC services and not designated for BEmONC services in the future (non-prospective EmONC); and 5) health posts.

According to "the 2012 Health Facility List" published by the Government of the Republic of Zambia (GRZ) in June 2013, there were 239 health facilities in the 11 MDGi target districts that were either managed by GRZ or financed by GRZ through a block grant (mission facilities). The remaining 294 health facilities were managed by the Army or by private service providers whether for-profit or not-for-profit. These facilities were excluded from the assessment.

The health facility selection strategy is described below:

Table 3. Health Facility Selection Strategy and Final Sample Size

Strata by Health Facility Type/ Level of Care	**Hospitals**	**Health Centers with EmONC (Current EmONC)**	**Health Centers without B-EmONC**		**Health Posts**	
			High case-load (prospective EmONC)	Non high case-load (none prospective)	Rural districts	Urban districts
Health facility selection strategy	Census	Census	Purposive sample	Random sample	Random sample	Random sample
Maximum sample size + buffer (20%)	13	30	36	19	13	9
Implemen-tation phase	Wave 1			Wave 2		
Total (potential maximum)	117* (120)					

**Three health posts in Rufunsa could not be surveyed because two (Bundabunda & Kanyongoloka) were still under construction and the health center in-charge was not available at the third facility (Chiyota).*

All hospitals and health centers with EmONC (current EmONC) services in the target districts were selected (13 hospitals and 30 current EmONC centers) for the health facility assessment. In addition, 64% of all facilities in Groups 3 and 4 in the target districts were either purposefully or randomly selected. Thus 36 prospective EmONC facilities were purposefully selected, 19 non-prospective EmONC facilities were randomly selected, and 9 urban health posts were also randomly selected whilst the 13 rural health posts in Masaiti and Rufunsa were all evaluated. In summary, we planned to assess 120 health facilities and ultimately surveyed 117 health facilities, which is nearly 50% of all eligible facilities (Annex Table 1). We anticipated that this would provide a representative sample of the status of health facilities in these 11 districts.

Study participants

Health facility assessment was conducted with the officer in charge of the facility or his or her deputy.

We used two tools for the health worker interviews. The first tool was for health workers that provide maternal and neonatal services. These included obstetricians, neonatologists, medical officers, clinical officers, midwives and nurses. The second tool was for health workers that provide infant, young child and nutrition services. These comprised pediatricians, medical officers, clinical officers, midwives, nurses and nutritionists.

For UTH and the general hospitals, we interviewed one of each of the categories mentioned above up to about ten (10) for each of the two tools. In the current EmONC facilities, we interviewed about four (4) health workers (two for each module). For non-BEmONC and small health posts we interviewed one or two health workers. Thus we planned to interview up to a total of 478 health workers.

Data collection

On the day of assessment, the study team arrived at each facility before clinic hours began in order to avoid disrupting service delivery. The person in-charge of the facility was presented with a letter of introduction from the Provincial Medical Officer (PMO) and District Community Medical Officer (DCMO). The team then explained the purpose and the nature of the study emphasizing that the findings would allow for improvement in service delivery. Verbal consent was taken from the in-charge for the facility assessment.

Health facility assessment

The study team assessed the level of staffing, RMNCH&N health services that were provided by the facility, availability and adequacy of infrastructure for service delivery, availability and state of medical equipment, availability of basic drugs and supplies, and availability of treatment charts and guidelines. We also reviewed outpatient, admission and laboratory registers related to maternal, neonatal and child health services.

Maternal, reproductive, and neonatal health service data collected included: short and long-term family planning options, number of vaginal and cesarean deliveries, maternal complications

(complications of abortion, ectopic pregnancy, hemorrhage, obstructed labor, pre-eclampsia / eclampsia, retained placenta, ruptured uterus, sepsis), as well as maternal deaths, stillbirths, and neonatal deaths.

We assessed the availability of length boards, scales, and mid-upper arm circumference tape for child anthropometric measurements and the availability of ready to use therapeutic foods (RUTF) for management of children with uncomplicated severe and moderate acute malnutrition. The assessment lasted approximately 4 to 6 hours in health centers or posts, and 2 to 3 days in hospitals depending on their size.

Health worker interview

On the day that we visited the facility, we interviewed health workers that provide maternal and neonatal services using module 1 of the health worker tool, and interviewed those that provide infant and young children services with module 2 of the health worker form. We did not provide any payments or other incentives to health staff members who gave verbal consent to participate. These interviews took place in a quiet, private location on a one to one basis. Respondents were assured that the individual results would not be shared with their supervisors.

Each health worker was interviewed using a structured survey instrument regarding their training, length of service, access to national guidelines, use of wall charts, algorithms / decision charts or other job aids for managing illnesses, and supervision of job performance. They were also interviewed on their practice and knowledge of assessment and management of RMNCH&N procedures and illnesses. Case studies were used in a gentle and non-threatening way to assess knowledge and practices. The interview lasted approximately 1 hour 45 minutes with minimal interruptions.

Study field team and training

We identified 27 local study staff to serve as research assistants to collect the data. Data collectors were health care professionals (nurses, midwifes, or clinical officers) and had previous research experience. The Project Coordinator, an experienced team manager familiar with the performance of health facility and health worker surveys, supervised the nine teams of three data collectors. Each team comprised two data collectors and one team supervisor. To maximize quality and minimize interviewer bias, all study staff were oriented in an intensive five day training workshop in which they learnt about the objectives of the assessment and study protocol, become familiar with study instruments, and practiced interviewing. They also underwent training on human participants' protection, despite minimal risk of interviewing only health facility staff. Staff had ongoing on-the-job supervision and mentorship throughout the baseline assessment.

Pre-testing of study tools

Before conducting data collection activities, we piloted the instruments with a small number of respondents at a hospital and a health center in Kabwe, Central Province, a location that was different from where the data were to be collected. Results of this pilot survey allowed us to revise the questionnaires and to continue interviewer training to ensure that data collection proceeded smoothly and with minimum disruption to the respondents.

Data management and data quality control

Quality control efforts were built in throughout the process. First, we adapted or used tools that had been previously validated, increasing the quality and validity of our findings. Second, we had appropriate management, oversight, and a rigorous training of our data collectors and team supervisors. Data collectors were trained in survey methodology and completion of Cardiff Teleforms®.

After completion of survey forms, it was the responsibility of the data collectors to do a preliminary check of completeness and accuracy of the forms, and to ensure that handwriting was clear and legible. The team supervisor then performed another check of the forms for completeness and consistency. The Project Coordinator provided the final review before the data forms were submitted for data entry by the Data Core team at ZCAHRD. Random visits to health facilities on the survey day by the study coordinator or one of the co-investigators served as an additional quality control measure. The forms were then stored in a secure location at data collection site until when they were transported to the ZCAHRD office in Lusaka for scanning and data entry.

Over the past decade while working in Zambia, we have successfully utilized the TeleForms® system for data verification and entry. This approach offers a high-volume, high-accuracy data capture and management system. Teleforms® enables hand-written text to be translated to computer readable files and then data are entered into a Microsoft® Access database. As Teleforms® includes a data verification system, the need for multiple data entry personnel is eliminated.

The data entry specialist with his/her dedicated scanner, scanned in the forms into the computer, and then the computer imported the scanned forms and parameters into the Access database, and all fields were verified through the TeleForms® software system. This approach acted in a manner similar to a double data entry system. An image file of each paper form was created and then was backed up to an external hard drive. Data from the TeleForms® system therefore included the actual scanned images of each completed tool and data sets in electronic form in Access databases. All of these electronic files are locked on password-protected computers in the ZCAHRD data core office. These files and database were backed up on to the ZCAHRD secure server on a weekly basis.

Data checking took take place with verification of the Access database with the paper forms by the Lusaka-based data manager. Additionally, data cleaning involved logic checks, range, missing data, and missing form checks.

Data analysis

The results of this health facility survey, which also includes assessments of health worker characteristics and familiarity with RMNCH&N, will be analyzed, summarized, and disaggregated by district- and province. The data will be stratified by level of the health system (hospitals, BEmONC health centers, non-BEmONC health centers, and health posts). When a response from an individual facility is unavailable, that facility will be excluded from the denominator. Univariate data distributions will be explored using frequencies and proportions for discrete/ categorical variables, and means/standard deviations/histograms or medians/ranges for continuous variables, as appropriate. Qualitative graphical displays of data will be employed as required (e.g. pareto charts). Correlations, chi-square tests and Student's t-tests/ one-way analysis of variance (ANOVA) will be used to examine basic bivariate associations. Non-parametric Wilcoxon rank sum tests will be considered for small sample sizes. Depending on data quality and appropriateness, opportunities for multivariate analysis will be considered. Mixed model approaches accounting for within-center clustering of outcomes and backward elimination model building strategies will be employed. Type 1 error rate will be controlled at 0.05 and SAS version 9.3 will be used for all statistical analyses.

RESULTS

Summary of health facilities and health workers surveyed

There were 117 facilities surveyed in the 11 target districts. The assessment was carried out over a period of 5 weeks from 13 July to 15 August 2014. Wave 1 health facilities (e.g. hospitals, current EmONC, and prospective EmONC facilities) comprised the majority (66%, n=79) of facilities assessed. The remaining 44% of the sites (n=38) were health posts and non-prospective EmONC (Table 4). More than half (55%) of all facilities surveyed were in urban locations and the GRZ was the operating agency for 96.5%; only 3.5% were mission-operated.

We also interviewed a total of 487 health workers in the MDGi districts. Two hundred and forty three (243) interviews were conducted with providers of maternal and newborn health, and 244 interviews assessed health worker provider knowledge and competency for Infant and child health, nutrition care.

Table 4: Number of facilities assessed by district

	Facility Type						
	Wave 1				Wave 2		
District	Prospective EmONC	Current EmONC	Hospital	All	Health Post	Non prospective EmONC	All
Chilanga	3	0	0	3	0	1	1
Chongwe	3	1	1	5	2	1	3
Kafue	4	0	1	5	2	3	5
Lusaka	2	12	2	16	2	2	4
Rufunsa	5	0	1	6	5	0	5
Subtotal Lusaka Province	**17**	**13**	**5**	**35**	**11**	**7**	**18**
Chingola	3	3	1	7	1	1	2
Kitwe	2	4	1	7	1	4	5
Luanshya	3	2	2	7	0	0	0
Masaiti	1	8	0	9	5	4	9
Mufulira	5	0	2	7	1	0	1
Ndola	5	0	2	7	0	3	3
Subtotal Copperbelt Province	**19**	**17**	**8**	**44**	**8**	**12**	**20**
All	**36**	**30**	**13**	**79**	**19**	**19**	**38**

Basic Infrastructure

Basic infrastructure to support the delivery of general medical including EmONC services (physical space, water, electricity, communication systems) was assessed. All comprehensive and basic EmONC facilities had at least a stand alone or combined labor and delivery room. All hospitals apart from Arthur Davidson Children's Hospital had operating theatres, laboratories and blood banks (Table 5). However, only 62% of hospitals had neonatal intensive care units (NICU). There were five hospitals that did not have NICUs. These included Nchanga North Hospital (Chingola District), Mpanshya Mission Hospital (Rufunsa District), Chongwe District Hospital, Kafue District Hospital, and Kamuchanga District Hospital (Mufulira District).

Only 37% (43 facilities) had pharmacies available 24 hours per day; 100% had medication supplies, and the government was the source of medications. Concerning physical infrastructure for infection prevention, only 37% of all facilities assessed had functional incinerators. Hospitals were

well supplied with 92% of all hospitals having incinerators, apart from Chongwe hospital. Incinerator availability declined with lower level type of facility with respect to EmONC service provision. Close to 50% of all current EmONC sites had incinerators; 31% of the prospective EmONC, 26% of the non-prospective, and only 6% of the health posts had incinerators.

Inspection of the health facilities revealed liquid spills or trash on the floor in only 4% of all facilities (5/117) and body fluids visible on the floor in 9%.

Table 5. Essential health facility units

	Facility Type											
	All (N=117)		Health Post (N=19)		Non-EmONC (N=19)		Prospective EmONC (N=36)		Current EmONC (N=30)		Hospital (N=13)	
	n	%	n	%	N	%	n	%	n	%	n	%
Labor room	44	38	4	21	1	5	14	39	15	50	10	77
Delivery room	45	38	4	21	1	5	15	42	15	50	10	77
Labor and delivery room (combined)	50	43	3	16	9	47	21	58	13	43	4	33
Postpartum room	56	48	3	16	3	16	18	50	20	67	12	92
Operating theatre	19	16	0	0	0	0	0	0	6	20	13	100
NICU	8	7	0	0	0	0	0	0	0	0	8	62
Pharmacy	111	95	18	95	15	79	35	97	30	100	13	100
Blood bank	7	6	0	0	0	0	0	0	0	0	7	54
Laboratory	52	44	6	32	0	0	11	31	25	83	10	77
Blood bank and lab combined	7	6	0	0	0	0	2	6	0	0	5	45
Incinerator	43	37	5	26	1	6	11	31	14	47	12	92

Seven facilities, one hospital and six current EmONC sites, mainly in Lusaka and Masaiti Districts, did not have enough delivery space. Pregnant women in these facilitates delivered on the floor and often had to share beds. The seven were: UTH, George, Mtendere, Chipata and Kanyama in Lusaka District and Kambowa and Chinondo in Masaiti District on the Copperbelt.

Nearly all the facilities assessed (97.4%) had access to functional piped or bore hole water for their use (Table 6). The remaining 2.6% also had access to water (or were connected to a water supply system) but their water supply source had malfunctioned. These health centers, which required urgent repairs, included Kankumba in Rufunsa; Kafironda and Kansuswa in Mufulira.

Table 6: Functional water supply & sanitation

	Facility Type											
	All (N=117)		Health Post (N=19)		Non-EmONC (N=19)		Prospective EmONC (N=36)		Current EmONC (N=30)		Hospital (N=13)	
	n	%	N	%	n	%	N	%	n	%	n	%
Water sources												
Piped	52	44.4	10	52.6	4	21.1	12	33.3	17	56.7	9	69.2
Hand pump / borehole	57	48.7	8	42.1	14	73.7	20	55.6	12	40	3	23.1
Other	5	4.3	1	5.3	0	0	2	5.6	1	3.3	1	7.7
No functional water supply	3	2.6	0	0	1	5.3	2	5.6	0	0	0	0
Functioning toilet available												
None available	11	9.7	5	27.8	3	15.8	2	5.9	1	3.5	0	0.0
Staff only	7	6.2	2	11.1	1	5.3	0	0.0	3	10.3	1	7.7
Clients only	6	5.3	2	11.1	1	5.3	0	0.0	1	3.5	2	15.4
Shared toilet	6	5.3	1	5.6	1	5.3	3	8.8	1	3.5	0	0.0
Toilet for staff and toilet for clients	83	73.5	8	44.4	13	68.4	29	85.3	23	79.3	10	76.9
Direction observations												
Soap and water available near toilet	60	57	7	47	7	44	19	56	17	59	10	83
Liquid spills or trash on floor	5	4	1	6	0	0	1	3	3	1	0	0
Body fluid visible on floor	10	9	3	17	0	0	5	14	2	7	0	0

The availability and flow of water was good at all hospitals with only 0.45 mean days without water in the past month. The flow of water was only problematic in non-prospective EmONC facilities with 1.38 mean days without water in the past month. The situation was worse in the current EmONC facilities with 1.67 mean days without water supply. Water flow was fair at prospective EmONC sites with 1.03 mean days without water in the past month, and 0.72 mean days without water at health posts.

Toilet facilities for either staff or clients were not available in 11 of the 117 assessed facilities. The facilities without toilets were located on both the Copperbelt (5 health posts) and Lusaka (4 health posts). Whilst most of these 11 facilities did not provide deliveries, toilets are important basic waste disposal infrastructure for any clinic. Two major reasons for lacking toilet facilities in the 11 health facilities were lack of water, collapsed pit latrines, or newly constructed health posts, especially in Rufunsa, where pit latrines had not yet been constructed.

Similar to the situation with the water supply, 95% of all facilities had access to electricity, and it was currently functional in 90% of the facilities (Table 7). Apart from Mpashya Mission Hospital in Rufunsa, which was supplied by a generator, all the other hospitals had current functional electricity with few power interruptions (mean of 0.55 ± 0.93 days without power supply in the last month.

Table 7: Electricity supply

	Facility Type											
	All (N=117)		Health Post (N=19)		Non-EmONC (N=19)		Pro-spective EmONC (N=36)		Current EmONC (N=30)		Hospital (N=13)	
	n	%	n	%	N	%	n	%	n	%	n	%
Functional electricity	110	95	19	100	15	83	34	94	29	97.0	13	100
Electricity currently functioning	101	90	17	89	12	80	31	86.1	29	96.7	12	92
No electricity currently functioning	16	10	2		7	20	5	13.9	1	3.3	1	8
Primary source of electricity												
Power lines	99	88.4	19	100	10	62.5	29	82.9	29	100	12	92.3
Generator	2	1.8	0	0	1	6.3	0	0	0	0	1	7.7
Solar	11	9.8	0	0	5	31.3	6	17.1	0	0	0	0
Reason electricity not functioning												
Needs maintenance	3	42.9	0	0	1	100	2	50	0	0	0	0
Load shedding	2	28.6	0	0	0	0	1	25	0	0	1	100
Other (unspecified)	2	28.6	1	100	0	0	1	25		0	0	0

The facilities that were most affected by power interruptions were health posts (mean 4.5 days without electricity), and the prospective and non-prospective EmONC centers with 4.26 mean days and 4.43 mean days without power in the last month respectively; hospitals had the least breaks in power availability (mean 0.5 days per month). The majority of the affected prospective EmONC facilities were on the Copperbelt whilst non-prospective affected facilities were spread out equally between Lusaka and Copperbelt Provinces. Reasons for current functionality problems in the two types of facilities ranged from load shedding to lack of adequate maintenance of the solar power systems. A few health posts without any electricity access required new connectivity.

The back up power supply was available only for 30% of all health facilities and was not available for two hospitals: Nchanga in Chingola and Roan Antelope in Luanshya, both on the Copperbelt. In addition there were 20 current EmONC sites, mostly in Lusaka, and another 27 prospective EmONC sites, mostly on the Copperbelt that did not have backup power.
The assessment of communication systems for emergency referrals revealed that 95% of the facilities had a cell phone signal (Table 8). Staff in 86% of these facilities owned personal cell phones but the policy for reimbursing staff for cell phone use was however very weak. Only 10% of the facilities had such a reimbursement policy in place. The bulk of the facilities without cell phone signal were in Masaiti District, and despite having two-way radios as alternative communication, these radios did not work in 1 of the 6 facilities without mobile phone signal.

Table 8: Communication infrastructure

	Facility Type											
	All (N=117)		Health Post (N=19)		Non-EmONC (N=19)		Pro-spective EmONC (N=36)		Current EmONC (N=30)		Hospital (N=13)	
	n	%	n	%	n	%	N	%	n	%	n	%
Landline in facility	15	13	1	5	1	6	0	0	4	13	9	75
Landline in maternity area	4	4	0	0	0	0	1	3	0	0	3	25
Cell phone owned by facility	56	49	9	47	2	11	14	39	19	63	12	1
Cell phone owned by staff member	99	86	17	89	17	94	31	86	26	87	8	67
Policy for reimbursing staff for cell phone use	11	10	3	17	0	0	3	8	4	13	1	8
Cell phone signal in facility	109	95	18	95	16	89	34	97	28	93	13	1
Two-way radio in facility	19	17	4	22	1	6	6	17	8	27	0	0

Fifty percent (50%) of the current EmONC and 36% of the prospective EmONC health facilities had functional motorized transport (ambulances or an equivalent) (Table 9). Notably very few had functional stretchers with the exception of hospitals (69%).

Table 9: Functional transport

	Facility Type											
	All (N=117)		Health Post (N=19)		Non-EmONC (N=19)		Pro-spective EmONC (N=36)		Current EmONC (N=30)		Hospital (N=13)	
	n	%	N	%	n	%	n	%	n	%	n	%
Functional motor vehicle	52	45	7	37	5	28	13	36	15	50	12	90
Functional motorcycle	18	16	3	16	1	6	7	19	4	13	3	25
Functional boat	1	1	0	0	0	0	1	3	0	0	0	0
Functional stretcher	27	23	2	11	3	17	6	17	7	23	9	69
Functional bicycle	41	36	9	47	6	35	13	36	11	37	2	17
Transport funds ever available for referral	14	12	2	11	4	21	0	0	8	27	0	0
Source of tools, parts, and mechanics for vehicle maintenance	44	7	6	75	4	5	11	58	15	94	8	67
Sufficient fuel available for vehicles	39	76	4	57	4	8	8	62	13	93	10	83

Seven facilities, one hospital and six current EmONC sites mainly in Lusaka and Masaiti Districts, did not have enough delivery space. Pregnant women in these facilitates delivered on the floor and often had to share beds. The seven were: UTH, George, Mtendere, Chipata and Kanyama in Lusaka District and Kambowa and Chinondo in Masaiti District on the Copperbelt.

The availability of registers for maternal and newborn care was excellent for labor and delivery wards and operating theaters (hospitals only) but less consistent for postpartum, gynecology ward, and newborn registers (Table 10). Surprisingly the newborn register was missing in many facilities, even current EmONC health centers and hospitals. Family planning registers were not available in

about 2/3 of all facilities. Safe abortion/post-abortion registers were rarely found in current EmONC health centers but were more common in hospitals. There were also small gaps in the availability of referral registers and major gaps in the availability of discharge registers, predominantly at lower levels of the health system. Generally HIV-related registers were widely available but PMTCT registers were not consistently available in the labor and delivery ward.

Table 10: Facility register availability

Registers (% facilities with register available and used)	Facility Type											
	Overall		Health Post (n = 19)		Non-EmONC Health Centre (n = 19)		Prospective EmONC Health Centre (n = 36)		Current EmONC Health Centre (n = 30)		Hospital (n =13)	
	N	%	N	%	N	%	N	%	N	%	N	%
Registers used for maternal and newborn care:												
Labor and delivery (L&D) ward register	84	74	9	50	7	37	29	83	28	93	11	92
Postpartum ward register	43	38	5	28	5	26	12	34	12	40	9	75
Newborn register	44	39	3	18	4	21	14	40	16	53	7	58
Operating theater register	12	11	0	0	0	0	0	0	0	0	12	100
Gynecology ward register	11	10	0	0	0	0	0	0	2	7	9	75
Family planning register in postpartum ward	39	34	7	39	4	21	8	23	16	53	4	33
Safe abortion/post-abortion register	23	21	0	0	0	0	3	9	11	37	9	82
Death/mortuary register	22	20	0	0	0	0	1	3	9	30	12	100
PMTCT L & D register	69	61	7	39	6	32	23	68	24	80	9	75
Referral register	75	66	11	61	14	74	19	54	24	80	7	64
Drug inventory register	89	78	13	72	15	79	24	69	26	87	11	92
Discharge register	32	29	0	0	1	6	7	21	16	55	8	73
Pediatric ward register	19	17	0	0	0	0	0	0	8	27	11	92
Malnutrition register	48	42	3	17	9	47	11	31	15	50	10	83
Youth friendly registers	24	21	0	0	6	32	6	17	9	30	3	25
General facility registers:												
VCT integrated register	97	85	13	72	16	84	29	83	27	90	12	100
Safe motherhood register	98	86	11	61	16	84	34	97	30	100	7	58
HIV counseling and testing register	107	94	14	78	17	89	34	97	30	100	12	100
Integrated PMTCT register	86	75	7	39	14	74	29	83	27	90	9	75
Family planning register	104	92	16	89	17	94	35	100	30	100	6	50
Community follow-up Register	39	35	3	17	7	37	11	32	17	57	1	8
Pre-ART register	70	61	4	22	10	53	23	66	22	73	11	92
ART register	65	57	2	11	8	42	21	60	23	77	11	92
EID (early infant diagnosis)	44	39	1	6	6	32	12	34	20	69	5	42
DNA PCR requisition book	70	63	4	22	10	53	22	67	25	86	9	75
HMIS (Health Management Information System) reports	105	93	13	76	18	95	34	97	28	93	12	100
SmartCare forms	41	36	2	11	4	21	10	29	16	55	9	75
Baby mother follow-up register	85	75	10	56	7	37	29	83	28	93	11	92

Human Resources

Health posts had a median of 2 employees, usually consisting of an enrolled nurse and one certified daily employee (CDE). In addition, there was a median of 2 community health workers (CHWs) and 2 traditional birth attendants (TBAs) (Table 11). While few health posts had community health assistants (CHA), one health post had 8 CHAs. Among the 19 non-EmONC health centers, there was generally a larger team of health workers consisting mainly of enrolled nurses, CDEs, registered and enrolled midwives, and environmental health technologists (EHTs). There also were more CHWs and TBAs associated with health centers than health posts. Prospective EmONC health centers, had staff levels that were similar to non-EmONC health centers. By contrast in the current EmONC health centers, there were many more enrolled and registered midwives with substantial numbers of nurses, clinical officers, and CDEs. Notably at this level of the health system, there were fewer CHWs and TBAs associated with the health center. The hospital level data are provided in Annex 1 because the table, even in landscape format, is too wide for the document.

Table 11. Cadres of health workers stratified by level of health system

	Health Post		No EmONC Health Centre		Prospective EmONC Health Centre		Current EmONC Health Centre		Hospital	
	N	Median (Range)	N	Median (Range)	N	Median (Range)	N	Median (Range)	N	Median (Range)
Nutritionists	19	0 (0)	19	0 (0-1)	36	0 (0-1)	30	1 (0-2)	13	1 (0-6)
Doctors	19	0 (0)	19	0 (0-1)	36	0 (0-1)	30	0 (0-3)	13	10 (2-355)
Medical licentiates	19	0 (0)	19	0 (0)	36	0 (0)	30	0 (0-1)	13	0 (0-3)
Clinical officers	19	0 (0-1)	19	1 (0-3)	36	1 (0-5)	30	3 (0-10)	13	10 (3-21)
Registered nurses	19	0 (0-2)	19	1 (0-5)	36	1 (0-7)	30	4 (0-16)	13	36 (8-507)
Enrolled nurses	19	1 (0-2)	19	2 (0-13)	36	2 (0-12)	30	5 (0-16)	13	43 (8-322)
Registered midwives	19	0 (0-1)	19	1 (0-2)	36	1 (0-4)	29	3 (0-10)	13	8 (3-63)
Enrolled midwives	19	0 (0-1)	19	1 (0-6)	36	1 (0-9)	30	7 (0-16)	13	10 (2-28)
Certified midwives	19	0 (0-3)	19	0 (0-1)	36	0 (0-3)	30	1 (0-17)	13	10 (0-19)
Pediatric specialists	19	0 (0)	19	0 (0)	36	0 (0)	30	0 (0)	13	1 (0-18)
Trained birth attendants	19	2 (0-12)	19	3 (0-26)	35	4 (0-25)	30	0 (0-16)	13	0 (0-18)
Untrained birth attendants	19	0 (0-10)	19	0 (0-8)	36	0 (0-11)	30	0 (0-4)	13	0 (0)
Community health workers	19	2 (0-50)	19	4 (0-36)	35	4 (0-34)	30	1 (0-334)	12	0 (0-7)
Community health assistants	19	0 (0-8)	18	0 (0-1)	36	0 (0-4)	30	0 (0-3)	12	0 (0-1)
Environmental health technicians	19	0 (0-1)	19	1 (0-2)	36	1 (0-2)	30	1 (0-3)	12	1 (0-4)
Classified daily employees	19	1 (0-4)	19	3 (1-7)	36	3 (0-11)	30	5 (1-55)	13	31 (0-900)
Radiology staff	19	0 (0)	19	0 (0)	36	0 (0-1)	30	0 (0-6)	12	4 (1-20)
Radiologists	0	--	1	0 (0)	1	0 (0-1)	1	0 (0)	13	0 (0-3)
Laboratory staff	19	0 (0)	19	0 (0-2)	36	0 (0-3)	30	2 (0-5)	12	9 (3-30)

Human Resources Gap Analysis

We conducted a gap analysis comparing data collected during the baseline health facility survey with the 2014 Establishment Register for MCDMCH (data provided in supplemental Excel spreadsheet) using one health facility from each of the health system. The analysis of UTH and Ndola Central Hospital has not yet been performed as these establishment data have not been provided to the ZCAHRD team. All six delivery centers that we analyzed as examples had no problem with human resources in terms of nursing and midwive staffing apart from Luangwa Urban Clinic in Kitwe which had gaps in nursing staff and doctors (missing two midwives, two nurses, and two doctors). The other delivery centers analyzed were either over employed by one cadre in each of the general nursing category and registered midwives but had under employed midwives by one cadre.

The other cadre of staff that is underemployed based on the official establishment register data is the Classified Daily Employee (CDE), which had insufficient numbers in 4 out 6 examples analyzed. Doctors are also under-employed by one to two in the two facilities that need to have doctors. Though this is a very limited sample, it gives a pattern of staffing levels available in clinics. Urban health posts seem to have relatively better staffing in the establishment up to five staff including CDE whilst rural HP only have 2 in the establishment.

According to the establishment registers, there is a shortage of enrolled and registered nurses and midwives at both Ndola Central and UTH. Specifically, the shortage of nurses at Ndola Central Hospital was 152 (34%) and at UTH was 291 (26%) when compared to their required numbers for nurses. The shortage for midwives was 29 (30%) at Ndola Central Hospital and 88 (44%) at UTH. There are adequate numbers of doctors at UTH due to supplementation by many interns.

Pharmacy

This section deals with results from the assessment of pharmacy, laboratory and blood bank. The assessment of the health facilities was aimed at determining if health centers had a functional pharmacy, laboratory and blood bank that operated according to a set of guidelines (Table 12). There was only one hospital, Levy Mwanawasa Hospital, which had a pharmacy available 24 hours a day. Pharmacy assessment included asking and verifying the major source of medicines for the facility, availability of a drug inventory register, when drugs where ordered and the overall management system of drugs and other supplies such as gloves and syringes. Availability of optimal and adequate storage space was also assessed.

Table 12. Pharmacy availability, operating hours, medication supply and drug inventory register

	All		Facility type									
			Health Post		Non-EmONC Health Centre		Pro-spective EmONC Health Centre		Current EmONC Health Centre		Hospital	
	N	%	N	%	N	%	N	%	N	%	N	%
Facility has pharmacy	111	95	15	79	18	95	35	97	30	100	13	100
Pharmacy available 24 hours	43	37	9	50	6	32	15	43	12	40	1	8
Facility has medication supply	115	99	17	94	19	100	36	100	30	100	13	100
Drug inventory register	91	78	12	75	16	80	24	69	27	84	12	92

Assessment of pharmacies to determine essential drug availability is presented in Table 13. Generally, availability of all categories of drugs, which include antiretroviral drugs, was not impressive. Drug availability is intermittent at all health facilities. It was not uncommon to find complete stock outs for most drugs during the assessment and further review of records showed that for most drugs, there was at least one stock out in the last 12 months.

Table 13. Availability of selected drugs at time of assessment and during last 3 months

	All				Facility type																	
					Health Post				No EmONC Health Centre				Prospective EmONC Health Centre				Current EmONC Health Centre				Hospital			
	Currently in Stock		Stock-out in past 3 months		Currently in Stock		Stock-out in past 3 months		Currently in Stock		Stock-out in past 3 months		Currently in Stock		Stock-out in past 3 months		Currently in Stock		Stock-out in past 3 months		Currently in Stock		Stock-out in past 3 months	
ARVs	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**	**# (N)**	**%**
3tc	55 (110)	50	46 (117)	39	1 (14)	7	11 (19)	58	8 (19)	42	9 (19)	47	13 (34)	38	13 (36)	36	20 (30)	67	12 (30)	40	13 (13)	100	1 (13)	8
AVT-Atazanir	2 (100)	2	81 (117)	69	0 (14)	0	12 (19)	63	1 (18)	6	14 (19)	74	0 (30)	0	20 (36)	56	0 (27)	0	27 (30)	90	1 (11)	9	8 (13)	62
AZT syrup	9 (109)	8	77 (117)	66	0 (14)	0	12 (19)	63	1 (19)	5	15 (19)	79	4 (34)	12	20 (36)	56	1 (30)	3	24 (30)	80	3 (12)	25	6 (13)	46
AZT/3TC (combivir)	86 (110)	78	21 (117)	18	3 (14)	21	8 (19)	42	17 (19)	89	3 (19)	16	27 (34)	79	4 (36)	11	27 (30)	90	3 (30)	10	12 (13)	92	3 (13)	23
Antibiotics																								
Amoxicillin	106 (110)	96	4 (117)	3	12 (14)	86	1 (19)	5	19 (19)	100	2 (19)	11	33 (34)	97	1 (36)	3	29 (30)	97	0 (30)	0	13 (13)	100	0 (13)	0
Amicillin injection	11 (110)	10	87 (117)	74	1 (14)	7	11 (19)	58	0 (19)	0	15 (19)	79	0 (34)	0	26 (36)	72	0 (30)	0	30 (30)	100	10 (13)	77	5 (13)	38
Cefixime	18 (109)	17	77 (117)	66	3 (14)	21	9 (19)	47	3 (19)	16	13 (19)	68	3 (34)	9	22 (36)	61	5 (29)	17	25 (30)	83	4 (13)	31	8 (13)	62
Anticonvulsants																								
Diazepam (valium injection)	100 (110)	91	9 (117)	8	10 (14)	71	3 (19)	16	19 (19)	100	0 (19)	0	33 (34)	97	2 (36)	6	29 (30)	97	1 (30)	3	9 (13)	69	3 (13)	23
Magnesium sulfate injection 50%	36 (110)	33	59 (117)	50	1 (14)	7	10 (19)	53	5 (19)	26	11 (19)	58	9 (34)	26	18 (36)	50	12 (30)	40	18 (30)	60	9 (13)	69	2 (13)	15
Antimalarials																								
Artemether-lumefantrine (coartem)	108 (110)	98	2 (117)	2	13 (14)	93	1 (19)	5	19 (19)	100	0 (19)	0	33 (34)	97	0 (36)	0	30 (30)	100	0 (30)	0	13 (13)	100	1 (13)	8
Parenteral Artesunate	9 (110)	8	82 (117)	70	0 (14)	0	12 (19)	63	0 (19)	0	15 (19)	79	0 (34)	0	24 (36)	67	3 (30)	10	25 (30)	67	6 (13)	46	6 (13)	46

All health facilities do not appear to have a systematic way of ordering drugs and other supplies across the spectrum of health facilities surveyed (Table 14). All health facilities order and receive drugs from the government.

Table 14. Drug supply order process in labor and delivery

	All		Facility type									
			Health Post		Non-EmONC Health Centre		Prospective EmONC Health Centre		Current EmONC Health Centre		Hospital	
	N	%	N	%	N	%	N	%	N	%	N	%
Same time each week/month/quarter	53	66.3	2	40	4	57.1	17	58.6	20	74.1	10	83.3
Stocks reach reorder level	10	12.5	1	20	1	14.3	4	13.8	4	14.8	0	0
When stocks run out	6	7.5	0	0	1	14.3	3	10.3	2	7.4	0	0
Patient by patient basis	9	11.3	2	40	1	14.3	4	13.8	1	3.7	1	8.3
Other	2	2.5	0	0	0	0	1	3.45	0	0	1	8.3
Drug supply orders in postnatal ward												
Same time each week/month/quarter	52	65.0	1	20	4	57.1	18	62.1	20	74.1	9	75.0
Stocks reach reorder level	8	10.0	2	40	1	14.3	2	6.9	3	11.1	0	0
When stocks run out	5	6.25	0	0	1	14.3	2	6.9	2	7.41	0	0
Patient by patient basis	10	12.5	2	40	0	0	4	13.8	2	7.4	2	16.7
Other	5	6.25	0	0	1	14.3	3	10.3	0	0	1	8.3

Laboratory and Blood Bank

Laboratory assessment included determining which facilities had a lab and could perform dried blood spot (DBS), creatinine, viral load, hemoglobin (Hb), ALT, and HIV opportunistic infection testing (Table 15). We also assessed if the health facilities had a microscope and could perform malaria rapid diagnostic tests (RDT). The number of trained lab technicians to conduct AFB microscopy was also assessed. Only 57% of surveyed health facilities had a lab. The scope of tests that can be performed at these labs varied considerably from very basic tests such as a microscopy for malaria at health centers to blood safety testing for syphilis and hepatitis C at hospitals. Only one lab at a tertiary hospital has the capacity to do HIV viral loads, which are critical in management of HIV patients.

Table 15. Capacity of labs at health facilities to conduct selected tests

	All		Facility type									
			Health Post		Non-EmONC Health Centre		Prospective EmONC Health Centre		Current EmONC Health Centre		Hospital	
	N	%	N	%	N	%	N	%	N	%	N	%
Does this facility have a laboratory?	57	49	0	0	6	32	13	36	25	83	13	100
Is there a set of guidelines for the laboratory?	49	74	0	0	3	33	10	63	23	92	13	100
Does this facility have the capacity to perform DBS tests?	25	37	0	0	4	44	3	19	13	52	5	38
Does this facility have the capacity to perform creatinine tests?	28	42	0	0	2	25	4	25	10	40	12	92
Does this facility have the capacity to perform viral load tests?	2	3	0	0	0	0	0	0	1	4	1	8
Does this facility have the capacity to perform Hb tests?	50	75	0	0	5	56	7	47	25	96	13	100
Does this facility have the capacity to perform ALT tests?	28	43	0	0	2	25	4	27	10	40	12	92

There were many gaps in the availability of key supplies for laboratories especially at lower levels of the health system (Table 16). In contrast, in hospitals and EmONC health centers where blood transfusion might be provided, there was generally an adequate supply of materials necessary for this life-saving procedure (Table 17).

Table 16. General laboratory supplies and equipment at health facilities

	All			Facility type														
				Health Post			No EmONC Health Centre			Prospective EmONC Health Centre			Current EmONC Health Centre			Hospital		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
Refrigerator for blood bank	16	103	16%	0	15	0%	0	15	0%	1	32	3%	2	28	7%	13	13	100%
Test tubes, small	21	103	20%	0	15	0%	1	15	7%	3	32	9%	7	28	25%	10	13	77%
Test tubes, medium	17	103	17%	0	15	0%	0	15	0%	3	32	9%	6	28	21%	8	13	62%
Microscope slides	48	102	47%	0	14	0%	3	15	20%	12	32	38%	20	28	71%	13	13	100%
Compound refrigerator	9	102	9%	0	14	0%	0	15	0%	1	32	3%	4	28	14%	4	13	31%
Microscope illuminator	14	102	14%	0	15	0%	0	15	0%	1	32	3%	8	27	30%	5	13	38%
Blood lancets	55	102	54%	1	14	7%	5	15	33%	15	32	47%	21	28	75%	13	13	100%
Cotton wool	69	103	67%	8	15	53%	9	15	60%	17	32	53%	22	28	79%	13	13	100%
Rack	49	103	48%	1	15	7%	3	15	20%	13	32	41%	20	28	71%	12	13	92%
8.5g/l sodium chloride solution	39	103	38%	2	15	13%	2	15	13%	7	32	22%	15	28	54%	13	13	100%
20% bovine albumin	10	103	10%	1	15	7%	0	15	0%	1	32	3%	1	28	4%	7	13	54%
Centrifuge, electric	37	103	36%	0	15	0%	3	15	20%	6	32	19%	15	28	54%	13	13	100%
Centrifuge, hand-driven	4	103	4%	0	15	0%	0	15	0%	0	32	0%	2	28	7%	2	13	15%
37 C water bath or incubator	18	103	17%	0	15	0%	0	15	0%	2	32	6%	6	28	21%	10	13	77%
Pipettes volumetric, 1 mL	22	103	21%	0	15	0%	1	15	7%	6	32	19%	8	28	29%	7	13	54%
Pipettes volumetric, 2 mL	11	103	11%	0	15	0%	0	15	0%	3	32	9%	3	28	11%	5	13	38%
Pipettes volumetric, 3mL	27	103	26%	0	15	0%	1	15	7%	8	32	25%	9	28	32%	9	13	69%
Pipettes volumetric, 5mL	9	103	9%	0	15	0%	0	15	0%	3	32	9%	2	28	7%	4	13	31%
Pipettes volumetric, 10mL	8	103	8%	0	15	0%	0	15	0%	2	32	6%	4	28	14%	2	13	15%
Pipettes volumetric, 20mL	6	103	6%	0	15	0%	0	15	0%	0	32	0%	4	28	14%	2	13	15%
Pipettes holder	5	103	5%	0	15	0%	0	15	0%	0	32	0%	2	28	7%	3	13	23%
Blood typing and cross-matching reagents	16	102	16%	0	14	0%	1	15	7%	1	32	3%	3	28	11%	11	13	85%
Bags for collecting blood	2	102	2%	0	15	0%	0	15	0%	0	31	0%	1	28	4%	1	13	8%

Table 17. Health facility capacity to test blood safety prior to transfusion

	All			Facility type														
				Health Post			No EmONC Health Centre			Prospective EmONC Health Centre			Current EmONC Health Centre			Hospital		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
Airway needle for giving blood	9	105	9	0	15	0	0	15	0	0	32	0	0	30	0	9	13	69
Artery forceps	10	104	10	1	15	7	1	15	7	3	32	9	2	29	7	3	13	23
Anticoagulant bottles	40	105	38	1	15	7	3	15	20	7	32	22	19	30	63	10	13	77
Scale for blood collection	9	105	9	0	15	0	0	15	0	1	32	3	2	30	7	6	13	46
Hepatitis B test	39	105	37	0	15	0	3	15	20	7	32	22	16	30	53	13	13	100
Hepatitis C test	7	105	7	0	15	0	0	15	0	0	32	0	2	30	7	5	13	38
HIV test	92	107	86	11	16	69	14	16	88	28	32	88	27	30	90	12	13	92
Syphilis test	47	105	45	3	15	20	7	15	47	11	32	34	16	30	53	10	13	77
Rapid syphilis test	67	106	63	7	15	47	11	16	69	18	32	56	19	30	63	12	13	92
Malaria rapid diagnostic test	85	107	79	14	16	88	16	17	94	25	31	81	19	30	63	11	13	85

Maternal and Newborn Health Services

There were 88 facilities that conducted deliveries. Enrolled midwives were the cadre of health worker that most commonly conducted deliveries (72%) followed by enrolled nurses (36%), certified midwives (36%), and registered nurses (24%) (Table 18). Notably unskilled birth attendants conducted deliveries in 18% of facilities. This latter practice occurred most commonly in non-EmONC health centers (55%) and prospective EmONC centers (30%). Survey respondents stated that 15.9% (14 of 88 facilities that did deliveries) of women stay <6 hours after delivery while the majority (83%) stay 6-24 hours and only 1.1% stay for >24 hours.

Table 18: Delivery attendants and delivery location characteristics

Delivery Characteristics (% of facilities)	Overall		Facility Type									
			Health Post (n = 19)		Non-EmONC Health Center (n = 19)		Prospective EmONC Health Center (n = 36)		Current EmONC Health Center (n = 30)		Hospital (n =13)	
	N	%	N	%	N	%	N	%	N	%	N	%
Conducted deliveries (past 12 months)	88	75	11	58	7	37	30	83	28	93	12	92
Delivery attendants:												
Specialist	7	8	0	0	0	0	0	0	1	4	6	50
Doctor	11	13	0	0	0	0	0	0	1	4	10	83
Medical licentiate	5	6	0	0	0	0	0	0	1	4	4	33
Clinical officer	16	18	1	9	2	29	7	23	5	18	1	8
Enrolled nurses	21	24	1	9	4	57	9	30	7	25	0	0
Registered nurse	32	36	8	73	3	43	13	43	8	29	0	0
Registered midwife	47	53	1	9	1	14	12	40	21	75	12	100
Certified midwife	28	32	1	9	1	14	4	13	14	50	8	67
Enrolled midwife	63	72	2	18	3	43	23	77	23	82	12	100
Trained birth attendant	16	18	6	55	1	14	9	30	0	0	0	0
Untrained birth assistant	7	8	0	0	0	0	0	0	1	4	6	50
Women delivering on the floor (% never)	80	91	10	91	6	86	29	97	24	86	11	92
Delivery patients sharing beds (% never)	79	91	11	100	6	100	28	93	23	82	11	92
Delivery patients sleeping on the floor (% never)	68	77	10	91	6	86	25	83	19	68	8	67
Stay at facility after uncomplicated delivery:												
< 6 hours	14	16	3	30	0	0	7	23	3	11	1	8
6-24 hours	73	83	7	70	7	100	23	74	25	89	11	92
>24 hours	1	1	0	0	0	0	1	3	0	0	0	0

Staff training in maternal and newborn health care

The level of staff training in essential newborn care was lowest in health posts and progressively increased to 93% in current EmONC health centers and 100% in hospitals (Table 19). Generally registered and enrolled midwifes, and doctors and medical licentiates in hospitals had the highest levels of essential newborn care training. Cadres of health care workers in health posts and non-EmONC heath centers had the largest gaps in training. Postnatal care training was 74% overall ranging from 58% of staff in health posts to 92% in hospitals. Like essential newborn care, generally registered and enrolled midwifes, and doctors and medical licentiates in hospitals had the highest levels of training. Other than certified and registered midwives, most cadres of health workers had insufficient levels of training in infection prevention.

Antenatal care training was very good overall (86%) with the greatest gaps in clinical officers (0%), registered nurses (8%), and enrolled midwives (54%). Overall 74% of staff had been trained in the active management of the third stage of labor (AMTSL). Training levels were highest in doctors and midwives and tended to increase in higher levels of the health system. PMTCT training was 66% overall and was highest in doctors and registered midwives. Gaps in PMTCT training appeared to be greatest at the lowest levels of the health system. Similar findings were observed for training on antiretroviral therapy (ART) although there were greater gaps in this training including only 17% of doctors having been trained in ART provision.

Table 19. Staff training in maternal and newborn health care

Staffing and training for maternal and newborn health (% facilities where at least one staff in each cadre is trained in)	Overall		Facility Type									
			Health Post (n = 19)		Non-EmONC Health Centre (n = 19)		Prospective EmONC Health Centre (n = 36)		Current EmONC Health Centre (n = 30)		Hospitals (n = 13)	
	N	%	N	%	N	%	N	%	N	%	N	%
Essential Newborn Care:												
Any staff	91	81	11	60	14	74	28	80	26	93	12	100
Doctor	16	14	0	0	0	0	1	3	2	7	13	100
Medical licentiate	7	6	0	0	0	0	0	0	2	7	5	38
Clinical officer	32	28	3	20	2	11	13	35	9	30	5	42
Registered nurse	38	32	5	30	1	5	18	50	9	30	5	38
Enrolled nurse	54	46	6	30	10	53	21	58	11	37	6	46
Registered midwife	56	48	4	20	1	5	15	42	23	77	13	100
Enrolled midwife	69	59	6	30	3	16	24	67	24	80	12	92
Certified midwife	31	26	1	10	1	5	6	17	15	50	8	62
Postnatal Care:												
Any staff	84	74	11	58	14	74	28	80	20	71	11	92
Doctor	14	12	0	0	0	0	1	3	1	3	12	92
Medical licentiate	6	5	0	0	0	0	0	0	2	7	4	31
Clinical officer	21	18	1	5	2	11	11	31	3	10	4	33
Registered nurse	29	25	2	11	6	32	14	39	4	13	3	23
Enrolled nurse	32	27	5	26	7	37	14	39	4	13	2	15
Registered midwife	53	45	0	0	9	47	15	42	19	63	10	77
Enrolled midwife	71	61	5	26	10	53	26	72	20	67	10	77
Certified midwife	26	22	1	5	1	5	7	19	12	40	5	38
Infection Prevention and Control:	84	75	11	58	15	79	26	74	20	74	12	100
Any staff	18	16	0	0	0	0	1	3	8	27	9	75

Doctor	7	6	1	5	0	0	0	0	3	10	3	25
Medical licentiate	41	36	1	5	5	26	15	43	14	47	6	50
Clinical officer	45	39	1	5	7	37	15	43	15	50	7	58
Registered nurse	62	54	7	37	11	58	20	57	16	53	8	67
Enrolled nurse	47	41	0	0	8	42	11	31	16	53	12	92
Registered midwife	62	53	5	26	7	37	21	60	17	57	12	92
Enrolled midwife	22	19	1	5	1	5	5	14	10	33	5	38
Certified midwife	84	75	11	58	15	79	26	74	20	74	12	100
Active Management of Third Stage Labor:												
Any staff	84	74	11	58	10	53	28	80	26	93	9	75
Doctor	11	9	0	0	0	0	1	3	1	3	9	69
Medical licentiate	5	4	0	0	0	0	0	0	1	3	4	31
Clinical officer	17	15	1	5	2	11	9	25	3	10	2	15
Registered nurse	19	16	1	5	3	16	12	33	2	7	1	8
Enrolled nurse	27	23	5	26	3	16	13	36	3	10	3	23
Registered midwife	50	43	0	0	5	26	14	39	22	73	9	75
Enrolled midwife	68	59	5	26	6	32	24	69	23	77	10	77
Certified midwife	30	26	2	11	1	5	6	17	13	43	8	62
Prevention of Mother to Child Transmission:												
Any staff	75	66	8	42	9	47	25	71	21	75	12	100
Doctor	17	15	0	0	1	5	1	3	5	17	10	83
Medical licentiate	4	3	1	5	0	0	0	0	0	0	3	25
Clinical officer	32	28	2	11	4	21	7	20	16	55	3	25
Registered nurse	27	23	2	11	4	21	7	19	9	30	5	42
Enrolled nurse	35	30	2	11	2	11	14	39	13	43	4	33
Registered midwife	49	42	0	0	6	32	12	33	18	60	13	100
Enrolled midwife	54	47	4	21	6	32	17	49	16	53	11	85
Certified midwife	6	5	0	0	0	0	2	6	2	7	2	15
Antiretroviral Therapy:	70	64	5	26	11	58	23	68	19	73	12	100
Any staff	20	18	0	0	1	5	1	3	8	29	10	83
Doctor	6	5	0	0	0	0	1	3	3	10	2	17
Medical licentiate	52	45	1	5	5	26	15	43	21	70	10	83
Clinical officer	40	35	2	11	4	21	9	25	16	55	9	75
Registered nurse	54	47	3	16	6	32	14	39	21	70	10	83
Enrolled nurse	33	28	0	0	6	32	7	19	14	47	6	50
Registered midwife	33	28	1	5	4	21	12	33	11	37	5	42
Enrolled midwife	4	3	0	0	1	5	1	3	2	7	0	0
Certified midwife	70	64	5	26	11	58	23	68	19	73	12	100
Antenatal Care:	96	86	15	79	16	84	30	88	25	89	10	83
Any staff	12	10	0	0	1	5	0	0	1	3	10	83
Doctor	3	3	0	0	0	0	0	0	0	0	3	25
Medical licentiate	17	15	2	11	4	21	9	26	2	7	0	0
Clinical officer	32	28	1	5	8	42	17	47	6	20	0	0
Registered nurse	50	43	10	53	10	53	23	64	6	20	1	8
Enrolled nurse	59	50	1	5	9	47	16	44	23	77	10	77
Registered midwife	77	66	4	21	10	53	27	77	25	83	11	85
Enrolled midwife	31	26	1	5	1	5	8	22	14	47	7	54
Certified midwife	96	86	15	79	16	84	30	88	25	89	10	83

Maternal and newborn health services: EmONC and other

Focused antenatal care was offered by 88% of facilities ranging from 58% of health posts to 97% of health centers (Table 20). Postnatal care was also commonly offered with the exception of non-EmONC health centers (only 63%). Obstetric surgery was offered in all hospitals except the Arthur Davidson Children's Hospital and general anesthesia was available in all hospitals. However, repair of obstetric fistula was only available in 42% (5/12) hospitals. Another notable service gap was for cervical screening (Pap smear) which was only done in 62% of hospitals and 47% of EmONC health centers. By contrast, diagnosis and treatment of STI was available in the majority of facilities ranging from 84% in health posts to 100% of EmONC health centers. Family planning, PMTCT, voluntary male circumcision, and logistics management services were commonly available services with lowest rates in health posts.

EmONC health centers and hospitals generally offered obstetric/neonatal, delivery and postnatal services in nearly 100% whereas these services were slightly less available at lower levels of the health system (Table 20). Post-delivery family planning services ranged from a low of 46% in health centers to a high of 83% of hospitals. Newborn resuscitation was highest in EmONC health centers and hospitals and lowest in non-EmONC health centers. Kangaroo mother care was offered in 69% of health facilities and notably was least common in EmONC health centers and hospitals.

The median distance to the nearest referral hospital was 18 km but ranged widely and was highest for health posts (Table 21). However, the estimated median time to nearest hospital was similar among all health facilities (30 minutes). Communication about referrals varied widely from 47% at non-EmONC health centers to 100% for health posts.

Table 20: Basic services and referral availability: maternal and newborn health

	All			Facility Type														
				Health Post			No EmONC Health Centre			Prospective EmONC Health Centre			Current EmONC Health Centre			Hospital		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
Basic Services																		
Antenatal care	103	117	88	11	19	58	17	19	89	35	36	97	28	30	93	12	13	92
Postnatal care	102	117	87	12	19	63	16	19	84	32	36	89	30	30	100	12	13	92
Obstetric surgery	12	117	10	0	19	0	0	19	0	0	36	0	0	30	0	12	13	92
General anesthesia	13	116	11	0	19	0	0	19	0	0	36	0	1	30	3	12	12	100
Fistula repair	6	117	5	0	19	0	0	19	0	1	36	3	0	30	0	5	13	38
Cervical screening	29	117	25	0	19	0	0	19	0	7	36	19	14	30	47	8	13	62
STI screening and treatment	111	117	95	16	19	84	17	19	89	36	36	100	30	30	100	12	13	92
Family planning services	112	117	96	18	19	95	17	19	89	36	36	100	30	30	100	11	13	85
PMTCT	105	117	90	11	19	58	17	19	89	35	36	97	29	30	97	13	13	100
Male circumcision	70	116	60	5	19	26	12	19	63	17	36	47	25	29	86	11	13	85
Logistics management	90	116	78	11	19	58	14	19	74	28	36	78	25	30	83	12	12	100
Service availability 24 hours/7days a week																		
Obstetric and neonatal care	79	117	68	9	19	47	4	19	21	25	36	69	28	30	93	13	13	100
Delivery	84	93	90	10	12	83	6	8	75	28	31	90	28	30	93	12	12	100
Postnatal care	86	94	91	10	12	83	6	8	75	28	32	88	30	30	100	12	12	100
Post-delivery family planning	67	98	68	6	13	46	3	10	30	24	33	73	24	30	80	10	12	83
Newborn resuscitation	77	91	85	9	12	75	4	7	57	24	31	77	28	29	97	12	12	100
Kangaroo mother care	63	91	69	9	12	75	5	7	71	23	31	74	18	29	62	8	12	67
Breastfeeding within 1 hour	86	90	96	10	11	91	6	7	86	30	31	97	28	29	97	12	12	100
Referral Services																		
Formal written protocol for referrals	81	115	70	14	19	74	11	18	61	21	36	58	27	30	90	8	12	67
Inform referral facility about the patient	53	116	46	12	19	63	5	19	26	16	36	44	13	30	43	7	12	58
Receive feedback about the outcome of patients	48	116	41	9	19	47	7	19	37	14	36	39	14	30	47	4	12	33
Receive feedback about quality of care of patients	42	116	36	5	19	26	6	19	3	17	36	47%	11	30	37	3	12	25

Table 21: Referral details

	All			Facility Type														
				Health Post			No EmONC Health Centre			Prospective EmONC Health Centre			Current EmONC Health Centre			Hospital		
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
Distance to nearest referral hospital with surgical facility	18	2	324	25	5	67	12	3	75	18	6	70	15	2	100	49	4	324
Time to nearest referral hospital with surgical facility	30	2	300	30	10	115	30	2	120	30	7	130	20	3	130	40	10	300

EmONC signal functions and other related services

Among the 7 signal functions that constitute basic EmONC, the administration of uterotonic drugs, and parenteral antibiotics were the most commonly performed functions whereas parenteral anticonvulsants, newborn resuscitation, manual removal of placenta, and removal of retained products of conception were less commonly performed in the last 12 months (Table 22). Assisted vaginal delivery was the least commonly performed signal function although 92% (11/12) of hospitals carried out this function. All hospitals met the criteria for comprehensive EmONC except two. No anticonvulsants or neonatal resuscitation had been performed in the last 12 months at Mpanshya Mission Hospital and no assisted vaginal delivery had been done at the Kamuchanga District Hospital. Very few health centers provided all 7 basic signal functions (except hospitals) or even all 6 functions (excluding assisted vaginal delivery). Data on the performance of EmONC signal functions in the last 3 months are presented in Annex Table 22.

Use of misoprostol was low overall (22%) and was highest in hospitals (92%). Staff actively performed AMTSL in 64% of health facilities ranging from 54% of non-EmONC health centers to 100% of hospitals. Partograph use also ranged widely with the lowest levels of use at lower levels of the health system. Breech delivery and delivery of multiple pregnancies had most commonly been performed in EmONC health centers and hospitals. Infection prevention measures were commonly practiced at all levels of the health system with the lowest level in non-EmONC health centers (71%).

Rapid HIV testing in the maternity ward was done in 62% of health facilities with the lowest levels of performance in health posts and non-EmONC health centers (Table 22). In contrast, there were notable deficiencies in the use of short- and long-term family planning methods, post-abortion care (except in hospitals), and post-abortion contraception. Maternity waiting homes were available at 53% of facilities overall, ranging from 20% of non-EmONC health centers to 77% of hospitals.

Table 22: EmONC signal functions, other obstetric, and essential newborn services administered in past 12 months

	All			Facility type														
				Health Post			No EmONC Health Centre			Prospective EmONC Health Centre			Current EmONC Health Centre			Hospital*		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
EmONC signal Functions (in past 12 months)																		
1. Antibiotics administered	70	110	64	12	18	67	7	14	50	20	36	56	19	30	63	12	12	100
2. Uterotonics administered	85	109	78	11	17	65	7	14	50	27	36	75	28	30	93	12	12	100
3. Anticonvulsants administered	51	109	47	4	17	24	4	14	29	12	36	33	20	30	67	11	12	92
4. Manual removal of placenta	59	109	54	8	17	47	5	14	36	17	36	47	17	30	57	12	12	100
5. Removal of retained products	60	109	55	5	17	29	3	14	21	19	36	53	21	30	70	12	12	100
6. Neonatal resuscitation	62	109	57	2	17	12	3	14	21	21	36	58	25	30	83	11	12	92
7. Assisted vaginal delivery	14	108	13	1	17	6	0	13	0	0	36	0	2	30	7	11	12	92
8. Blood transfusion	12	108	11	0	17	0	0	14	0	0	35	0	0	30	0	12	12	100
9. C-section	12	108	11	0	17	0	0	14	0	0	35	0	0	30	0	12	12	100
Facilities with 9 signal functions (1-9)	10	116	9	0	19	0	0	19	0	0	36	0	0	30	0	10	12	83
Facilities with 7 signal functions (1-7)	11	116	9	1	19	5	0	19	0	0	36	0	0	30	0	10	12	83
Facilities with 6 signal functions (1-6)	26	116	22	1	19	5	1	19	5	5	36	14	8	30	27	11	12	92
Other Obstetric Services																		
Use of misoprostol for obstetric indications	24	108	22	4	17	24	0	14	0	2	35	6	7	30	23	11	12	92
Removal of retained products with vacuum aspiration	12	66	18	0	9	0	0	9	0	0	20	0	6	20	30	6	8	75
Removal of retained products with D&C	10	68	15	0	9	0	0	9	0	5	25	20	0	17	0	5	8	63
Removal of retained products with D&E	4	64	6	0	9	0	0	9	0	1	21	5	0	17	0	3	8	38
Removal of retained products with misoprostol	14	67	21	1	9	11	0	9	0	1	20	5	7	21	33	5	8	63
Routine AMTSL	86	104	83	10	15	67	7	13	54	30	34	88	27	30	90	12	12	100
Routine partograph use	67	104	64	5	15	33	4	13	31	20	34	59	26	30	87	12	12	100
Breech delivery in past 3 months	48	104	46	1	15	7	1	13	8	14	34	41	21	30	70	11	12	92
Multiple deliveries in past 2 months	55	105	52	5	16	31	1	13	8	17	34	50	21	30	70	11	12	92
Routine infection prevention control	99	107	93	15	16	94	10	14	71	33	35	94	29	30	97	12	12	100
HIV testing in L&D in past 3 months	65	104	63	5	15	33	6	13	46	17	34	50	26	30	87	11	12	92

ARV dispense in L&D in past 3 months	69	104	66	3	15	20	5	13	38	23	34	68	26	30	87	12	12	100
Short-term family planning provided in past 3 months	96	110	87	17	17	100	13	15	87	33	36	92	28	30	93	5	12	42
Long-term family planning provided in past 3 months	64	110	58	4	17	24	6	15	40	20	36	56	27	30	90	7	12	58
Surgical family planning in past 3 months	10	110	9	0	17	0	0	15	0	0	36	0	0	30	0	10	12	83
Health worker that can do tubal ligation	14	110	13	0	17	0	0	15	0	0	36	0	3	30	10	11	12	92
Health worker that can do vasectomy	12	109	11	0	17	0	0	15	0	0	36	0	3	30	10	9	11	82
post-abortion care provided	59	110	54	7	17	41	3	15	20	17	36	47	22	30	73	10	12	83
Post-abortion family planning provided	55	110	50	8	17	47	1	15	7	16	36	44	18	30	60	12	12	100
Facility has mother's shelter	7	109	6	2	17	12	0	15	0	1	35	3	2	30	7	2	12	17
Essential newborn services (past 12 months)																		
Encouraged immediate breastfeeding	101	110	92	13	17	76	13	17	76	34	35	97	30	30	100	11	11	100
Encouraged hygienic cord care	100	110	91	13	17	76	13	17	76	33	35	94	30	30	100	11	11	100
Practiced Helping Babies Breathe	67	111	60	4	17	24	4	17	24	23	35	66	25	30	83	11	12	92
Practiced Kangaroo Mother Care	55	110	50	6	17	35	4	16	25	20	35	57	16	30	53	9	12	75
Antibiotics to prevent newborn infection administered	58	109	53	4	17	24	2	17	12	18	34	53	23	30	77	11	11	100
Corticosteroids administered for preterm birth	23	110	21	1	17	6	2	17	12	5	35	14	3	29	10	12	12	100
Intensive care for newborn provided	21	108	19	1	16	6	0	17	0	2	33	6	7	30	23	11	12	92
Antibiotics for newborn sepsis provided	53	111	48	8	17	47	4	17	24	16	35	46	13	30	43	12	12	100
ARV for newborns provided	73	111	66	3	17	18	7	17	41	25	35	71	26	30	87	12	12	100
IV fluids for newborns provided	27	110	25	1	16	6	1	17	6	8	35	23	5	30	17	12	12	100
Oxygen provided for sick newborns	36	110	33	0	16	0	0	17	0	6	35	17	18	30	60	12	12	100

* Arthur Davidson Children's Hospital was not included in this portion of the analysis as it does not conduct deliveries or provide EmONC services.

There were 15 health facilities that acknowledged having performed assisted vaginal delivery in the last 12 months. These included 2 prospective EmONC health centers, 3 current EmONC health centers and 10 hospitals. The prospective EmONC health centers had both performed forceps delivery, while the EmONC health centers had used vacuum extractors in two of three deliveries and forceps for the third. All ten hospitals had used vacuum extractors; none had performed forceps deliveries.

Essential newborn services

Encouraging immediate breastfeeding and hygienic cord care were commonly performed with lowest levels in health posts and health centers (Table 22). Helping Babies Breathe and Kangaroo mother care were performed in 60% and 50% of all facilities. Use of corticosteroids in preterm labor, intensive care for preterm babies, and injectable antibiotics for neonatal sepsis was low overall with the exception of hospitals. There were also gaps in the delivery of ARVs to HIV-exposed newborns in labor wards, ranging from only 18% in non-EmONC health centers to 100% of hospitals.

Commodities—medications, equipment, and supplies

Most higher-level health facilities had amoxicillin in stock but not health posts (only 12/19) and the majority had had at least one stock out in the last year (Table 23). The availability of other antibiotics ranged widely with many facilities not having ceftriaxone in stock on the day of the survey. In contrast, cotrimoxazole was widely available for both mothers and especially for newborns.

Magnesium sulfate was generally available especially in health center and hospitals as was diazepam and phenobarbital. The availability of newer antihypertensive drugs was relatively limited; in contrast methyldopa was widely available. Oxytocin was usually in stock on the day of the visit whereas misoprostol was often not available. The available of artemether-lumefantrine was excellent as was quinine. Relatively few facilities had IV artesunate (<50% of hospitals) but this was only recently introduced in a limited number of referral hospitals. First-line ARVs were usually available including drugs for PMTCT; many health facilities did not have second line ARVs available.

Supplies and medications like basic IV fluids, paracetamol, ferrous sulfate, folic acid, tetanus vaccine, and vitamin K for newborns were widely available whereas narcotic analgesics were not. Tocolytics other than salbutamol were not generally available in CEmONC hospitals nor were many emergency drugs (e.g. adrenaline and atropine).

Table 23: Medications for maternal and newborn health current stock and stock-outs in last 12 months overall stratified by facility type:

	All						Facility type																										
							Health Post						No EmONC Health Centre						Prospective EmONC Health Centre						Current EmONC Health Centre						Hospital					
	Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
Antibiotics																																			
Amikacin injection	0	110	0	93	117	79	0	14	0	12	19	63	0	19	0	16	19	84	0	34	0	25	36	69	0	30	0	30	30	100	0	13	0	10	13	77
Amoxicillin	106	110	96	108	117	92	12	14	86	13	19	68	19	19	100	19	19	100	33	34	97	33	36	92	29	30	97	30	30	100	13	13	100	13	13	100
Ampicillin capsules	4	115	3	99	117	85	0	19	0	16	19	84	1	19	5	16	19	84	0	35	0	27	36	75	1	29	3	29	30	97	2	13	15	11	13	85
Amicillin injection	11	110	10	96	117	82	1	14	7	12	19	63	0	19	0	16	19	84	0	34	0	26	36	72	0	30	0	30	30	100	10	13	77	12	13	92
Cefixime	18	109	17	97	117	83	3	14	21	13	19	68	3	19	16	16	19	84	3	34	9	27	36	75	5	29	17	29	30	97	4	13	31	12	13	92
Ceftriaxone	33	115	29	101	117	86	2	19	11	16	19	84	4	19	21	16	19	84	6	35	17	27	36	75	11	29	38	29	30	97	10	13	77	13	13	100
Cephazolin sodium	2	110	2	95	117	81	0	14	0	12	19	63	1	19	5	16	19	84	0	34	0	26	36	72	1	30	3	30	30	100	0	13	0	11	13	85
Chloramphenicol injection	13	110	12	97	117	83	1	14	7	12	19	63	1	19	5	16	19	84	1	34	3	26	36	72	1	30	3	30	30	100	9	13	69	13	13	100
Clindamycin	4	110	4	95	117	81	0	14	0	12	19	63	0	19	0	16	19	84	1	34	3	26	36	72	3	30	10	30	30	100	0	13	0	11	13	85
Cloxacillin sodium	63	109	58	102	117	87	7	14	50	13	19	68	9	18	50	16	19	84	16	34	47	30	36	83	20	30	67	30	30	100	11	13	85	13	13	100
Erythromicin	101	110	92	107	117	91	12	14	86	14	19	74	18	19	95	19	19	100	30	34	88	31	36	86	28	30	93	30	30	100	13	13	100	13	13	100
Oral flucloxacillin	5	110	5	94	117	80	1	14	7	12	19	63	0	19	0	16	19	84	0	34	0	25	36	69	1	30	3	30	30	100	3	13	23	11	13	85
Gentamicin injection	93	108	86	105	117	90	9	13	69	12	19	63	18	19	95	19	19	100	27	34	79	32	36	89	26	29	90	29	30	97	13	13	100	13	13	100
Mebendazole	104	110	95	110	117	94	14	14	100	14	19	74	17	19	89	19	19	100	33	34	97	34	36	94	28	30	93	30	30	100	12	13	92	13	13	100
Metronidazole (flagyl) injection	21	110	19	96	117	82	0	14	0	12	19	63	2	19	11	17	19	89	4	34	12	26	36	72	4	30	13	30	30	100	11	13	85	11	13	85
Metronidazole (flagyl)-in injection for newborn	12	110	11	97	117	83	0	14	0	12	19	63	0	19	0	16	19	84	2	34	6	26	36	72	1	30	3	30	30	100	9	13	69	13	13	100
Tetracycline eye ointment	91	110	83	109	117	93	11	14	79	14	19	74	16	19	84	19	19	100	31	34	91	33	36	92	25	30	83	30	30	100	8	13	62	13	13	100
Trimethoprim/sulfamethoxazole (cotrimoxazole, septrin)	88	110	80	110	117	94	8	14	57	14	19	74	17	19	89	19	19	100	24	34	71	34	36	94	26	30	87	30	30	100	13	13	100	13	13	100

Trimethoprim/ sulfamethoxazole syrup	84	110	76	108	117	92	5	14	36	14	19	74	15	19	79	19	19	100	29	34	85	32	36	89	22	30	73	30	30	100	13	13	100	13	13	100
Anticonvulsants																																				
Diazepam (valium injection)	100	110	91	108	117	92	10	14	71	13	19	68	19	19	100	19	19	100	33	34	97	33	36	92	29	30	97	30	30	100	9	13	69	13	13	100
Magnesium sulfate injection 50%	36	110	33	97	117	83	1	14	7	11	19	58	5	19	26	17	19	89	9	34	26	27	36	75	12	30	40	30	30	100	9	13	69	12	13	92
Phenobarbital injection	29	110	26	94	117	80	0	14	0	12	19	63	2	19	11	16	19	84	3	34	9	25	36	69	11	30	37	29	30	97	13	13	100	12	13	92
Phenobarbitone injection for newborn	22	109	20	97	117	83	0	14	0	12	19	63	1	19	5	16	19	84	1	34	3	27	36	75	7	29	24	29	30	97	13	13	100	13	13	100
Phenytoin	3	110	3	94	117	80	0	14	0	11	19	58	0	19	0	16	19	84	3	34	9	26	36	72	0	30	0	30	30	100	0	13	0	11	13	85
Antihypertensives																																				
Hydralazine	19	110	17	96	117	82	0	14	0	12	19	63	0	19	0	16	19	84	3	34	9	26	36	72	5	30	17	30	30	100	11	13	85	12	13	92
Labetalol	0	109	0	96	117	82	0	14	0	12	19	63	0	19	0	16	19	84	0	33	0	26	36	72	0	30	0	30	30	100	0	13	0	12	13	92
Methyldopa	38	110	35	104	117	89	1	14	7	13	19	68	5	19	26	19	19	100	10	34	29	29	36	81	10	30	33	30	30	100	12	13	92	13	13	100
Nifedipine	59	110	54	0	117	0	7	14	50	0	19	0	11	19	58	0	19	0	18	34	53	0	36	0	16	30	53	0	30	0	7	13	54	0	13	0
Antimalarials																																				
Artemisinin-based combination	21	110	19	98	117	84	0	14	0	12	19	63	0	19	0	16	19	84	7	34	21	27	36	75	7	30	23	30	30	100	7	13	54	13	13	100
Artemether-lumefantrine (Coartem)	108	110	98	109	117	93	13	14	93	14	19	74	19	19	100	19	19	100	33	34	97	33	36	92	30	30	100	30	30	100	13	13	100	13	13	100
Parenteral artesunate	9	110	8	95	117	81	0	14	0	12	19	63	0	19	0	16	19	84	0	34	0	25	36	69	3	30	10	30	30	100	6	13	46	12	13	92
Quinine oral	107	110	97	110	117	94	12	14	86	14	19	74	19	19	100	19	19	100	34	34	100	34	36	94	29	30	97	30	30	100	13	13	100	13	13	100
Quinine injectable	76	110	69	106	117	91	5	14	36	13	19	68	13	19	68	18	19	95	24	34	71	32	36	89	21	30	70	30	30	100	13	13	100	13	13	100
ARVs																																				
3tc	55	110	50	98	117	84	1	14	7	12	19	63	8	19	42	16	19	84	13	34	38	28	36	78	20	30	67	30	30	100	13	13	100	12	13	92
Atazanavir/ ritonavir	7	110	6	94	117	80	0	14	0	11	19	58	2	19	11	15	19	79	1	34	3	26	36	72	1	30	3	30	30	100	3	13	23	12	13	92
AVT-Atazanir	2	100	2	85	117	73	0	14	0	12	19	63	1	18	6	15	19	79	0	30	0	22	36	61	0	27	0	27	30	90	1	11	9	9	13	69
AZT syrup	9	109	8	93	117	79	0	14	0	12	19	63	1	19	5	16	19	84	4	34	12	26	36	72	1	30	3	30	30	100	3	12	25	9	13	69
AZT/3TC (combivir)	86	110	78	106	117	91	3	14	21	12	19	63	17	19	89	19	19	100	27	34	79	32	36	89	27	30	90	30	30	100	12	13	92	13	13	100
Efavirenz	64	110	58	101	117	86	0	14	0	12	19	63	8	19	42	18	19	95	19	34	56	29	36	81	24	30	80	30	30	100	13	13	100	12	13	92

Efavirenz combo	48	109	44	98	117	84	0	14	0	12	19	63	7	19	37	16	19	84	12	34	35	28	36	78	18	29	62	29	30	97	11	13	85	13	13	100
Emtricitabine	16	110	15	97	117	83	0	14	0	12	19	63	3	19	16	17	19	89	6	34	18	26	36	72	2	30	7	30	30	100	5	13	38	12	13	92
FTC and DF	29	110	26	98	117	84	0	14	0	12	19	63	6	19	32	16	19	84	6	34	18	27	36	75	11	30	37	30	30	100	6	13	46	13	13	100
Lopinavir/ritonavir	57	110	52	100	117	85	0	14	0	12	19	63	8	19	42	17	19	89	15	34	44	28	36	78	22	30	73	30	30	100	12	13	92	13	13	100
NVP syrup	61	110	55	105	117	90	3	14	21	12	19	63	15	19	79	19	19	100	18	34	53	31	36	86	15	30	50	30	30	100	10	13	77	13	13	100
sd-nevirapine (NVP)	91	110	83	106	117	91	5	14	36	12	19	63	17	19	89	19	19	100	30	34	88	32	36	89	28	30	93	30	30	100	11	13	85	13	13	100
Tenofovir	13	110	12	97	117	83	0	14	0	12	19	63	3	19	16	17	19	89	3	34	9	25	36	69	3	30	10	30	30	100	4	13	31	13	13	100
ART	66	110	60	102	117	87	1	14	7	12	19	63	11	19	58	17	19	89	20	34	59	30	36	83	23	30	77	30	30	100	11	13	85	13	13	100
Opportunistic Infection Drugs																																				
Cotrimoxazole tablets 100/80mg	10	110	9	97	117	83	1	14	7	12	19	63	1	19	5	16	19	84	3	34	9	27	36	75	2	30	7	30	30	100	3	13	23	12	13	92
Cotrimoxazole tablets 400/80mg	91	110	83	107	117	91	8	14	57	13	19	68	17	19	89	19	19	100	27	34	79	32	36	89	27	30	90	30	30	100	12	13	92	13	13	100
Cotrimoxazole tablets 800/160mg	15	110	14	96	117	82	0	14	0	12	19	63	1	19	5	16	19	84	5	34	15	26	36	72	5	30	17	30	30	100	4	13	31	12	13	92
Cotrimoxazole suspension 200/40 per 5ml	79	110	72	108	117	92	5	14	36	13	19	68	14	19	74	19	19	100	26	34	76	33	36	92	21	30	70	30	30	100	13	13	100	13	13	100
IV Fluids																																				
Dextran	3	111	3	98	117	84	0	15	0	12	19	63	2	19	11	18	19	95	1	34	3	26	36	72	0	30	0	30	30	100	0	13	0	12	13	92
Dextrose	81	110	74	103	117	88	8	14	57	13	19	68	16	19	84	19	19	100	21	34	62	28	36	78	25	30	83	30	30	100	11	13	85	13	13	100
Glucose 10%	44	110	40	97	117	83	0	15	0	11	19	58	8	19	42	17	19	89	11	34	32	27	36	75	12	29	41	29	30	97	13	13	100	13	13	100
Glucose 40%	75	110	68	97	117	83	9	14	64	12	19	63	10	19	53	16	19	84	20	34	59	27	36	75	26	30	87	30	30	100	10	13	77	12	13	92
Glucose 50%	92	111	83	104	117	89	7	15	47	13	19	68	16	19	84	19	19	100	29	34	85	31	36	86	27	30	90	28	30	93	13	13	100	13	13	100
Glucose 5%	100	111	90	105	117	90	12	15	80	13	19	68	17	19	89	19	19	100	31	34	91	31	36	86	28	30	93	29	30	97	12	13	92	13	13	100
Ringer's lactate	94	111	85	108	117	92	10	15	67	13	19	68	19	19	100	19	19	100	29	34	85	34	36	94	25	30	83	29	30	97	11	13	85	13	13	100
Normal saline 0.9%	85	111	77	110	117	94	10	15	67	14	19	74	17	19	89	19	19	100	24	34	71	34	36	94	23	30	77	30	30	100	11	13	85	13	13	100
Analgesics																																				
Aspirin	104	110	95	110	117	94	11	14	79	14	19	74	19	19	100	19	19	100	34	34	100	34	36	94	28	30	93	30	30	100	12	13	92	13	13	100
Indomethacin	4	105	4	90	117	77	0	14	0	12	19	63	0	17	0	14	19	74	1	33	3	25	36	69	0	28	0	27	30	90	3	13	23	12	13	92

Morphine	7	110	6	97	117	83	0	14	0	12	19	63	0	19	0	16	19	84	0	34	0	26	36	72	0	30	0	30	30	100	7	13	54	13	13	100
Paracetamol	107	110	97	110	117	94	13	14	93	14	19	74	19	19	100	19	19	100	33	34	97	34	36	94	29	30	97	30	30	100	13	13	100	13	13	100
Pethidine	9	110	8	97	117	83	0	14	0	12	19	63	0	19	0	16	19	84	0	34	0	26	36	72	0	30	0	30	30	100	9	13	69	13	13	100
Corticosteroids																																				
Dexamethasone or betamethasone	29	110	26	100	117	85	1	14	7	12	19	63	2	19	11	18	19	95	6	34	18	28	36	78	7	30	23	30	30	100	13	13	100	12	13	92
Hydrocortisone	100	110	91	109	117	93	11	14	79	14	19	74	18	19	95	19	19	100	32	34	94	33	36	92	27	30	90	30	30	100	12	13	92	13	13	100
Prednisone injection	9	110	8	96	117	82	1	14	7	12	19	63	2	19	11	16	19	84	1	34	3	26	36	72	2	30	7	30	30	100	3	13	23	12	13	92
Prednisolone	65	110	59	105	117	90	3	14	21	13	19	68	14	19	74	18	19	95	19	34	56	31	36	86	17	30	57	30	30	100	12	13	92	13	13	100
Anesthetics																																				
Halothan	8	105	8	89	117	76	0	14	0	12	19	63	0	17	0	14	19	74	0	33	0	25	36	69	0	28	0	27	30	90	8	13	62	11	13	85
Ketamine	13	105	12	90	117	77	0	14	0	12	19	63	0	17	0	14	19	74	0	33	0	25	36	69	0	28	0	26	30	87	13	13	100	13	13	100
Lidocaine 7.5% in dextrose	3	105	3	88	117	75	0	14	0	12	19	63	0	17	0	14	19	74	1	33	3	25	36	69	0	28	0	26	30	87	2	13	15	11	13	85
Lignocaine/lidocaine 2% or 1%	98	109	90	108	117	92	12	14	86	14	19	74	18	19	95	19	19	100	31	34	91	33	36	92	25	29	86	29	30	97	12	13	92	13	13	100
Tocolytics																																				
Ritodrine	0	105	0	90	117	77	0	14	0	12	19	63	0	17	0	14	19	74	0	33	0	25	36	69	0	28	0	27	30	90	0	13	0	12	13	92
Salbutamol	99	105	94	105	117	90	12	14	86	14	19	74	17	17	100	17	19	89	31	33	94	33	36	92	27	28	96	28	30	93	12	13	92	13	13	100
Uterotonics																																				
Ergometrine	6	108	6	94	117	80	0	14	0	12	19	63	0	19	0	16	19	84	2	34	6	26	36	72	2	29	7	29	30	97	2	12	17	11	13	85
Methylergometrine	1	109	1	95	117	81	0	14	0	12	19	63	0	19	0	16	19	84	0	34	0	26	36	72	1	30	3	30	30	100	0	12	0	11	13	85
Misoprostol	10	109	9	96	117	82	0	14	0	12	19	63	2	19	11	17	19	89	1	34	3	27	36	75	2	30	7	29	30	97	5	12	42	11	13	85
Oxytocin	103	109	94	109	117	93	12	14	86	14	19	74	17	19	89	19	19	100	32	34	94	34	36	94	30	30	100	30	30	100	12	12	100	12	13	92
Prostaglandin	0	107	0	93	117	79	0	13	0	12	19	63	0	19	0	16	19	84	0	33	0	25	36	69	0	30	0	29	30	97	0	12	0	11	13	85
Other Drugs																																				
Aminophylline injection	58	110	53	103	117	88	4	14	29	12	19	63	8	19	42	17	19	89	15	34	44	31	36	86	18	30	60	30	30	100	13	13	100	13	13	100
Anti-tetanus serum	16	110	15	96	117	82	1	14	7	12	19	63	2	19	11	16	19	84	3	34	9	25	36	69	8	30	27	30	30	100	2	13	15	13	13	100

Folic acid	102	109	94	108	117	92	11	13	85	13	19	68	18	19	95	18	19	95	31	34	91	34	36	94	30	30	100	30	30	100	12	13	92	13	13	100
Ferrous sulfate or fumarate	108	110	98	109	117	93	13	14	93	14	19	74	19	19	100	18	19	95	34	34	100	34	36	94	29	30	97	30	30	100	13	13	100	13	13	100
Heparin	6	109	6	93	117	79	0	14	0	11	19	58	0	19	0	16	19	84	0	34	0	26	36	72	0	29	0	29	30	97	6	13	46	11	13	85
Anti-rho (d) immune globulin	2	110	2	96	117	82	0	14	0	12	19	63	0	19	0	16	19	84	0	34	0	26	36	72	2	30	7	30	30	100	0	13	0	12	13	92
Iron	2	110	2	96	117	82	0	14	0	12	19	63	0	19	0	16	19	84	0	34	0	26	36	72	0	30	0	30	30	100	2	13	15	12	13	92
Magnesium trisilicate	104	110	95	107	117	91	12	14	86	14	19	74	19	19	100	18	19	95	31	34	91	33	36	92	30	30	100	29	30	97	12	13	92	13	13	100
Multivitamins	4	110	4	96	117	82	0	14	0	12	19	63	2	19	11	16	19	84	0	34	0	26	36	72	1	30	3	30	30	100	1	13	8	12	13	92
Sodium citrate	3	110	3	95	117	81	0	14	0	12	19	63	0	19	0	16	19	84	1	34	3	26	36	72	2	30	7	29	30	97	0	13	0	12	13	92
Nystatin oral	90	110	82	107	117	91	10	14	71	13	19	68	15	19	79	18	19	95	27	34	79	33	36	92	26	30	87	30	30	100	12	13	92	13	13	100
Oral rehydration solution	224	228	98	228	234	97	36	38	95	38	38	100	38	38	100	38	38	100	70	70	100	70	72	97	58	58	100	58	60	97	22	24	92	24	26	92
Pyrimethamine	108	110	98	110	117	94	12	14	86	14	19	74	19	19	100	19	19	100	34	34	100	34	36	94	30	30	100	30	30	100	13	13	100	13	13	100
Ranitidine injection for newborn	2	110	2	96	117	82	0	14	0	12	19	63	1	19	5	16	19	84	0	34	0	26	36	72	0	30	0	30	30	100	1	13	8	12	13	92
Tetanus toxoid vaccine	94	110	85	104	117	89	7	14	50	12	19	63	18	19	95	18	19	95	32	34	94	33	36	92	27	30	90	29	30	97	10	13	77	12	13	92
Gentian violet paint	18	110	16	95	117	81	1	14	7	12	19	63	2	19	11	16	19	84	2	34	6	26	36	72	8	30	27	30	30	100	5	13	38	11	13	85
Vitamin K	28	110	25	99	117	85	0	14	0	12	19	63	3	19	16	17	19	89	3	34	9	27	36	75	11	30	37	30	30	100	11	13	85	13	13	100
Zinc available	97	115	84	107	117	91	13	19	68	18	19	95	17	19	89	18	19	95	31	35	89	31	36	86	27	29	93	28	30	93	9	13	69	12	13	92
Emergency Drugs																																				
adrenaline (epinephrine)	88	108	81	105	117	90	8	14	57	12	19	63	18	18	100	18	19	95	27	34	79	34	36	94	23	29	79	28	30	93	12	13	92	13	13	100
Atropine	54	108	50	99	117	85	2	14	14	12	19	63	7	18	39	17	19	89	14	34	41	29	36	81	21	29	72	28	30	93	10	13	77	13	13	100
Calcium gluconate	9	108	8	93	117	79	0	14	0	12	19	63	0	18	0	15	19	79	0	34	0	26	36	72	2	29	7	29	30	97	7	13	54	11	13	85
Diphenhydramine	2	108	2	94	117	80	0	14	0	12	19	63	0	18	0	15	19	79	0	34	0	26	36	72	1	29	3	29	30	97	1	13	8	12	13	92
Ephedrine	2	108	2	94	117	80	0	14	0	12	19	63	0	18	0	15	19	79	0	34	0	26	36	72	1	29	3	29	30	97	1	13	8	12	13	92
Furosemide	88	108	81	105	117	90	4	14	29	13	19	68	15	18	83	16	19	84	30	34	88	34	36	94	26	29	90	29	30	97	13	13	100	13	13	100
Naloxone	0	108	0	93	117	79	0	14	0	12	19	63	0	18	0	15	19	79	0	34	0	25	36	69	0	29	0	29	30	97	0	13	0	12	13	92
Nitroglycerine	0	108	0	94	117	80	0	14	0	12	19	63	0	18	0	15	19	79	0	34	0	26	36	72	0	29	0	29	30	97	0	13	0	12	13	92
Promethazine	101	108	94	106	117	91	9	14	64	13	19	68	18	18	100	18	19	95	33	34	97	34	36	94	29	29	100	29	30	97	12	13	92	12	13	92

EmONC supplies including assisted delivery kits, autoclaves, autoclave supplies, BP cuffs, and clean delivery kits were generally available at higher levels of the health system (EmONC health centers and hospitals) but not lower levels (Table 24). Supply and equipment data for the last three months are presented in Annex Table 24. Notable supply gaps included incubators, icterometers, Hemocues, neonatal resuscitation supplies, and manual vacuum aspiration packs. Partograph availability increased progressively through higher levels of the health system. Another notable gap was towels for drying newborns. Ultrasound was only available in a limited number of health facilities, primarily hospitals.

Table 24: Availability of EmONC supplies and equipment

	All						Facility type																										
							Health Post						No EmONC Health Centre						Prospective EmONC Health Centre						Current EmONC Health Centre						Hospital					
	Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
EmONC Supplies																																			
Assisted delivery kits	21	110	19%	65	86	76%	0	18	0%	13	13	100%	1	14	7%	9	10	90%	4	36	11%	22	27	81%	5	30	17%	20	25	80%	11	12	92%	1	11	9%
Adult stethoscope	101	112	90%	10	110	9%	14	18	78%	2	16	13%	14	15	93%	1	15	7%	34	36	94%	3	36	8%	28	30	93%	2	30	7%	11	13	85%	2	13	15%
Autoclave	62	115	54%	48	101	48%	3	19	16%	11	14	79%	5	18	28%	10	15	67%	20	36	56%	15	32	47%	25	30	83%	8	29	28%	9	12	75%	4	11	36%
Autoclave supplies	55	116	47%	52	100	52%	2	19	11%	12	14	86%	6	19	32%	10	16	63%	17	35	49%	14	29	48%	22	30	73%	11	29	38%	8	13	62%	5	12	42%
Adult ventilator bag	37	113	33%	64	99	65%	0	18	0%	13	13	100%	4	16	25%	10	14	71%	12	36	33%	19	29	66%	12	30	40%	18	30	60%	9	13	69%	4	13	31%
Adult ventilator mask	35	113	31%	64	98	65%	0	18	0%	13	13	100%	2	16	13%	11	13	85%	11	36	31%	19	29	66%	11	30	37%	19	30	63%	11	13	85%	2	13	15%
Bleach	101	117	86%	24	112	21%	16	19	84%	2	18	11%	16	19	84%	3	18	17%	29	36	81%	9	34	26%	27	30	90%	6	30	20%	13	13	100%	4	12	33%
BP cuff	107	113	95%	8	109	7%	15	18	83%	1	16	6%	16	16	100%	0	16	0%	33	36	92%	4	35	11%	30	30	100%	3	29	10%	13	13	100%	0	13	0%
Clean delivery kits	71	110	65%	33	98	34%	6	18	33%	8	14	57%	6	14	43%	6	12	50%	22	36	61%	11	31	35%	26	30	87%	6	30	20%	11	12	92%	2	11	18%
Protective clothing	91	117	78%	20	109	18%	15	19	79%	1	16	6%	16	19	84%	2	18	11%	28	36	78%	8	35	23%	24	30	80%	7	30	23%	8	13	62%	2	10	20%
Cup for expressing milk	24	112	21%	71	94	76%	2	18	11%	12	14	86%	4	15	27%	8	12	67%	5	36	14%	23	29	79%	7	30	23%	23	27	85%	6	13	46%	5	12	42%
Doppler	35	113	31%	68	98	69%	2	18	11%	11	12	92%	2	16	13%	14	15	93%	17	36	47%	15	31	48%	6	30	20%	23	28	82%	8	13	62%	5	12	42%
Dressing instrument packs	48	111	43%	50	95	53%	4	18	22%	11	14	79%	4	14	29%	6	9	67%	12	36	33%	19	31	61%	19	30	63%	10	28	36%	9	13	69%	4	13	31%
Fluorescent tubes	11	112	10%	79	90	88%	0	18	0%	13	13	100%	0	15	0%	12	12	100%	0	36	0%	27	27	100%	3	30	10%	24	27	89%	8	13	62%	3	11	27%
Fetal stethoscope	104	113	92%	8	109	7%	14	18	78%	2	16	13%	15	16	94%	1	16	6%	34	36	94%	2	35	6%	30	30	100%	1	30	3%	11	13	85%	2	12	17%
Gloves	115	117	98%	11	116	9%	19	19	100%	1	19	5%	19	19	100%	1	19	5%	36	36	100%	2	36	6%	29	30	97%	4	30	13%	12	13	92%	3	12	25%
Hemocue	42	115	37%	75	99	76%	1	19	5%	13	14	93%	6	18	33%	13	16	81%	15	35	43%	22	30	73%	16	30	53%	21	29	72%	4	13	31%	6	10	60%
Icterometer	0	110	0%	86	87	99%	0	18	0%	13	13	100%	0	15	0%	12	12	100%	0	36	0%	27	27	100%	0	29	0%	26	26	100%	0	12	0%	8	9	89%
Incubator	25	111	23%	73	92	79%	0	18	0%	13	13	100%	1	15	7%	12	12	100%	4	36	11%	25	29	86%	13	30	43%	20	28	71%	7	12	58%	3	10	30%
Labor and delivery table	79	112	71%	25	105	24%	9	18	50%	5	13	38%	7	15	47%	7	14	50%	27	36	75%	6	35	17%	26	30	87%	4	30	13%	10	13	77%	3	13	23%
Scale for mother	96	112	86%	13	105	12%	15	18	83%	2	15	13%	14	16	88%	1	15	7%	33	36	92%	1	33	3%	23	30	77%	8	30	27%	11	12	92%	1	12	8%

Manual vacuum aspiration packs	34	109	31%	59	91	65%	0	18	0%	13	13	100%	0	14	0%	10	10	100%	5	35	14%	23	29	79%	18	30	60%	11	28	39%	11	12	92%	2	11	18%
newborn scale	92	113	81%	19	106	18%	12	18	67%	3	14	21%	10	16	63%	5	15	33%	29	36	81%	6	34	18%	28	30	93%	3	30	10%	13	13	100%	2	13	15%
Needles and syringes	116	116	100%	9	115	8%	19	19	100%	1	19	5%	18	18	100%	0	18	0%	36	36	100%	3	36	8%	30	30	100%	2	29	7%	13	13	100%	3	13	23%
Neonatal resuciation packs	51	111	46%	46	96	48%	3	18	17%	11	14	79%	1	14	7%	9	10	90%	15	36	42%	15	32	47%	21	30	70%	9	29	31%	11	13	85%	2	11	18%
Neonatal resucitation table	42	112	38%	57	97	59%	0	18	0%	13	13	100%	2	15	13%	10	12	83%	7	36	19%	24	31	77%	21	30	70%	8	28	29%	12	13	92%	2	13	15%
Newborn ventilator bag	61	113	54%	45	104	43%	2	18	11%	11	13	85%	3	16	19%	12	15	80%	21	36	58%	14	34	41%	23	30	77%	6	29	21%	12	13	92%	2	13	15%
Newborn ventilator mask	60	113	53%	47	105	45%	1	18	6%	12	13	92%	4	16	25%	11	15	73%	20	36	56%	14	34	41%	22	30	73%	8	30	27%	13	13	100%	2	13	15%
Filled oxygen cylinder	39	113	35%	63	97	65%	1	18	6%	12	13	92%	1	16	6%	12	13	92%	10	36	28%	18	29	62%	17	30	57%	17	30	57%	10	13	77%	4	12	33%
Oxygen tubing	36	113	32%	59	95	62%	0	18	0%	13	13	100%	1	16	6%	12	13	92%	9	36	25%	19	29	66%	15	30	50%	14	28	50%	11	13	85%	1	12	8%
Partograph	76	111	68%	36	102	35%	7	17	41%	7	14	50%	5	15	33%	9	13	69%	25	36	69%	12	33	36%	27	30	90%	7	29	24%	12	13	92%	1	13	8%
Pediatric stethoscope	17	111	15%	72	88	82%	1	18	6%	12	13	92%	1	16	6%	12	13	92%	3	35	9%	24	27	89%	6	30	20%	20	26	77%	6	12	50%	4	9	44%
Radiant water	27	112	24%	68	93	73%	0	18	0%	13	13	100%	0	15	0%	12	12	100%	6	36	17%	24	30	80%	13	30	43%	15	28	54%	8	13	62%	4	10	40%
Rectal thermometer	6	112	5%	85	92	92%	0	18	0%	14	14	100%	0	15	0%	12	12	100%	4	36	11%	24	28	86%	0	30	0%	27	27	100%	2	13	15%	8	11	73%
Episiotomy/cervical/vaginal laceration repair packs	50	110	45%	47	94	50%	3	18	17%	11	14	79%	4	14	29%	6	9	67%	15	36	42%	15	31	48%	19	30	63%	11	29	38%	9	12	75%	4	11	36%
Sharps container	110	117	94%	13	115	11%	16	19	84%	3	18	17%	18	19	95%	1	19	5%	36	36	100%	3	36	8%	30	30	100%	1	30	3%	10	13	77%	5	12	42%
Soap	114	117	97%	13	116	11%	19	19	100%	1	19	5%	19	19	100%	0	19	0%	35	36	97%	3	35	9%	30	30	100%	2	30	7%	11	13	85%	7	13	54%
Tape measure	90	112	80%	16	106	15%	11	18	61%	4	15	27%	11	15	73%	4	15	27%	31	36	86%	4	35	11%	24	30	80%	4	28	14%	13	13	100%	0	13	0%
Newborn thermometer (other)	89	112	79%	16	101	16%	13	18	72%	4	16	25%	11	15	73%	3	14	21%	23	36	64%	7	29	24%	29	30	97%	1	29	3%	13	13	100%	1	13	8%
Towel	13	112	12%	80	90	89%	3	18	17%	12	15	80%	2	15	13%	12	12	100%	2	36	6%	26	27	96%	1	30	3%	25	26	96%	5	13	38%	5	10	50%
Ultrasound	15	111	14%	74	88	84%	0	18	0%	14	14	100%	0	15	0%	12	12	100%	1	35	3%	21	24	88%	3	30	10%	26	27	96%	11	13	85%	1	11	9%
Urinalysis tests	72	117	62%	61	106	58%	8	19	42%	9	16	56%	10	19	53%	13	17	76%	20	36	56%	20	32	63%	22	30	73%	12	29	41%	12	13	92%	7	12	58%
Uterine evacuation kits	17	110	15%	70	86	81%	0	18	0%	13	13	100%	0	14	0%	9	9	100%	4	36	11%	24	29	83%	7	30	23%	18	25	72%	6	12	50%	6	10	60%
Operating Theatre Supplies																																				
Anesthetic face masks	14	22	64%	10	20	50%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	13	13	100%	2	11	18%
Anesthetic vaporizer	10	22	45%	9	18	50%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	9	13	69%	1	9	11%
C-section packs	13	22	59%	12	20	60%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	12	13	92%	4	11	36%

Endoscopes	14	22	64%	9	20	45%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	13	13	100%	1	11	9%
Endotracheal tube connectors	13	22	59%	11	20	55%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	12	13	92%	3	11	27%
Intubating forceps	11	22	50%	11	20	55%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	10	13	77%	3	11	27%
Laryngoscopes	13	22	59%	10	20	50%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	12	13	92%	2	11	18%
Oropharyngeal airways	13	22	59%	11	20	55%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	12	13	92%	3	11	27%
Oxygen cylinders (operating theater)	14	22	64%	7	20	35%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	2	4	50%	2	4	50%	12	13	92%	0	11	0%
Spinal needles	11	22	50%	14	19	74%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	10	13	77%	6	10	60%
Suction equipment	60	112	54%	50	103	49%	5	18	28%	10	15	67%	4	15	27%	10	13	77%	19	36	53%	17	33	52%	20	30	67%	12	29	41%	12	13	92%	1	13	8%
Electric suction	13	22	59%	10	20	50%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	1	4	25%	3	4	75%	12	13	92%	2	11	18%
Foot-operated suction	4	22	18%	16	18	89%	0	1	0%	1	1	100%	0	1	0%	1	1	100%	0	3	0%	3	3	100%	0	4	0%	4	4	100%	4	13	31%	7	9	78%

Family planning supplies were often not available with the exception of combination oral contraceptives and 3 month injectables (Table 25). There was limited availability of female condoms, implants, IUDs, emergency contraceptives and ITNs. Stock-out data for the last three months are presented in Annex Table 25.

Table 25: Postpartum and post-abortion supplies

	All						Facility type																										
							Health Post						No EmONC Health Centre						Prospective EmONC Health Centre						Current EmONC Health Centre						Hospital					
	Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months			Currently in Stock			Stock-out in past 12 months		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
3-month injectables	96	110	87%	108	117	92%	11	14	0.79	14	19	74%	17	19	89%	19	19	1	33	34	97%	33	36	92%	27	30	90%	30	30	100%	8	13	62%	12	13	92%
Emergency contraception	35	110	32%	96	117	82%	1	14	7%	12	19	63%	5	19	26%	16	19	0.84	9	34	26%	27	36	75%	13	30	43%	30	30	100%	7	13	54%	11	13	85%
Female condoms	42	109	39%	100	117	85%	4	14	29%	13	19	68%	5	19	26%	16	19	0.84	14	33	42%	29	36	81%	12	30	40%	30	30	100%	7	13	54%	12	13	92%
Implants	62	110	56%	99	117	85%	3	14	21%	12	19	63%	11	19	58%	17	19	0.89	21	34	62%	29	36	81%	22	30	73%	29	30	97%	5	13	38%	12	13	92%
Insecticide-treated bed nets	48	110	44%	100	117	85%	4	14	29%	12	19	63%	6	19	32%	16	19	0.84	18	34	53%	30	36	83%	13	30	43%	30	30	100%	7	13	54%	12	13	92%
Intrauterine devices	47	110	43%	98	117	84%	1	14	7%	12	19	63%	8	19	42%	17	19	0.89	15	34	44%	27	36	75%	18	30	60%	30	30	100%	5	13	38%	12	13	92%
Male condoms	103	110	94%	109	117	93%	13	14	93%	14	19	74%	17	19	89%	19	19	1	33	34	97%	34	36	94%	30	30	100%	30	30	100%	10	13	77%	12	13	92%
Combined oral contraceptives	98	110	89%	109	117	93%	12	14	86%	14	19	74%	17	19	89%	19	19	1	32	34	94%	34	36	94%	29	30	97%	30	30	100%	8	13	62%	12	13	92%

Most health facilities order supplies at the same time each week, month, or quarter (66% overall ranging from 40% of health posts to 83% of hospitals) although some waited until stocks reached a reorder level or medications were ordered on a patient-by-patient basis. The results were similar for labor and delivery, and the postnatal ward.

Community outreach services

Commonly offered community outreach services included immunizations (93%), vitamin A supplementation and deworming (91%), family planning (89% overall), community sensitization programs (88%), male involvement in maternal and newborn health (76%), and promotion of facility-based deliveries (74%) (Table 26). Community HIV testing (52%), social support groups (56%), and newborn care (63%) were less commonly provided services. Generally health centers provided community outreach services more commonly than health posts. Only one hospital (Mpanshya Mission Hospital) completed this portion of the survey.

Table 26: Provision of community outreach services

	All			Facility type													
				Health Post			No EmONC Health Centre			Prospective EmONC Health Centre			Current EmONC Health Centre			Hospital		
	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%	#	N	%
HIV testing outreach	42	81	52%	7	15	47%	5	14	36%	16	28	57%	13	23	57%	1	1	100%
PMTCT outreach	53	84	63%	8	15	53%	10	15	67%	20	31	65%	14	22	64%	1	1	100%
ANC outreach	57	85	67%	9	15	60%	11	16	69%	23	29	79%	13	24	54%	1	1	100%
Promotion of facility deliveries	65	88	74%	10	15	67%	9	16	56%	25	31	81%	20	25	80%	1	1	100%
Newborn care outreach	52	82	63%	9	14	64%	8	15	53%	18	28	64%	16	24	67%	1	1	100%
Family planning outreach	77	87	89%	10	14	71%	15	16	94%	30	31	97%	22	25	88%	0	1	0%
Male involvement in maternal and neonatal health outreach	63	83	76%	7	13	54%	13	16	81%	22	29	76%	20	24	83%	1	1	100%
Male involvement in family planning outreach	60	84	71%	5	13	38%	12	15	80%	24	30	80%	18	25	72%	1	1	100%
Male involvement in HIV CT outreach	65	82	79%	9	14	64%	12	15	80%	26	30	87%	17	22	77%	1	1	100%
Immunization outreach	85	91	93%	10	15	67%	17	17	100%	32	33	97%	25	25	100%	1	1	100%
Tracking EPI defaulters	55	81	68%	5	12	42%	10	16	63%	22	29	76%	17	23	74%	1	1	100%
Tracking EID defaulters	47	80	59%	4	12	33%	9	16	56%	15	27	56%	18	24	75%	1	1	100%
MUAC screening and IYCF counseling outreach	58	84	69%	7	14	50%	11	15	73%	21	31	68%	19	24	79%	0	0	0%
SAM defaulter tracing	56	83	67%	5	11	45%	10	16	63%	20	31	65%	21	25	84%	0	0	0%
Vitamin A supplementation outreach	86	94	91%	11	15	73%	17	17	100%	32	35	91%	25	26	96%	1	1	100%
Key family practices outreach	55	85	65%	8	14	57%	13	17	76%	17	29	59%	17	25	68%	0	0	0%
Social support groups outreach	45	81	56%	5	12	42%	10	17	59%	11	29	38%	19	23	83%	0	0	0%
Community sensitization programs	82	93	88%	11	15	73%	17	17	100%	30	35	86%	24	26	92%	0	0	0%
Involvement of traditional leaders	52	77	68%	8	13	62%	10	16	63%	20	29	69%	14	19	74%	0	0	0%

Health worker knowledge of maternal and newborn health

There were 248 respondents to the maternal and newborn health survey, most of whom were female with a mean age around 40 years (Table 27). Enrolled nurses were most commonly interviewed at health posts and hospitals whereas in health centers midwives (both enrolled and certified) completed the survey. Most respondents worked full time. Most had completed their training several years earlier although there was a wide range with some just having started working. The amount of time that they had worked at their current facility was relatively short overall but increased with type of facility with those working at hospitals serving the longest. On average respondents had worked 21 shifts with a range of 40 to 55 hours per week in the last month in direct patient care. Health workers at health posts tended to work the most number of hours per week.

Very few admitted to having no supervision at all (0-14%) with higher percentages for those at hospitals. Regular formal supervisory meetings were common, ranging from 69% in hospitals to 84% in health posts. At hospitals, 47% of respondents claimed that they never had any technical support or direct supervision of their work. Many respondents had not had any supervision in the last 3 months including 65% at health posts, 76% at non-EmONC health centers, 63% at prospective EmONC health centers, and 72% at EmONC health centers.

Table 27. Respondent characteristics

	All		Health Posts		Health Centers						Hospitals	
					No EmONC		Prospective EmONC		Currently EmONC			
	N	(%)	N	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Demographic characteristics	n=243		n=19		n=21		n=66		n=58		n=79	
Female (%)	207	83.5	17	89.5	19	90.5	57	86.4	50	86.2	64	81.1
Mean age, years (range)	40.8	21-71	43.6	23-62	37.5	23-54	41.3	23-70	41.4	22-63	40.2	21-71
Professional classification	n=238		n=19		n=21		n=65		n=55		n=79	
Obstetrician (%) n = 1	1	0.4	0	0	0	0	0	0	0	0	1	1.3
Medical doctor (%) 2	8	3.2	0	0	0	0	0	0	0	0	8	10.1
Clinical officer/medical licentiate (%) 3	9	3.6	0	0	0	0	4	6.2	1	1.8	4	5
Registered public health nurse (%) 4	0	0	0	0	0	0	0	0	0	0	0	0
Registered/certified midwife (%) 5	63	25.4	2	11.1	4	19.1	9	13.9	17	30.9	31	39.2
Registered/certified nurse (%) 6	25	10.1	3	16.7	6	28.6	7	10.8	5	9	4	5
Enrolled midwife (%) 7	83	33.5	5	27.8	5	23.8	26	40	24	43.6	23	29.1
Enrolled nurse (%) 8	32	12.9	8	44.4	5	23.8	15	23.1	2	3.6	2	2.5
Other (define in footnote) (%) 9	17	6.9	0	0	1	4.8	4	6.2	6	10.9	6	7.6
Highest level of training completed	n=241		n=18		n=20		n=65		n=58		n=80	
Certificate (%) 1	139	56.1	14	77.8	11	55	43	66.2	35	60.3	36	45
Diploma (%) 2	82	33.1	4	22.2	9	45	20	37.8	20	34.5	29	36.3
Advanced diploma (%) 3	6	2.4	0	0	0	0	0	0	1	1.7	5	6.3
Post-graduate diploma (%) 4	2	0.8	0	0	0	0	0	0	1	1.7	1	1.3
Medical degree (MD or MB ChB) (%) 5	9	3.6	0	0	0	0	0	0	0	0	9	11.3
PhD (%) 7	0	0	0	0	0	0	0	0	0	0	0	0
Other (%) 9	3	1.2	0	0	0	0	2	3.1	1	1.7	0	0
Job characteristics	n=230		n=19		n=21		n=65		n=58		n=80	
Currently working full time (%)	218	87.9	16	84.2	20	95.2	58	87.9	52	91.2	72	90
Currently working part-time (%)	12	4.8	1	5.3	0	0	4	6.1	2	3.5	5	6.3
Times since professional qualification (years): mean, range	13.7	0-51	17.6	1-36	9.1	0-32	14.9	0-51	14.3	0-41	12.6	0-43
Length of work at this facility (years): mean, range	4.3	0-41	1.6	0-5	2	0-9	3.5	0-22	3.8	0-28	6.7	0-41
Time worked per week in last month (hours): mean, range	44.4	2-91	50.3	40-84	44.4	35-84	45	Feb-84	42.2	30-91	44.1	23-80
Time spent per week in direct patient care (hours): mean, range	42.2	0-85	50.1	40-84	44.1	35-84	43.6	Feb-84	39.9	Oct-84	40.3	0-85
Time spent each week on other units (hours): mean, range	8	0-60	3.8	0-18	11.8	0-48	10	0-56	8.8	0-60	5.6	0-40
Scheduled shifts worked in average month	19.8	1-56	20.9	Jan-48	21.4	Jan-28	21.4	Jan-56	21.5	Jan-46	16.3	Jan-48

Supervision	n=248		n=20		n=22		n=66		n=59		n=81	
I never receive any supervision (%)	17	6.9	0	0	1	4.6	3	4.6	4	6.8	9	11.1
Formal supervision with regular meetings (%)	184	74.2	16	80	19	86.4	52	78.8	43	72.9	54	66.7
Supervision available if I request it (%)	24	9.7	2	10	1	4.6	5	7.6	7	11.9	9	11.1
Supervision consists of negative feedback when performance is poor (%)	13	5.2	0	0	0	0	4	6.1	4	6.8	5	6.2
When was the last time you received any technical support or supervision in your work?	n=239		n=17		n=21		n=65		n=58		n=78	
I have never received any (%)	49	19.8	0	0	1	4.8	6	9.2	7	12.1	35	44.9
Last 3 months (%)	134	54	11	64.7	16	76.2	40	61.5	42	72.4	25	32.1
Past 4-6 months (%)	37	14.9	5	29.4	3	14.3	14	21.5	6	10.3	9	11.5
Past 7-12 months	11	4.4	1	5.9	1	4.8	5	7.7	1	1.7	3	3.8
More than 12 months ago (%)	8	3.2	0	0	0	0	0	0	2	3.4	6	7.7

While more than half of respondents were familiar with the major aspects of focused antenatal care (with higher levels of knowledge at hospitals), very few respondents (0-16%) spontaneously mentioned all six aspects (Table 28). Similarly, when asked about which women require a special care plan, most respondents mentioned women with 5+ deliveries and a history of severe obstetric complications but few asked about pregnancy interval, previous stillbirths or neonatal deaths, and previous instrumental delivery.

Respondents tended to be more familiar with the signs that suggest a woman is in labor although only about a third mentioned all four signs. When asked about what observations they make as they monitor progress of a woman in labor, most mentioned uterine contractions, cervical dilation, fetal heart beat, and maternal vital signs whereas degree of molding, color of amniotic fluid, and descent of the head were less commonly described. As with focused antenatal care, hospital-based respondents had better levels of knowledge on the progress of labor. Nearly all would register these observations on a partograph. When asked about steps to take during the active management of the third stage of labor, most mentioned the need to use oxytocin or ergometrine. In contrast, slightly fewer mentioned uterine massage and cord traction.

Table 28. Pregnancy, labor, and delivery knowledge questions

	All		Health Posts (N=20)		Health Centers						Hospitals (N=81)	
					No EmONC (N=22)		Prospective EmONC (N=66)		Current EmONC (N=59)			
	n	(%)	n	(%)	N	(%)	n	(%)	n	(%)	n	(%)
Aspects of focused antenatal care*												
Minimum of 4 consultations (%)	118	57.3	11	57.9	9	45	37	57.8	28	50.9	49	64.5
Ensure woman has birth plan (%)	96	46.6	9	47.4	8	40	24	37.5	23	41.8	42	55.3
Prevent illness (malaria and TT) (%)	140	68	12	63.2	13	65	45	70.3	29	52.7	61	80.3
Detect existing illness and manage complications (%)	129	62.3	11	57.9	12	60	36	56.3	32	58.2	53	69.7
Teach danger signs (%)	109	52.9	11	57.9	7	35	36	56.3	21	38.2	47	61.8
Promote breastfeeding (%)	48	23.3	4	21.1	1	5	13	20.3	8	14.5	27	35.5
Mentioned all 6 aspects (%)	19	9.2	3	15.8	0	0	5	7.8	2	3.6	11	14.5

Which women require a special care plan?												
Women who have had a C section (%)	124	60.2	10	52.6	12	57.1	34	54.8	24	45.3	57	78.1
Women with 5+ deliveries (%)	124	60.2	12	63.2	9	42.9	42	67.7	33	62.3	42	57.5
Pregnancy interval <2 y or >5 y (%)	34	16.5	5	26.3	3	14.3	10	16.1	5	9.4	13	17.8
Previous stillbirths (%)	36	17.5	7	36.8	0	0	6	9.7	7	13.2	20	27.4
Previous neonatal death (%)	19	9.2	4	21.1	0	0	3	4.8	5	9.4	10	13.7
Previous instrumental delivery (%)	27	13.1	3	15.8	1	4.8	5	8.1	6	11.3	16	21.9
History of severe obstetrical complications (%)	163	79.1	14	73.7	15	71.4	42	67.7	44	83	63	86.3
Previous obstetric fistula repair (%)	29	14.1	3	15.8	0	0	6	9.7	3	5.7	17	23.3
Mentioned all 8 aspects (%)	1	0.5	1	5.3	0	0	0	0	0	0	0	0
How do you know when a woman is in labor?												
Regular uterine contractions (%)	185	89.8	18	94.7	16	76.2	57	89.1	48	85.7	72	92.3
Cervical dilatation (%)	170	82.5	15	78.9	15	71.4	54	84.4	47	83.9	63	80.8
Discharge of blood and mucus (%)	165	80.1	15	78.9	17	81	48	75	47	83.9	65	83.3
Breaking of the water/ruptured membranes (%)	98	47.6	11	57.9	6	28.6	32	50	26	46.4	40	51.3
Mentioned all four (%)	64	31.1	8	42.1	3	14.3	20	31.3	18	32.1	25	32.1
What observations do you make as you monitor progress of a woman in labor?												
Fetal heartbeat (%)	185	89.8	14	82.4	17	85	56	90.3	47	85.5	72	97.3
Color of amniotic fluid (%)	61	29.6	5	29.4	5	25	14	22.6	12	21.8	31	41.9
Degree of molding (%)	46	22.3	2	11.8	2	10	7	11.3	12	21.8	32	43.2
Dilatation of the cervix (%)	162	78.6	15	88.2	15	75	42	67.7	45	81.8	61	82.4
Descent of the head (%)	96	46.6	3	17.6	8	40	24	38.7	28	50.9	43	58.1
Uterine contractions (%)	171	83	12	70.6	12	60	52	83.9	46	83.6	65	87.8
Maternal blood pressure (%)	194	94.2	16	94.1	19	95	60	96.8	54	98.2	67	90.5
Maternal temperature (%)	170	82.5	12	70.6	18	90	50	80.6	47	85.5	63	85.1
Maternal pulse (%)	167	81.1	11	64.7	17	85	49	79	49	89.1	60	81.1
Mentioned all 9 observations (%)	23	11.2	0	0	0	0	5	8.1	5	9.1	15	20.3
Where do you register these observations?												
On a partograph (%)	187	90.8	16	88.9	19	90.5	56	87.5	54	93.1	71	92.2
In the patient's clinical record (%)	105	51	8	44.4	12	57.1	34	53.1	31	53.4	35	45.5
On partograph in prenatal card (%)	27	13.1	4	22.2	1	4.8	6	9.4	14	24.1	7	9.1
On a piece of paper (%)	21	10.2	6	33.3	1	4.8	6	9.4	5	8.6	6	7.8
What actions are taken during active management of the third stage of labor?												
Immediate oxytocin (within 1-2 min) (%)	176	85.4	14	77.8	14	66.7	49	76.6	54	94.7	75	97.4
Immediate ergometrine (within 1-2 min) (%)	12	5.8	2	11.1	0	0	1	1.6	2	3.5	8	10.4
Controlled cord traction (%)	156	75.7	8	44.4	14	66.7	49	76.6	43	75.4	67	87
Uterine massage (%)	126	61.2	7	38.9	8	38.1	41	64.1	36	63.2	62	80.5
Mentioned all 4 aspects (%)	9	4.4	2	11.1	0	0	1	1.6	1	1.8	6	7.8

*For all variables, percentage = proportion who mentioned specific topics.

Knowledge of signs of heavy bleeding in a pregnant woman was good for signs of shock and anemia but poor for most other signs and only a very small proportion of health workers spontaneously mentioned all seven signs (Table 29). Similarly, very few health workers were able to describe all eight actions that should be taken for a woman with heavy postpartum bleeding although a majority mentioned the use of uterotonics, IV fluids, examining for lacerations, and referring.

Table 29. Emergency obstetrical care questions

	All		Health Posts		Health Centers						Hospitals (N=81)	
					No EmONC		Prospective EmONC		Currently EmONC			
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
When a woman arrives with heavy bleeding or develops severe bleeding after birth, what signs do you look for?*	n=210		n=17		n=21		n=63		n=57		n=74	
Signs of shock (%)	164	78.1	13	76.5	13	61.9	52	82.5	44	77.2	60	81.1
Amount of external blood (%)	95	45.2	5	29.4	7	33.3	19	30.2	37	64.9	34	45.9
Signs of anemia (%)	121	57.6	11	64.7	14	66.7	30	47.6	38	66.7	44	59.5
Damage to the genital tract (%)	112	53.3	9	52.9	9	42.9	30	47.6	31	54.4	46	62.2
Whether uterus is contracted (%)	114	54.3	8	47.1	6	28.6	31	49.2	30	52.6	53	71.6
Retained products or placenta (%)	101	48.1	8	47.1	7	33.3	28	44.4	24	42.1	48	64.9
Full bladder (%)	75	35.7	1	5.9	4	19	18	28.6	24	42.1	36	48.6
Mentioned all 7 signs (%)	15	7.1	0	0	0	0	4	6.3	5	8.8	7	9.5
When a woman develops heavy bleeding after delivery, what do you do?*	n=210		n=18		n=21		n=66		n=55		n=72	
Massage the fundus (%)	113	53.8	6	33.3	9	42.9	23	34.8	37	67.3	52	72.2
Give ergometrine or oxyctoxin (%)	145	69.1	15	83.3	10	47.6	42	63.6	45	81.8	51	70.8
Begin IV fluids (%)	161	76.7	14	77.8	17	81	47	71.2	45	81.8	57	79.2
Empty full bladder (%)	104	49.5	4	22.2	10	47.6	25	37.9	32	58.2	42	58.3
Take blood for hemoglobin and cross matching (%)	92	43.8	5	27.8	10	47.6	20	30.3	22	40	44	61.1
Examine woman for lacerations (%)	144	68.6	12	66.7	8	38.1	42	63.6	38	69.1	58	80.6
Manually remove retained products (%)	100	47.6	7	38.9	8	38.1	27	40.9	27	49.1	47	65.3
Refer (%)	101	48.1	14	77.8	12	57.1	35	53	40	72.7	8	11.1
Mentioned all 8 actions (%)	11	5.2	1	5.6	0	0	3	4.5	4	7.3	3	4.2
When a woman who just gave birth has retained placenta, what do you do?	n=210		n=18		n=20		n=63		n=57		n=74	
Empty full bladder (%)	79	37.6	6	33.3	6	30	18	28.6	27	47.4	33	44.6
Check for signs of separation of placenta before controlled cord traction (%)	73	34.8	6	33.3	5	25	18	28.6	19	33.3	36	48.6
Give or repeat oxytocin (%)	149	71	13	72.2	8	40	41	65.1	46	80.7	57	77
Administer IV fluids (%)	121	57.6	12	66.7	8	40	35	55.6	36	63.2	46	62.2
Monitor vital signs for shock and act (%)	61	29.1	6	33.3	4	20	14	22.2	16	28.1	29	39.2
Check that uterus is well contracted (%)	81	38.6	5	27.8	7	35	21	33.3	23	40.4	35	47.3
Determine blood type and cross match (%)	31	14.8	2	11.1	2	10	6	9.5	8	14	19	25.7
Prepare operating theater (%)	28	13.3	0	0	1	5	3	4.8	4	7	26	35.1
Refer (%)	131	62.4	15	83.3	15	75	51	81	48	84.2	11	14.9
Mentioned at least 8 actions (%)**	9	4.3	1	5.6	0	0	3	4.8	2	3.5	4	5.4
What are the immediate complications of an unsafe abortion?	n=210		n=18		n=21		n=66		n=57		n=78	
Sepsis (%)	180	85.7	14	77.8	16	76.2	54	81.8	49	86	74	94.9
Bleeding (%)	167	79.5	14	77.8	17	81	53	80.3	47	82.5	63	80.8
Genital injuries (%)	64	30.5	7	38.9	3	14.3	16	24.2	15	26.3	35	44.9
Abdominal injuries (%)	80	38.1	12	66.7	5	23.8	19	28.8	21	36.8	36	46.2
Shock (%)	89	42.4	5	27.8	10	47.6	30	45.5	18	31.6	46	59
Mentioned all 5 complications (%)	17	8.1	2	11.1	0	0	3	4.5	6	10.5	14	17.9

When you see a woman with complications from an unsafe or incomplete abortion, what do you do?	n=210		n=17		n=21		n=66		n=56		n=74	
Do a vaginal exam (%)	88	41.9	9	52.9	8	38.1	30	45.5	21	37.5	34	45.9
Assess vaginal bleeding (%)	88	41.9	5	29.4	8	38.1	25	37.9	25	44.6	37	50
Assess vital signs (%)	95	45.2	8	47.1	3	14.3	27	40.9	32	57.1	38	51.4
Begin IV fluids (%)	114	54.3	9	52.9	9	42.9	30	45.5	36	64.3	44	59.5
Begin antibiotics (%)	131	62.4	11	64.7	14	66.7	43	65.2	29	51.8	49	66.2
Do vacuum aspiration (manual/electric) (%)	74	35.2	4	23.5	4	19	13	19.7	18	32.1	43	58.1
Do dilatation with curettage or evacuation (%)	35	16.7	3	17.6	2	9.5	10	15.2	0	0	25	33.8
Provide counseling (%)	79	37.6	2	11.8	2	9.5	22	33.3	15	26.8	46	62.2
Refer (%)	135	64.3	15	88.2	18	85.7	52	78.8	47	83.9	12	16.2
Mentioned all 9 actions (%)	1	0.5	0	0	0	0	0	0	0	0	1	1.4
What information do you give patients who were treated for an unsafe abortion?	n=210		n=18		n=21		n=65		n=56		n=78	
How to prevent reproductive tract infection and HIV (%)	70	33.3	7	38.9	3	14.3	17	26.2	20	35.7	35	44.9
Information about when a woman can conceive again (%)	73	34.8	7	38.9	7	33.3	18	27.7	20	35.7	30	38.5
Family planning counselling (%)	165	78.6	13	72.2	15	71.4	49	75.4	45	80.4	67	85.9
Refer for family planning methods (%)	125	59.5	11	61.1	13	61.9	27	41.5	38	67.9	54	69.2
Information on social support (%)	42	20	4	22.2	3	14.3	14	21.5	5	8.9	21	26.9
Information on consequences of an unsafe abortion (%)	155	73.8	13	72.2	14	66.7	44	67.7	45	80.4	59	75.6
When a woman presents as a victim of rape, what do you do?	n=210		n=18		n=21		n=65		n=57		n=77	
Encourage her to report to police (%)	116	55.2	10	55.6	15	71.4	36	55.4	34	59.6	38	49.4
Facilitate filling out the police report (%)	48	22.9	2	11.1	4	19	13	20	12	21.1	27	35.1
Counsel for pre and post HIV testing (%)	155	73.8	13	72.2	15	71.4	45	69.2	41	71.9	62	80.5
Counsel about pregnancy prevention (%)	65	31	5	27.8	6	28.6	14	21.5	17	29.8	35	45.5
Provide emergency contraception (%)	73	34.8	6	33.3	5	23.8	18	27.7	22	38.6	33	42.9
Provide post-exposure HIV prophylaxis (%)	107	51	5	27.8	11	52.4	29	44.6	26	45.6	52	67.5
Request that she do urine/vaginal smears and/or blood tests (%)	104	49.5	6	33.3	7	33.3	31	47.7	24	42.1	56	72.7
Refer (%)	95	45	14	77.8	10	47.6	37	56.9	30	52.6	14	18.2

*For all variables, percentage = proportion who mentioned specific topics.
**There are two actions that are mutually exclusive (preparing operating theater and referral)

While most respondents spontaneously mentioned the importance of keeping a baby warm (86%-94%), only about half of the respondents in prospective and current EmONC health centers and hospitals mentioned having the mother initiate breastfeeding within 30 minutes of delivery (Table 30). There was poor recall of signs of possible serious bacterial infections in newborns with the exception of hypothermia or fever. Fortunately most health workers would initiate antibiotics and/or refer newborns with suspected sepsis. There were many gaps in knowledge of the steps necessary for neonatal resuscitation except at higher levels of the health system. Very few respondents were able to describe appropriate treatment for umbilical cord infections.

Table 30. Newborn care questions

	All		Health Posts		Health Centers						Hospitals	
					No EmONC		Prospective EmONC		Currently EmONC			
	N	%	n	%	n	%	n	%	n	%	n	%
*What immediate care did you give the newborn last time you delivered a baby?**	N=248		n=18		n=21		n=62		n=53		n=75	
Cleaned baby's mouth before shoulder came out (%)	110	45	7	41	7	41	26	42	25	47	43	57
Cleaned baby's mouth, face, and nose (%)	175	73	12	71	12	71	46	74	37	70	60	80
Ensured the baby was breathing (%)	135	56	10	59	10	59	35	57	24	45	43	57
Ensured the baby was dry (%)	179	74	12	71	12	71	42	68	44	83	57	76
Observed for color (%)	69	30	7	41	7	41	18	29	15	28	20	27
Ensured baby was kept warm (%)	212	88	16	94	16	94	53	86	46	87	68	91
Administered prophylaxis for eyes (%)	39	16	6	35	6	35	11	18	6	11	12	16
Weighed the baby (%)	151	63	11	65	11	65	40	65	38	72	44	59
Cared for the umbilical cord (%)	155	64	12	71	12	71	40	65	35	66	50	67
Had mother initiate breastfeeding within 30 min (%)	127	52	13	77	13	77	31	50	28	53	38	51
Health workers demonstrating knowledge of 4 essential newborn care actions	71	29	7	35	1	5	17	26	19	32	27	33
What are signs and symptoms of infection (or sepsis) in newborns	75	31	n=18		n=21		n=66		n=57		n=79	
Less movement (%)	75	31	4	22	5	24	15	23	18	31.6	33	42
Poor or no breastfeeding (%)	154	64	11	61	12	57	41	62	31	54.4	58	73
Hypothermia or hyperthermia (fever) (%)	218	90	17	94	17	81	60	91	52	91.2	71	90
Restlessness or irritability (%)	168	70	10	56	13	62	46	70	41	71.9	58	73
Difficult or fast breathing (%)	88	37	9	50	3	14	24	36	15	26.3	37	47
Deep jaundice (%)	64	27	4	22	7	33	15	23	17	29.8	21	27
Severe abdominal distension (%)	24	10	2	11	2	10	4	6	6	10.5	10	13
Mentions all 7 signs and symptoms (%)	4	2	1	6	0	0	0	0	0	0	3	4
When a newborn presents with signs of infection, what initial steps do you take?	n=242		n=18		n=21		n=64		n=54		n=75	
Explain condition to mother (%)	48	20	3	17	2	10	9	14	9	17	24	32
Continue to breastfeed or give expressed breast milk (%)	83	34	5	28	5	24	17	27	16	30	34	45
Keep airways open (%)	34	14	1	6	3	14	3	5	7	13	19	25
Begin antibiotics (%)	181	76	13	72	13	62	49	77	34	63	65	87
Refer (%)	145	61	15	83	16	76	47	73	40	74	22	29
Please describe how you would diagnose birth asphyxia	n=216		n=13		n=21		n=51		n=53		n=77	
Depressed breathing (%)	167	77	9	69	15	71	39	77	35	66	68	88
Floppiness (%)	110	51	7	54	9	43	22	43	26	49	46	60
Heart rate below 100 bpm (%)	122	56	5	39	6	29	21	41	32	60	57	74
Central cyanosis (%)	160	74	11	85	12	57	39	77	38	72	59	77
Mentions all 4 signs (%)	54	25	1	8	2	10	9	18	16	30	26	34
Please describe the steps of neonatal resuscitation	n=216		n=13		n=21		n=50		n=54		n=74	
Call for help (%)	50	23	2	15	3	14	8	16	14	26	23	31
Explain condition to mother (%)	45	21	2	15	2	10	8	16	14	26	18	24
Place newborn face up (%)	98	46	7	54	8	38	14	28	26	48	41	55

Wrap or cover baby except face and upper chest (%)	111	51	5	39	6	29	19	38	28	52	50	68
Position baby's head so neck is slightly extended (%)	113	53	5	39	10	48	26	52	26	48	44	60
Suction mouth then nose (%)	172	80	9	69	12	57	38	76	43	80	67	91
Start ventilation using bag and mask (%)	165	76	8	62	10	48	37	74	40	74	67	91
Were steps mentioned in sequential order? (%)	27	13	1	8	2	10	9	18	6	11	8	11
If resuscitating with a bag and mask or tube and mask, what do you do	n=216		n=13		n=21		n=51		n=54		n=76	
Place mask so it covers baby's chin, mouth, and nose (%)	163	75	11	85	14	67	37	73	40	74	61	80
Ensure proper seal has been formed (%)	108	50	6	46	8	38	25	49	22	41	46	61
Ventilate 1-2 times and see if chest is rising (%)	137	63	9	69	11	52	32	63	33	61	52	68
Ventilate 40 times per minute for 1 minute (%)	59	27	2	15	4	19	15	29	11	20	26	34
Pause and determine whether baby is breathing spontaneously (%)	120	56	9	69	7	33	29	57	22	41	53	70
If baby is breathing and there is no sign of respiratory difficulty, what do you do?	n=137		n=13		n=21		n=49		n=53		n=75	
Initiate breastfeeding (%)	132	61	9	69.2	9	42.9	28	57.1	33	62.3	48	64
Continue monitoring the baby (%)	136	63	9	69.2	10	47.6	27	55.1	32	60.4	55	73.3
If baby does not begin to breath or is breathing <30/min, what do you do?	n=216		n=13		n=21		n=49		n=53		n=75	
Continue to ventilate (%)	108	50	5	39	10	48	27	55	28	53	35	47
Administer oxygen, if available (%)	137	63	1	8	9	43	29	59	33	62	62	83
Assess need for special care (%)	65	30	4	31	3	14	6	12	15	28	37	49
Explain to mother what is happening (%)	62	29	1	8	2	10	13	27	16	30	28	37
Resuscitate per neonatal resuscitation guidelines (%)	53	25	4	31	0	0	7	14	7	13	32	43
What are effective measures for prevention of hypothermia before and after birth?	N=248		n=20		n=22		n=66		n=59		n=81	
Keep delivery place warm (%)	195	79	13	65	18	82	53	80	49	83	62	77
Thermal protection during resuscitation (%)	74	30	4	20	8	36	19	29	19	32	24	30
Wrapping/dying immediately after birth (%)	126	51	8	40	11	50	34	52	28	47	45	56
Skin-to-skin contact between mother and baby (%)	103	42	8	40	8	36	26	39	18	31	43	53
No bathing immediately after birth (%)	77	31	2	10	7	32	20	30	18	31	30	37
Initiation of breastfeeding within 1 h of birth (%)	54	22	4	20	8	36	14	21	9	15	19	23
Routine temperature measurement (%)	57	23	4	20	9	41	9	14	14	24	21	26
Thermal protection during transport (%)	21	8	3	15	3	14	4	6	4	7	7	9
Special thermal protection for LBW infants (%)	22	9	1	5	2	9	6	9	4	7	9	11
Maternity ward or nursery kept warm at all times (%)	29	12	2	10	1	5	6	9	5	8	15	19
Appropriate clothing and bedding (%)	107	43	10	50	8	36	30	45	26	44	33	41
Hypothermia training and raising staff awareness (%)	0	0	0	0	0	0	0	0	0	0	0	0
If you see a baby with possible sepsis, what treatment would you provide?	n=248		n=16		n=21		n=56		n=57		n=78	
No treatment, refer to another facility (%)	25	10	0	0	7	33	8	14	9	16	1	1
IV penicillin (%)	35	14	2	13	2	10	9	16	9	16	13	17
IV penicillin plus gentamicin (%)	105	42	8	50	6	29	21	38	20	35	49	63
IV cefotaxime (%)	13	5	0	0	0	0	0	0	3	5	10	13

Oral amoxicillin (%)	16	6	2	13	3	14	8	14	2	4	1	1
Oral cotrimoxazole (%)	1	0	0	0	0	0	1	2	0	0	0	0
Other (%)	36	15	4	25	3	14	9	16	14	25	4	5
If you see a baby with an umbilical cord infection, what treatment would you provide?	n=248		n=16		n=21		n=56		n=57		n=78	
No, treatment, refer to another facility (%)	16	6	2	13	2	10	7	13	4	7	1	1
Clean stump and paint with gentian violet (%)	30	12	1	6	1	5	10	18	10	18	7	9
IV penicillin (%)	30	12	0	0	4	19	6	11	7	12	13	17
IV cloxacillin or equivalent (%)	25	10	2	13	1	5	4	7	1	2	17	22
IV penicillin plus gentamicin (%)	61	25	6	38	3	14	12	21	13	23	27	35
IV ampicillin plus gentamicin (%)	4	2	0	0	0	0	0	0	2	4	2	3
Oral cotrimoxazole (%)	4	2	0	0	2	10	0	0	1	2	1	1
Chloramphenicol (%)	1	0	0	0	0	0	0	0	1	2	0	0
Other (%)	60	24	5	31	8	38	17	30	18	32	10	13

*For all variables, percentage = proportion who mentioned specific topics.

Generally past instruction and experience providing focused antenatal care was excellent (Table 31). The total number of respondents to the questionnaire was 243 total; these included 19 health workers at health posts, 21 in non-EmONC, 65 in candidate EmONC, 58 in current EmONC, and 79 in hospitals (although the number varies slightly from question to question. Although many health workers had been trained to use partographs, very few had ever used them in health posts and non-EmONC health centers. This was true for many aspects of obstetrical care including management of postpartum hemorrhage, manual vacuum aspiration, recognition of puerperal sepsis, and management of pre-eclampsia and eclampsia. By contrast, most health workers were more conversant in PMTCT delivery.

Table 31. Service Provision and Training for Obstetrical Care

Ni = instructed (ever trained on this topic). Ns = have you ever provided this service?

	All (N=117)		Health Posts (N=12)		Health Centers						Hospitals (N=57)	
					No EmONC (N=17)		Pro-spective EmONC (N=52)		Currently EmONC (N=51)			
	N^I	N^S	N^I	N^S	N^I	N^S	N^I	N^S	N^I	N^S	N^I	N^S
Antenatal care												
Provide focused antenatal care (FANC)	200	184	13	12	15	17	59	59	49	58	64	78
Educate mothers regarding exclusive breast-feeding	210	220	16	18	16	18	59	62	56	57	63	65
Check for anemia	239	233	19	17	20	20	64	62	58	58	78	76
Check blood pressure	241	235	19	19	20	20	65	63	58	58	79	76
Check for malaria	226	207	16	16	20	19	62	58	53	50	75	64
Provide malaria prophylaxis	236	211	18	16	20	19	65	62	58	51	75	63
Test for syphilis	202	157	15	10	17	15	57	44	49	40	64	48
Counsel on delivery planning	227	217	19	17	18	18	61	61	55	54	74	67
Counsel about family planning and contra-ception	231	221	18	18	19	17	61	61	56	54	77	67

Labor and Delivery												
Assess fetal position	234	219	18	15	20	17	62	60	56	57	78	70
Listen to the fetal heart	237	224	18	15	20	17	65	62	56	57	78	73
Use a partograph	223	173	17	7	18	7	60	45	53	50	75	64
Perform active management of the third stage of labor	232	194	17	12	20	9	63	53	56	53	76	67
Begin IV fluids	235	203	19	14	20	13	64	51	56	52	76	73
Bleeding in Pregnancy and Labor												
Perform manual vacuum aspiration (MVA)	121	44	7	0	11	0	23	5	57	8	50	31
Administer parenteral uterotonics for postpartum hemorrhage	210	147	15	7	17	5	53	34	57	35	75	66
Suture vaginal lacerations	223	175	15	10	17	7	60	46	57	50	74	62
Eclampsia/pre-eclampsia												
Administer IM or IV magnesium sulphate	206	108	13	0	17	1	50	17	50	26	76	64
Administer other anticonvulsants for management of eclampsia	210	111	14	0	16	3	56	22	50	27	74	59
Infection in pregnancy, labor and after delivery												
Recognize postpartum sepsis (endometritis)	210	112	1	1	14	1	57	29	53	28	72	53
Administer parenteral antibiotics	221	163	16	8	19	9	58	37	54	38	74	71
Complicated delivery												
Perform vacuum delivery	121	44	7	0	11	0	23	5	30	8	50	31
Perform forceps delivery	76	7	3	0	5	0	12	1	19	0	37	6
Make and repair episiotomy	193	128	12	6	14	5	47	26	51	38	69	53
Perform manual removal of placenta and/or retained products	200	135	11	4	12	5	51	33	50	38	76	55
PMTCT												
Provide PMTCT regimen to mother and newborn	224	195	17	9	16	13	60	57	55	51	76	65

Essential newborn care was provided in less than half of health posts and was progressively more common in higher levels of the health system. There were some important gaps in service provision for newborns at all levels of the health system, including treatment of umbilical cord infections, eye infections, jaundice, and neonatal sepsis (Table 32).

Table 32. Service provision and training for newborn care

	All		Health Posts (N=11)		Health Centers						Hospitals (N=75)	
					No EmONC (N=13)		Pro-spective EmONC (N=44)		Currently EmONC (N=33)			
	n	%	n	%	n	%	n	%	n	%	n	%
Does your facility manage sick babies? Which of the following services do you provide?												
Essential newborn care (%)	143	57.7	5	45.5	9	69.2	36	81.8	31	93.9	69	92
Neonatal resuscitation (%)	114	46	1	9.1	1	7.7	0	0	1	3	5	6.7
Warming of babies with hypothermia with injectable antibiotics (%)	99	39.9	1	9.1	0	0	1	2.3	0	0	0	0
Treatment of umbilical cord infection (%)	78	31.5	2	18.2	0	0	2	4.5	0	0	0	0
Treatment of skin pustules (%)	74	28.6	0	0	0	0	0	0	0	0	0	0
Treatment of eye infections (%)	73	29.4	1	9.1	0	0	0	0	1	3	0	0
Provision of ARVs for PMTCT (%)	44	17.7	0	0	2	15.4	1	2.3	0	0	0	0
Management of jaundice (%)	60	24.2	0	0	0	0	0	0	0	0	0	0
Management of neonatal sepsis	90	36.3	0	0	1	7.7	4	9.1	0	0	1	1.3
Management of pneumonia (%)	15	6	0	0	0	0	0	0	0	0	0	0
IMCI (%)	25	10.1	1	9.1	0	0	0	0	0	0	0	0
	N^I	N^S	N^I	N^S	N^I	N^S	N^I	N^S	N^I	N^S	N^I	N^S
Procedures for Newborn Care	N=241		n=16		n=21		n=56		n=57		n=78	
Perform essential newborn care (%)	220	187	10	9	15	8	47	41	48	46	52	43
Resuscitate a newborn a newborn with bag and mask	218	151	10	5	13	4	45	26	47	38	55	43
Evaluation and treatment of omphalitis	192	100	9	4	10	4	44	19	44	24	45	22
Neonatal sepsis management	197	118	8	3	13	5	39	18	41	24	53	37

Ni = instructed (ever trained on this topic) while Ns = have you ever provided this service.

Reproductive and Adolescent Health, Child Health and Nutrition Services

General facility resources

This section describes the resources available at study health facilities that contribute to the provision of three classes of services: reproductive and adolescent health services; child health services; and child nutrition services. For each class of service, key summary indicators are stratified by type of facility (i.e., health post, health center, and hospital), and include: service availability; equipment and supplies; and clinician training as well as measures of clinician knowledge. Data were collected from 19 health posts, 85 health centers, and 13 hospitals.

The types of equipment described in Table 33 contribute to all three classes of services mentioned above, so we present them here before moving to class-specific indicators. All hospitals and more than three-quarters of health centers and health posts had at least one inpatient bed; hospitals had on average 325 beds, health centers 13 beds, and health posts 2.5 beds. Nearly all health facilities had at least one thermometer and a closed container for disposal of sharps. Less than half of health posts and health centers had a timer for measuring patient respiratory rate; 73% of hospitals had a timer. Finally, no health posts and very few health centers had either a pulse oximeter or a chest x-ray machine, while these pieces of equipment were found in 42% and 69% of hospitals, respectively.

Table 33. Equipment at study facilities

	All		Facility Type									
			Health Post (N=19)		No EmONC Health Centre (N=19)		Pro-spective EmONC Health Centre (N=36)		Current EmONC Health Centre (N=30)		Hospital (N=13)	
	#	%	#	%	#	%	#	%	#	%	#	%
At least one patient bed	97	84	14	78	11	58	32	89	27	90	13	100
Number of patient beds, *mean (SD)*	46	181	3	2	5	12	11	20	20	17	325	465
Thermometer	116	99	19	100	19	100	35	97	30	100	13	100
Timer for measuring respiratory rate	50	44	8	44	5	26	19	53	10	33	8	73
Pulse oximeter	8	7	0	0	2	11	1	3	0	0	5	42
Chest x-ray machine	16	14	0	0	0	0	1	3	6	20	9	69
Safety box or closed container for used sharps	111	97	18	95	19	100	34	94	28	9	12	100

Reproductive and Adolescent Health

In this section we describe the availability of resources used in the provision of reproductive and adolescent health services. Table 36 provides data on service availability at each type of study facility. Family planning services were provided at around half of health posts and three-quarters of health centers, as well as 38% of hospitals. Roughly the same proportions of each type of facility provided patients with education on safe sex practices. Nearly all primary care facilities (i.e., health posts and health centers) provided male condoms, while only half of hospitals did so. The most widely available contraception methods were the combined estrogen and progesterone oral contraceptive, available at 79% of health posts and 89% of health centers, and injectable contraception, available at 74% of health posts and 89% of health centers. Other types of contraception, including intrauterine devices, implants, and female condoms were available at around one-quarter to one-half of facilities.

The extended program on immunization (EPI) was provided at nearly all primary care facilities, and just over half of hospitals. Further, adolescent testing and counseling was available at nearly all facilities, while antiretroviral treatment (ART) for HIV-positive adolescents was available at 11% of health posts, 61% of health centers, and all hospitals. Finally, 62% of hospitals had a dedicated neonatal intensive care unit (NICU); none of the primary care facilities included in the study had a NICU of their own.

Table 34. Reproductive and adolescent health services available at study health facilities

	All		Facility Type									
			Health Post (N=19)		No EmONC Health Centre (N=19)		Pro-spective EmONC Health Centre (N=36)		Current EmONC Health Centre (N=30)		Hospital (N=13)	
	#	%	#	%	#	%	#	%	#	%	#	%
Reproductive health services												
Family planning	82	70	9	47	12	63	30	83	26	87	5	38
Education on safe sex practices	76	65	9	47	12	63	27	75	22	73	6	46
Types of contraception available												
Combined estrogen progesterone oral pills	95	81	15	79	15	79	32	89	29	97	4	31
Emergency contraception	40	34	1	5	5	26	12	33	18	60	4	31
Intrauterine contraceptives	43	37	2	11	7	37	12	33	19	63	3	23
Implant contraception	61	52	5	26	8	42	19	53	25	83	4	31
Injectable contraception	94	80	14	74	16	84	31	86	29	97	4	31
Male condoms	105	90	18	95	17	89	34	94	29	97	7	54
Female condoms	60	51	4	21	8	42	21	58	23	77	4	31
Neonatal and adolescent health services												
EPI services	107	92	16	84	18	0.9	36	100	30	100	7	58
HIV counseling and testing for adolescents	111	95	17	89	17	89	34	94	30	100	13	100
ART services for adolescents	67	57	2	11	8	42	22	61	22	73	13	100
NICU	8	7	0	0	0	0	0	0	0	0	8	62

The survey of resources used as part of the expanded program on immunization (EPI) revealed that 29% of health posts and half of hospitals and health centers had a separate room or area designated specifically for immunizations. Thirty-nine percent of health posts, 96% of health centers, and 62% of hospitals had a working refrigerator for vaccine storage.

None of the clinicians based at study health posts had received Integrated Management of Adolescent Illness (IMAI) training; only two health centers had a clinician (a clinical officer) trained in IMAI. Fifteen percent of hospitals had a doctor trained in IMAI, 8% had a trained registered nurse and an additional 8% had a trained certified midwife.

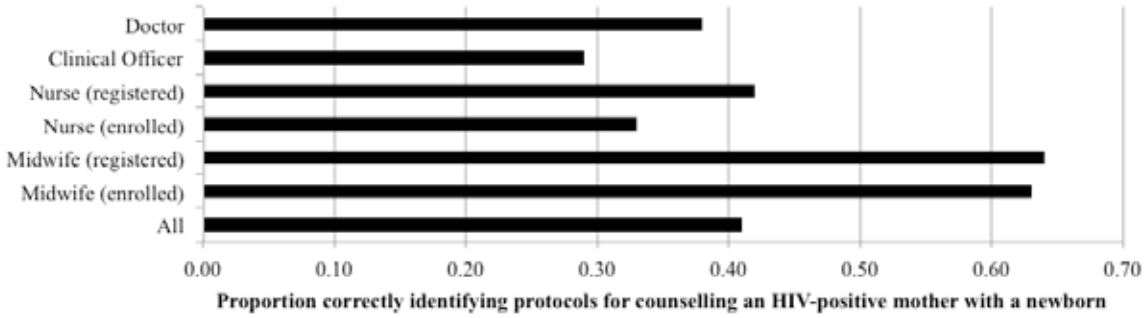
In Table 35, we describe the probability of each cadre of provider having ever received particular reproductive and adolescent health instruction. As expected, nearly all doctors and clinical officers had received training in most of the topic areas investigated. Further, more than half of the nursing and midwifery cadres had also received training in each area. Counseling for vaccine delivery was very high in all cadres, as was counseling on family planning and contraception.

Table 35. Reproductive and adolescent health instruction ever received by clinical staff

	All		Doctors (N=8)		Clinical Officers (N=23)		Nurses				Midwives			
							Registered (N=50)		Enrolled (N=75)		Registered (N=25)		Enrolled (N=36)	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Vaccine delivery	213	88	5	63	22	96	43	86	68	91	24	96	33	92
Assessment of danger signs	213	88	8	100	23	100	43	86	66	88	23	92	31	86
Counseling on delivery planning	180	75	7	88	18	78	35	70	52	69	24	96	33	92
Counseling on family planning and contraception	204	85	8	100	22	96	42	84	57	76	24	96	34	94
Counseling on adolescent sexual and reproductive health	160	66	8	100	18	78	33	66	48	64	21	84	20	56
Provision of adolescent health services	159	66	8	100	19	83	32	65	45	60	20	80	20	56
HIV/AIDS prevention and management for adolescents	176	73	8	100	23	100	33	66	54	72	21	84	24	67

As part of the study instrument, clinicians were asked to describe protocols for counselling an HIV-positive mother with a baby younger than 6 months. In Figure 4, we summarize the proportion of each cadre of provider that correctly identified all important protocol details. Interestingly, midwives (both registered and enrolled) were more likely to be correct than the other cadres; around two-thirds of midwives were correct, as compared to around one-third of clinicians in other cadres.

Figure 4. Clinician knowledge of HIV counselling for mothers of newborns



Clinicians at study facilities were also presented with three clinical scenarios that described children with various signs of dangerous illness. The first scenario was designed to test provider knowledge of adolescent danger signs; the second scenario tested knowledge of adolescent cough; and the third scenario tested knowledge of general newborn health. Recognition of danger signs in an adolescent was generally very good across all cadres of health workers (Table 36). In contrast, correct interpretation of a young child with a cough was very poor, ranging from 0 among registered midwives to 13% of doctors. Appropriate assessment and management of a sick neonate was best done by doctors whereas clinical officers and nurses performed less well.

Table 36. Clinician knowledge of interpreting adolescent health symptoms

Correctly interpreted case scenario on:	All		Doctors (N=8)		Clinical Officers (N=23)		Nurses				Midwives			
							Registered (N=50)		Enrolled (N=75)		Registered (N=25)		Enrolled (N=36)	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Adolescent danger signs (Petronella)	203	84	6	75	20	87	46	92	63	84	21	84	25	69
Adolescent cough (Lackson)	29	12	1	13	1	4	2	4	6	8	0	0	2	8
Newborn health (Joyce)	155	64	7	88	13	57	23	46	47	63	15	60	19	53

Finally, Table 37 provides information on health guidelines clearly posted on the walls of study health facilities. At health posts, the most commonly posted guidelines were for STI treatment (53%), exclusive breastfeeding up to 6 months (47%), and prevention of mother-to-child transmission of HIV (PMTCT). These same guidelines were posted at around three-quarters of health centers; guidelines on family planning were also posted at 72% of health centers. Finally, most hospitals had multiple guidelines posted and nearly all had guidelines on male circumcision.

Table 37. Reproductive and adolescent health guidelines posted at study health facilities

	All (N=117)		Facility Type									
			Health Post (N=19)		No EmONC Health Centre (N=19)		Prospective EmONC Health Centre (N=36)		Current EmONC Health Centre (N=30)		Hospital (N=13)	
	#	%	#	%	#	%	#	%	#	%	#	%
Postpartum check-up of mother	29	25%	0	0%	4	21%	9	25%	13	43%	3	23%
Exclusive breastfeeding up to 6 months	80	68%	9	47%	11	58%	27	75%	25	83%	8	62%
Complimentary feeding	53	45%	5	26%	7	37%	18	50%	17	57%	6	46%
Family planning methods	74	63%	7	37%	11	58%	25	69%	25	83%	6	46%
Prevention of mother-to-child transmission (PMTCT)	79	68%	9	47%	12	63%	26	72%	24	80%	8	62%
Standard sexually transmitted infection (STI) treatment	67	57%	10	53%	11	58%	16	44%	24	80%	6	46%
Male circumcision	49	42%	2	11%	7	37%	11	31%	18	60%	11	85%
Sex education	39	33%	4	21%	7	37%	12	33%	12	40%	4	31%
Reproductive health	34	29%	1	5%	5	26%	8	22%	15	50%	5	38%

Child Health

In this section we describe the availability of resources used in the provision of child health services. Table 38 provides data on service availability at each type of study facility. Of all facilities visited, only two hospitals had a pediatric intensive care unit. Pediatric care for children HIV/AIDS was available at 32% of health posts, 69% of health centers, and 77% of hospitals. Integrated Management of Childhood Illness (IMCI) services were provided at a majority of health posts and health centers (63% and 88%, respectively) and around half of hospitals. Finally, community outreach activities were part of service provision at 37% of health posts, 68% of health centers, and only 8% of hospitals.

Table 38. Child health services available at study health facilities

	All		Health Post ` N=19		Health Center N=85		Hospital N=13	
	#	%	#	%	#	%	#	%
Pediatric intensive care unit	2	2%	0	0%	0	0%	2	15%
Pediatric care for HIV/AIDS	75	64%	6	32%	59	69%	10	77%
Integrated Management of Childhood Illness (IMCI)	94	80%	12	63%	75	88%	7	54%
Emergency care with triage assessment and treatment	86	74%	13	68%	66	78%	7	54%
Information, education and communication (IEC)	79	68%	8	42%	62	73%	9	69%
Community outreach	66	56%	7	37%	58	68%	1	8%

Pediatric medication ordering practices are presented in Table 39. This was usually done at the same time each week or month.

Table 39. Pediatric medication ordering practices

	All		Health Post ` N=19		Health Center N=85		Hospital N=13	
	#	%	#	%	#	%	#	%
Pediatric Ward								
When stocks reach specified level	10	9%	2	11%	8	10%	0	0%
Never reorder	2	2%	1	5%	1	1%	0	0%
Other reorder schedule	2	2%	1	5%	0	0%	1	8%
When stocks run out	12	10%	0	0%	8	10%	4	31%
Patient by patient basis	7	6%	0	0%	3	4%	4	31%
Same time each week/month/etc.	34	29%	1	5%	23	27%	10	77%
Pediatric Outpatient								
When stocks reach specified level	12	10%	3	16%	7	8%	2	15%
Never reorder	2	2%	1	5%	1	1%	0	0%
When stocks run out	13	11%	1	5%	9	11%	3	23%
Other reorder schedule	5	4%	0	0%	2	2%	3	23%
Patient by patient basis	4	3%	0	0%	2	2%	2	15%
Same time each week/month/etc.	50	43%	4	21%	38	45%	8	62%

Clinician training in Integrated Management of Childhood Illness (IMCI) at study health facilities was assessed. This revealed that very few doctors (15% in hospitals and none in health centers or health posts had been trained in IMCI in the last two years. Slightly more clinical officers had been trained in IMCI—23% of hospitals and 18% of health centers. Only one health post had an enrolled nurse trained in IMCI while 22% of health centers had enrolled nurses trained in IMCI. Overall there were major deficits in IMCI training in the last two years.

The assessment of clinician training in malaria case management at health facilities revealed that only one of the study health posts had staff with malaria case management training. A small number of clinicians at health centers were trained in malaria case management: 16% of health centers had a trained enrolled nurse; 11% had a trained clinical officer; and an additional small

percentage had a trained registered nurse, midwife, or doctor. Finally, around 10 to 20% of each clinician cadre found at hospitals had training in malaria case management.

In Table 40, we describe the probability of each cadre of provider having ever received instruction on specific aspects of child health. In contrast to the above data on IMCI training in the last two years, a greater proportion of all cadres had had IMCI training at some point in the past. Nearly all doctors and clinical officers had received training in most of the topic areas investigated. Further, the majority of nurses and midwives had also received training in each area. Instruction in treatment of diarrhea and treatment of pneumonia, two very important child illnesses in Zambia, were very high in all cadres, as were treatment of malaria and treatment of dehydration.

Table 40. Child health instruction ever received by clinical staff

	All		Doctors (N=8)		Clinical Officers (N=23)		Nurses				Midwives			
							Regis-tered (N=50)		Enrolled (N=75)		Regis-tered (N=25)		Enrolled (N=36)	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Integrated management of childhood illness (IMCI)	151	63	5	63	19	83	35	70	45	60	16	64	20	56
Treatment of diarrhea	211	88	7	88	23	100	43	86	67	89	23	92	30	83
Treatment of pneumonia or acute respiratory infection	202	84	8	100	22	96	42	84	66	88	23	92	29	81
Management of suspected severe bacterial infection	184	76	7	88	23	100	36	72	59	79	21	84	26	72
Prevention of malaria	214	89	8	100	22	96	40	80	69	92	24	96	31	86
Treatment of dehydration	222	92	8	100	23	100	45	90	68	91	24	96	32	89
Treatment of anemia	220	91	8	100	23	100	44	88	70	93	24	96	33	92
Deworming	220	92	8	100	23	100	44	88	68	91	24	96	32	89

Clinicians were asked to describe protocols for a series of child health services, including those for diagnosing malaria and treating severe pneumonia. In Table 41, we summarize the proportion of each cadre of provider that correctly identified all important protocol details. This reveals many gaps in the spontaneous recall of danger signs by health care professionals with only 4% of registered nurses and 25% of doctors recalling all four IMCI danger signs.

Table 41. Clinician knowledge of child health services

	All		Doctors (N=8)		Clinical Officers (N=23)		Nurses				Midwives			
							Registered (N=50)		Enrolled (N=75)		Registered (N=25)		Enrolled (N=36)	
Correctly identified	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**
Danger sign for medical evaluation: Convulsions	141	60	4	50	14	64	38	78	40	54	16	64	18	53
Danger sign for medical evaluation: Lethargy	91	39	5	63	9	41	23	47	30	41	8	32	11	32
Danger sign for medical evaluation: Unable to eat or drink	119	50	2	25	6	27	27	55	39	53	11	44	19	56
Danger sign for medical evaluation: Vomiting	73	32	2	25	7	32	30	42	17	24	8	33	10	29
All 4 danger signs	26	11	2	25	4	18	2	4	14	19	4	16	5	15
3 danger signs	38	16	3	38	5	23	11	22	20	27	7	28	11	32
2 danger signs	69	29	1	13	9	41	18	37	22	30	7	28	10	29
1 danger sign	68	29	0	0	3	14	11	22	10	14	6	24	5	15
0 danger signs	35	15	2	25	1	5	7	14	8	11	1	4	3	9
Identified correct method of diagnosing malaria in a child	221	92	8	100	22	96	46	92	67	89	24	96	33	92
Identified correct treatment of malaria	226	95	7	88	22	96	45	92	71	96	25	100	33	92
Correct treatment for non-severe pneumonia	180	75	5	63	18	78	32	64	59	59	24	96	29	81
Correct treatment for severe pneumonia	10	4	0	0	0	0	2	4	4	5	0	0	0	0
Correct treatment for non-bloody diarrhea with severe dehydration	100	42	2	29	9	39	20	42	33	44	8	33	18	50

Clinicians at study facilities were also presented with two clinical scenarios that described children with various signs of dangerous illness. The first scenario was designed to test provider knowledge of child diarrhea; and the second scenario tested knowledge of child cough and malaria (Table 42). Generally all cadres of health workers performed poorly with the child diarrhea scenario and very poorly with the febrile child case.

Table 42. Clinician knowledge of interpreting child health symptoms

	All		Doctors (N=8)		Clinical Officers (N=23)		Nurses				Midwives			
							Registered (N=50)		Enrolled (N=75)		Registered (N=25)		Enrolled (N=36)	
Correctly identified	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**
Child diarrhea (Kennedy)	46	19	4	50	9	39	11	22	16	21	9	36	10	28
Child cough/malaria (Mary)	27	11	1	13	3	13	4	8	7	9	2	8	3	8

Child Nutrition

In this section we describe the availability of resources used in the provision of child nutrition services. Infant & young child feeding education was provided at 42% of health posts, 66% of health centers, and 77% of hospitals. Therapeutic feeding for acute malnutrition was available at a minority of health posts (3%) and health centers (41%), but at nearly all hospitals (92%). Finally, micronutrient supplementation was available at 32% of health posts, 56% of health centers, and 77% of hospitals.

Table 43 provides detailed information on resources used as part of the provision of child nutrition services at study facilities. While very few health posts and health centers had a pediatric nutrition unit, around two-thirds of hospitals had such a unit. Nearly all study health facilities had a weighing scale for children. Length/height boards for measuring children were found at 17% of health posts, 63% of health centers, and 100% of hospitals. Finally, nearly all study health facilities had tape to measuring children's mid-upper arm circumference (MUAC).

Table 43. Nutrition infrastructure and equipment at study facilities

	All		Facility Type					
			Health Post		Health Center		Hospital	
	#	%	#	%	#	%	#	%
Pediatric nutrition unit	11	10%	0	0%	3	4%	8	67%
Weighing scale	112	96%	18	95%	81	95%	13	100%
Length/height board	69	60%	3	17%	53	63%	13	100%
Measuring tape for MUAC	93	82%	16	89%	64	76%	13	108%

Table 44 provides information on clinician training in infant and young child feeding (IYCF) at study health facilities. None of the study health posts had staff with training in IYCF. A small number of clinicians at health centers were trained in IYCF: 18% of health centers had a trained enrolled midwife; 14% had a trained registered midwife; and an additional small percentage had a trained clinician in another cadre. Finally, around 10 to 20% of each clinician cadre found at hospitals had training in IYCF.

Table 44. Clinician training in infant and young child feeding (IYCF) in the last two years

	All		Facility Type					
			Health Post		Health Center		Hospital	
	#	%	#	%	#	%	#	%
Any staff trained in IYCF	29	25%	0	0%	24	28%	5	38%
Nutritionists trained in infant young child feeding	4	3%	0	0%	2	2%	2	17%
Doctors trained in infant young child feeding	3	3%	0	0%	0	0%	3	25%
Medical Licentiates trained in infant young child feeding	1	1%	0	0%	1	1%	0	0%
Clinical officers trained in infant young child feeding	5	4%	0	0%	4	5%	1	8%
Nurses trained in infant young child feeding	6	5%	0	0%	5	6%	1	8%
Enrolled nurses trained in infant young child feeding	9	8%	0	0%	8	9%	1	8%
Registered midwives trained in infant young child feeding	13	11%	0	0%	12	14%	1	8%
Enrolled midwives trained in infant young child feeding	15	13%	0	0%	15	18%	0	0%
Certified midwives trained in infant young child feeding	2	2%	0	0%	1	1%	1	8%

Table 45 provides information on clinician training in treatment of severe acute malnutrition (SAM). As with IYCF, none of the study health posts had staff with training in treatment of SAM. In addition, very few health centers had clinicians trained in the treatment of SAM. Finally, at hospitals, training in treatment of SAM was more common, but still low: 15% had a trained doctor; 31% had a trained registered nurse; 31% had a trained enrolled nurse; an additional small percentage had a trained clinician in another cadre.

Table 45. Clinician training in the treatment of severe acute malnutrition (SAM) in the last two years

	All		Facility Type					
			Health Post		Health Center		Hospital	
	#	%	#	%	#	%	#	%
Any staff trained in malnutrition management	17	15%	0	0%	10	12%	7	54%
Nutritionists trained in treatment of severe malnutrition	3	3%	0	0%	1	1%	2	17%
Doctors trained in treatment of severe malnutrition	2	2%	0	0%	0	0%	2	17%
Medical Licentiates trained in treatment of severe malnutrition	1	1%	0	0%	1	1%	0	0%
Clinical officers trained in treatment of severe malnutrition	4	3%	0	0%	3	4%	1	9%
Nurses trained in treatment of severe malnutrition	7	6%	0	0%	3	4%	4	33%
Enrolled nurses trained in treatment of severe malnutrition	9	8%	0	0%	5	6%	4	33%
Registered midwives trained in treatment of severe malnutrition	2	2%	0	0%	1	1%	1	8%
Enrolled midwives trained in treatment of severe malnutrition	2	2%	0	0%	2	2%	0	0%
Certified midwives trained in treatment of severe malnutrition	3	3%	0	0%	1	1%	2	17%

In Table 46, we describe the percentage of each cadre of provider having ever received particular child nutrition instruction. Overall, training in child nutrition was high at study facilities. Nearly all doctors, clinical officers, and registered midwives had received training in most of the topic areas investigated. Further, at least three-quarters of nurses had also received training in each area.

Table 46. Child nutrition instruction ever received by clinical staff

	All		Professional classification																			
			Pedia-trician		Medical doctor		Clinical officer		Medical licenti-ate		Nutrition-ist		Regis-tered /certified nurse		Regis-tered /certified midwife		Enrolled midwife		Enrolled nurse		Other (CDE,E-HT,etc.)	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Severe acute malnutrition training	200	83	1	100	7	88	22	96	2	100	10	100	39	78	21	84	26	74	63	84	9	82
Breastfeeding counseling training	203	85	1	100	7	100	19	83	2	100	10	100	39	80	24	96	34	94	59	79	8	73
Complementary feeding training	195	81	0	0%	8	100	19	83	2	100	10	100	38	78	23	92	31	86	56	75	8	73
Vitamin A supplementation training	221	92	1	100	8	100	22	96	2	100	8	80	44	88	24	96	33	92	68	91	11	100

Clinicians were asked to describe protocols for two child nutrition services: inpatient management of severe acute malnutrition; and management of severe dehydration with severe acute malnutrition. The proportion of each cadre of provider that correctly identified all important protocol details for inpatient management of severe acute malnutrition ranged from 96% of clinical officers to 78% of enrolled nurses with 84% or more of all other cadres correctly identifying the need for inpatient management. Similarly, the knowledge of management of severe dehydration associated with severe acute malnutrition was excellent, ranging from 79% for both enrolled nurses and midwives to 96% of registered midwives.

Finally, clinicians at study facilities were presented with a clinical scenario that described a child with signs of malnutrition. While 75% of physicians correctly interpreted a malnutrition case scenario, only about half or less of other cadres of health workers provided correct responses (clinical officers 43%; registered nurses 48%; enrolled nurses 49%; and registered and enrolled midwives (52%).

Partographs, Caesarian section, maternal deaths, neonatal death reviews

Partograph review

We reviewed 173 partographs from the 117 health facilities, including 35 from the 13 hospitals, 69 from the 30 current EmONC health centers, 58 from the 36 EmONC candidate health centers and 11 from the 19 health centers without EmONC. None of 19 health posts provided a partograph for review. The most common actions performed appropriately were assessment of contractions at least every hour (91.8%), checking for descent between first examination and delivery (90.1%) and checking fetal heart rate at least at hourly intervals. The least common actions performed appropriately were checking vital signs including maternal temperature, maternal pulse and maternal blood pressure. In the few cases where augmentation was used, it was not used appropriately (Table 47). Even though none of the cases reviewed showed the performance of all the critical actions, 72.8 % performed at least five or more.

Table 47. Performance of facilities in partograph use

	No EmONC N = 11	Candidate EmONC N =58	Current EmONC N =69	Hospital N = 35	All facilities N=173
Appropriate checking of maternal temperature	2 (18.2)	7 (12.1)	0	5 (14.3)	14 (8.1)
Appropriate checking of maternal BP	1 (9.1)	19 (32.8)	23 (33.3)	7 (20.0)	50 (28.9)
Appropriate checking of maternal pulse	1(11.1)*	10 (17.2)	9 (13.0)	4 (11.4)	24 (14.0)*
Appropriate checking of fetal heart rate (at least every hour)	11 (100)	52 (89.7)	57 (83.8)	31 (88.6)	151 (87.8)
Appropriate assessment of contractions (at least every hour)	10 (90.9)	54 (94.7)	62 (91.2)	31 (88.6)	157 (91.8)
Appropriate vaginal examination	4 (36.4)	34 (58.6)	46 (66.7)	23 (65.7)	107 (61.9)
Appropriate check of descent	7 (63.4)	51 (87.9)	64 (95.5)	32 (91.4)	154 (90.1)
Appropriate check of state of membranes or color of liquor	6 (54.6)	41 (71.9)	41 (61.2)	28 (82.4)	116 (68.6)
Time of delivery appropriately documented on partograph	8 (88.9)	50 (100)	63 (100)	27 (93.1)	148 (98.0)
Augmentation used appropriately	0	0	1 (20.0)	1 (16.7)	2 (12.5)
Appropriate use of partograph (all 10 critical actions performed)	0	0	0	0	0
Poor use of partograph (less than five of the 10 critical actions performed)	6 (54.6)	11 (19.0)	20 (29.0)	10 (28.6)	47 (27.2)
Moderate use of partograph (at least 5 of the critical actions were performed)	5 (45.4)	47 (81.0)	49 (71.0)	25 (71.4)	126 (72.8)

Caesarean Delivery Review

We reviewed 36 Caesarian section (C/S) cases from the 13 hospitals (Table 48). One hospital did not provide cases for review. Thirty cases provided information on the type of C/S of which 70% were categorized as emergency C/S. About half of the emergency C/S provided data on the time between the decision and the beginning of the C/S. In all these cases the time was more than 30 minutes. The mean time was 5.4 hours and ranged from just about one hour to nearly 17 hours. There was little information on the causes of delay but in the five cases where the cause of delay was indicated, it was due to human resource constraints. CPD was the more common indication for C/s (31.4%) and in 45.5% cases the C/S was performed by a general practitioner. In one case, a non-physician (clinical officer) performed the C/S. Both maternal and newborn outcomes were good. Prophylactic antibiotics were used in 78.8% of cases (n=33) and 31.3% of the women were given permanent method of contraception (n=16). The average duration of hospitalization was about 4 days for both elective and emergency C/S.

Table 48: Review of C/S cases

No	Variable	Number	%
Time of death (n=34)			
	C/S classified as emergency	21	70
	C/S classified as elective	9	30
Time between decision and beginning of surgery for emergency C/S (n=16)			
	< 30 minutes	0	0
	> 30 minutes	16	100
Causes of delay of start of emergency C/S (>30 minutes) (n=16)			
	Delay due to human resource	4	25
	Delay due to lack of equipment or infrastructure	0	0
	Delay due to other reasons	1	6.3
	No information	11	68.7
Indication for C/S (n=35)			
	C/S due to CPD	11	31.4
	C/S due to fetal distress	4	11.4
	C/S due to failed induction	3	8.6
	C/S due to previous scar	3	8.6
	C/S due to others	14	40
Who performed the C/S> (n=33)			
	General practitioner	15	45.5
	General surgeon	11	33.3
	Obstetrician/gynecologist	6	18.2
	Non-physician (clinical officer)	1	3.0
Outcome for newborn (n=36)			
	Normal live birth	34	94.4
	Stillbirth	2	5.6
Maternal outcome (n=34)			
	Alive	34	100.0
	Dead	0	0
Prophylactic antibiotics administered (n=33)		26	78.8
Wound infected (n=26)		2	7.7
Women given permanent method of contraception (n=16)		5	31.3

Maternal Death Review

We reviewed 34 maternal deaths, 29 from the 13 hospitals, four from the current EmONC health centers and one from a candidate EmONC health center. There were no maternal deaths from health centers without EmONC and health posts. In most cases, the data were incomplete. The average age of the women was 29.2 years (range 17 – 45 years). The average estimated gestational age at time of first ANC was 23.2 weeks (range 8 weeks to 40 weeks) and the average number of ANC visits during the pregnancy was 3 (range 2 to 5).

More women died after delivery (58.8%), were referred to hospital where they died (62.5%) and had C/S (56.0%) (Table 49). The primary causes of death included postpartum hemorrhage (31.0%), eclampsia (17.2%), and ruptured uterus (13.8%). Most of the women received life-saving treatment such as IV fluids (87.9%), oxygen (67.7%) and antibiotics (65.6%). In 63.0% of cases, the newborn was alive. Factors contributing to the death included delayed arrivals (36.0%), delayed in diagnosis (28.6%), and delayed transfer (19.2%).

Table 49. Maternal death review analysis

No	Variable	Number	%
Time of death (n=34)			
	After delivery	20	58.8
	During pregnancy/before delivery	8	23.5
	During obstetric surgery	5	14.7
	During vaginal delivery	1	2.9
Referred to facility where dead occurred (n=32)		20	62.5
Source of referral (n=20)			
	Health center	15	75.0
	Another hospital	2	10.0
	Private hospital/private clinic (%)	1	5.0
	Others	2	10.0
Place of delivery (n=26)			
	Delivered in a hospital	22	84.6
	Delivered at health center	3	11.5
	Delivered at home	1	3.8
Type of delivery (n=25)			
	C/S	14	56.0
	Vaginal delivery	8	32.0
	Laparotomy (uterine rupture)	3	12.0
Primary cause of death (n=29)			
	Postpartum hemorrhage	9	31.0
	Eclampsia	5	17.2
	Ruptured uterus	4	13.8
	Infection/sepsis	3	10.4
	Others	8	27.6
Day of death (n=34)			
	Monday-Friday	21	61.8
	Saturday or Sunday	13	38.2
Life-saving treatment received			
	Received IV fluids (n=33)	29	87.9
	Received blood transfusion (n=34)	15	44.1
	Received antibiotics (n=32)	32	65.6
	Received oxytocics (n=33)	33	60.6

	Received anticonvulsants (n=32)	8	25.0
	Received oxygen (n=31)	21	67.7
Life-saving intervention or procedure performed			
	Had manual removal of placenta (n=31)	11	35.5
	Had C/S (n=33)	15	45.5
	Had hysterectomy (n=32)	4	12.5
	Had laparotomy (n=32)	5	15.6
Outcome of newborn (n=27)			
	Normal live birth	17	63.0
	Live with distress	1	3.7
	Dead	9	33.3
Factors contributing to death			
	Death due to delayed arrival (n=25)	9	36.0
	Death due to delayed transfer (n=26)	5	19.2
	Death at facility due to lack of supplies (26)	4	15.4
	Death at facility due to absence/slowness of health worker (n=27)	4	14.8
	Death due to delay in diagnosis (n=28)	8	28.6

Neonatal Death Review

We reviewed 92 neonatal deaths which included 32 from hospitals, 41 from current EmONC health centers and 19 from a candidate EmONC health center (Table 50). There were no neonatal deaths from health centers without EmONC and health posts. More than half (57.6%) of the neonatal deaths occurred less than 24 hours after birth and in most cases, the baby died in the facility where it was delivered (83.3%). The delivery was mostly cephalic vaginal (80.0%) and the gestation was singleton (98.6%). The gestational age at birth of a little over half of them was term.

Complications suffered by the neonates included asphyxia, low birth weight-preterm, congenital malformation and sepsis. Life-saving interventions performed included reanimation (56.1%), suction of fluids (55.9%) and immediate newborn care (50.8%). Breastfeeding in the first half hour and putting to the breast immediately after birth were rarely done. The primary cause of death was asphyxia (44.6%), preterm (13.9%), and congenital malformation (12.3%). In all cases the mothers were alive.

Table 50. Neonatal death review analysis

No	Variable	Number	%
Age of neonate at death (n=92)			
	< 24 hours (%)	53	57.6
	≥ 24 hours < 7days	17	18.5
	≥ 7days	22	23.9
Location of delivery (n=66)			
	In this facility (facility of death)	55	83.3
	Home	7	10.6
	Other facility	3	4.6
	En route to a facility	1	1.5
Type of delivery (n=65)			
	Cephalic vaginal delivery	52	80.0
	Breech	7	10.8
	C/S	5	7.7
	Instrumental vaginal delivery	1	1.5

Type of gestation (n=69)			
	Singleton gestation	68	98.5
	Multiple gestation	1	1.5
Gestational age at birth (n=59)			
	Preterm	27	45.8
	Gestational age at birth was term	32	54.2
Complications of the new born			
	Had asphyxia (n=48)	27	43.8
	Had LBW – preterm (n=54)	23	42.6
	Had congenital malformation (n=43)	8	18.6
	Had neonatal sepsis (n=43)	7	16.3
	Had respiratory distress – meconium aspiration (n=42)	6	14.3
	Had respiratory distress – unspecified (n=42)	6	14.3
	Had respiratory distress – cyanosis (n=43)	5	11.6
	Had fever (n=40)	5	12.5
	Had LBW – small for gestation (n=40)	4	10
	Had respiratory distress – pneumonia (n=42)	2	4.8
Interventions performed			
	Reanimation (n=66)	37	56.1
	Suction of fluids (n=68)	38	55.9
	Warmed with lamp (n=65)	8	12.3
	Warmed with thermal (n=66)	23	34.9
	Warmed with radiant heater (n=65)	10	15.4
	Immediate newborn care (n=65)	33	50.8
	Breastfed in the first half hour (n=65)	8	12.3
	Put to the breast immediately after birth (n=65)	5	7.7
	Cared for low birth weight (n=68)	12	17.7
	Adrenaline used (n=65)	5	7.7
	Received oxygen (n=67)	35	52.2
	Resuscitated with bag and mask (n=67)	31	46.3
	Heart massage performed (n=65)	12	18.5
	Given hypertonic glucose (10%) (n=69)	29	42.0
	Feeding tube (n=63)	6	9.5
	Given antibiotics (n=69)	22	31.9
Primary cause of death (n=65)			
	Asphyxia	29	44.6
	Congenital malformation	8	12.3
	Preterm	9	13.9
	Neonatal sepsis	6	9.2
	Primary cause of death due to syndrome of meconium aspiration (%)	3	4.6
	Primary cause of death due to others (%)	10	15.4

Data management and facility register review

Patient documentation at study facilities

In Table 51, we describe the systems in place at study facilities to manage administrative data. Around three quarters of health posts, and nearly all health centers and hospitals had: dedicated staff to oversee monthly reports; a formal record system; and completed HIA1 and HIA2 reports for the two months preceding the study. Only one health post has a computerized medical record system, while around half of health centers and hospitals have such a system.

Table 51. Data management at study facilities

	All		Health Posts		Health Centers		Hospitals	
			(N=19)		(N=85)		(N=13)	
	n	(%)	n	(%)	n	(%)	n	(%)
Dedicated staff who oversees monthly reports	91	80	13	72	66	78	12	100
Formal medical record system	105	92	13	72	80	95	12	100
Computerized medical record system	43	38	1	6	35	43	7	58
Monthly reports (HIA1 and HIA2) for last two months	103	90	13	72	78	94	12	100

Annual service volumes at study facilities

In the following set of tables, we present information, including medians and interquartile ranges, on annual volumes for a series of important services. In Table 61, we focus on HIV and ART services. From the table, it is clear that the majority of these services were provided at health centers and hospitals. The median health centers had 976 HIV counseling and testing clients per year, while the median hospital had 1,630 such clients. Nearly all ART care was provided at hospitals, with a median of 150 clients at ART at these facilities during the year.

Table 52. Annual volume of HIV and ART services

	All		Health Posts		Health Centers		Hospitals	
			(N=19)		(N=85)		(N=13)	
	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)
HIV counseling and testing clients	631	241,2007	112	25, 269	975.5	318, 2093	1630	186, 3079
HIV+ clients enrolled in pre-ART care	50.5	0,344.5	1.5	0,14	77	1.5,496.5	97	1,334
HIV+ clients on ART	7.5	0, 473	0	0, 0	12	0,550	10.5	11, 2809

In Table 53, we present annual volumes for maternal health services. The majority of antenatal care (ANC) was provided at health centers (with a median of 485 ANC bookings per year), though health posts also provided a substantial volume of ANC services. Alternatively, the vast majority of deliveries occurred at hospitals, with a median of 1,689 total deliveries per year, as compared to a median of 193 and 38 deliveries at health centers and health posts, respectively. The few instances of post-abortion care provided at study facilities occurred at hospitals.

Table 53. Annual volume of maternal health services

	All		Health Posts (N=19)		Health Centers (N=85)		Hospitals (N=13)	
	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)	Median	(Q1, Q3)
ANC and deliveries								
New antenatal care bookings	338	172,1099	119	65, 263	485	248,1315	1.5	0, 277
Spontaneous vaginal deliveries	128	20,1128	34	0, 71	139	41,1108	1403	317,2224
Deliveries with vacuum extraction	0	0, 0	0	0, 0	0	0, 0	14.5	1,39
Forceps deliveries	0	0, 0	0	0, 0	0	0, 0	0	0, 4
Craniotomies/embryotomies	0	0, 0	0	0, 0	0	0, 0	0	0, 0
Cesarean deliveries	0	0, 0	0	0, 0	0	0, 0	99.5	25,711
Laparotomies	0	0, 0	0	0, 0	0	0, 0	3	0, 7
Total deliveries	127	17,1130	22	0,73	142.5	41,1108	1682.5	1044.5,2982
Post-abortion care (PAC) and family planning (FP)								
PAC cases	0	0, 36	0	0, 0	0	0, 6	269	48.5,543.5
Post-abortion discharge with FP method	0	0, 3	0	0, 0	0	0, 0	104	0,232
Postpartum discharge with FP method	0	0, 7	0	0, 1	0	0, 42	0	0, 0

Table 54 presents volumes of obstetric complications and deaths at study facilities. Consistent with the data in Table 57 that showed that most deliveries occurred at hospitals, nearly all complications occurred at hospitals. Most recorded complications were due to direct obstetric causes; the median yearly volume of antepartum hemorrhage at hospitals was 10, while the median yearly volume of postpartum hemorrhage was 13. The median yearly volume of abortion complications at study hospitals was 21. Finally, the volume of maternal deaths at all study facilities was low.

Table 54. Annual volume of obstetric complications and deaths

	All		Health Posts (N=19)		Health Centers (N=85)		Hospitals (N=13)	
	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)
Direct obstetric complications								
Antepartum hemorrhage	0	0, 3	0	(0,0)	0	(0,3)	8	(1,20)
Postpartum hemorrhage	1	0, 6	0	(0,0)	1	(0,5)	10.5	(7,24)
Retained placenta	0	0, 4	0	(0,0)	0	(0,4)	6	(3,12)
Prolonged/obstructed labor	1	0, 13	0	(0,0)	1	(0,11)	13	(4,54)
Ruptured uterus	0	0, 0	0	(0,0)	0	(0,0)	4	(0,10)
Postpartum sepsis	0	0, 0	0	(0,0)	0	(0,0)	0.5	(0,10)
Severe pre-eclampsia/eclampsia	0	0, 8	0	(0,0)	0	(0,6)	9.5	(1,74)
Abortion complications (hemorrhage or sepsis)	0	0, 6	0	(0,0)	0	(0,6)	21	(2,588)
Ectopic pregnancy	0	0, 0	0	(0,0)	0	(0,0)	6	(0,51)
Other direct obstetric complications	0	0, 6	0	(0,0)	0	(0,6)	55.5	(1,158)
Indirect obstetric complications								
Malaria	0	0, 2	0	(0,7)	0	(0,6)	1.5	(0,49)
HIV/AIDS-related	0	0, 0	0	(0,0)	0	(0,17)	0.5	(0,47)
Severe anemia	0	0, 0	0	(0,0)	0	(0,2)	4	(1,18)

Hepatitis	0	0, 0	0	(0,0)	0	(0,0)	0	(0,0)
Other indirect complications	0	0, 4	0	(0,0)	0	(0,5)	0	(0,268)
Direct obstetric deaths								
Antepartum hemorrhage	0	0, 0	0	(0,0)	0	(0,0)	0	(0,1)
Postpartum hemorrhage	0	0, 0	0	(0,0)	0	(0,0)	0	(0,3)
Retained placenta	0	0, 0	0	(0,0)	0	(0,0)	0	(0,1)
Prolonged/obstructed labor	0	0, 0	0	(0,0)	0	(0,0)	0	(0,0)
Ruptured uterus	0	0, 0	0	(0,0)	0	(0,0)	0	(0,2)
Postpartum sepsis	0	0, 0	0	(0,0)	0	(0,0)	0	(0,1)
Severe pre-eclampsia/eclampsia	0	0, 0	0	(0,0)	0	(0,0)	0	(0,2)
Abortion complications (hemorrhage of sepsis)	0	0, 0	0	(0,0)	0	(0,0)	0	(0,4)
Ectopic pregnancy	0	0, 0	0	(0,0)	0	(0,0)	0	(0,0)
Other direct obstetric causes	0	0, 0	0	(0,0)	0	(0,0)	0.5	(0,4)
Indirect obstetric deaths								
Malaria	0	0, 0	0	(0,0)	0	(0,0)	0	(0,1)
HIV/AIDS-related	0	0, 0	0	(0,0)	0	(0,0)	0	(0,2)
Severe anemia	0	0, 0	0	(0,0)	0	(0,0)	0	(0,1)
Hepatitis	0	0, 0	0	(0,0)	0	(0,0)	0	(0,0)
Maternal deaths of unknown cause	0	0, 0	0	(0,0)	0	(0,0)	0	(0,0)

We present annual volumes of newborn outcomes in Table 55. Again, given that most births occur at hospitals, newborn outcomes are primarily recorded at hospitals. Consistent across all facilities, around 10 percent of all newborns at facilities can be categorized as low birth weight (i.e., below 2.5 kg). The median yearly volume of normal and low birth weight stillbirths at study hospitals was 14 and 8, respectively, while the median yearly volume of normal and low birth weight very early neonatal deaths was 7 and 1, respectively.

Table 55. Annual volume of newborn outcomes and very early (first 24 hours) neonatal deaths

	All		Health Posts (N=19)		Health Centers (N=85)		Hospitals (N=13)	
	median	**(Q1, Q3)**	**median**	**(Q1, Q3)**	**median**	**(Q1, Q3)**	**median**	**(Q1, Q3)**
Newborn Outcomes								
Live birth, ≥2.5 kg	117	(117,1017)	9	(0,57)	130.5	(15, 967)	1482.5	(316.5, 2798)
Live birth, <2.5 kg	8	(0,71)	1	(0,5)	12	(0,71)	157	(10, 273)
Live births, unspecified weight	0	(0,3)	0	(0,1)	0	(0,3)	0	(0,11)
Fresh stillbirths, ≥2.5 kg	0	(0,2)	0	(0,0)	0	(0,2)	5.5	(0,18)
Fresh stillbirths, < 2.5 kg	0	(0,1)	0	(0,0)	0	(0,1)	5.5	(0,14)
Stillbirths, unspecified weight	0	(0,0)	0	(0,0)	0	(0,0)	0.5	(0,2)
Macerated stillbirths	0	(0, 6)	0	(0,0)	0	(0,6)	33	(13, 68)
Very early (first 24 hours) neonatal deaths								
Very early neonatal deaths, ≥ 2.5 kg	0	(0,1)	0	(0,0)	0	(0,1)	6.5	(0,25)
Very early neonatal deaths, < 2.5 kg	0	(0,0)	0	(0,0)	0	(0,0)	0.5	(0,15)
Very early neonatal deaths, unspecified weight	0	(0,0)	0	(0,0)	0	(0,0)	5.5	(0,26)

We present annual volumes of under-five child morbidity in Table 56. There are two key points to take from this table. First, malaria and diarrhea account for a large proportion of morbidity in children under five coming into study facilities. Second, a large proportion of these cases are being seen at health posts and health centers. The median yearly volume of malaria cases seen at health centers and health posts is 454 and 297, respectively; for diarrhea, those volumes are 301 and 145, respectively. The majority of pneumonia cases, on the other hand, are being seen at hospitals.

Table 56. Annual volume of under-five child morbidity

	All		Health Posts (N=19)		Health Centers (N=85)		Hospitals (N=13)	
	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)
Malaria	406	(102, 851)	297	(53,493)	431	(138, 1065)	133	(95, 405)
Pneumonia, severe or very severe	70	(15, 193)	13	(0,23)	78	(19, 230)	125.5	(73, 797)
Diarrhea	264	(119, 781)	145	(89, 183)	300.5	(188, 1124)	117	(39, 546)
HIV/AIDS	0	(0, 7)	0	(0,0)	1	(0,7)	17	(3,36)
Severe acute malnutrition, uncomplicated	3	(0, 22)	0	(0,0)	4	(0,25)	69	(2,214)
Severe acute malnutrition, complicated	0	(0, 0)	0	(0,0)	0	(0,0)	0	(0,34)

The vast majority of infant and child deaths occur in hospitals (Table 57). There was a median of 4 deaths due to severe acute malnutrition in health centers and no deaths due to malaria, pneumonia, diarrhea, HIV/AIDS, or other causes. By far the largest cause of the deaths at study hospitals was severe acute malnutrition, with a median yearly volume of 110 at these facilities. This was followed by other causes (median 37 deaths), pneumonia (median 14 deaths), malaria (median 10 deaths), and diarrhea (median 8 deaths).

Table 57. Annual volume of infant and child death

	All		Health Posts (N=19)		Health Centers (N=85)		Hospitals (N=13)	
	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)	median	(Q1, Q3)
Malaria	0	(0,0)	0	(0,0)	0	(0,0)	9.5	(1,16)
Pneumonia	0	(0,0)	0	(0,0)	0	(0,0)	14	(6,52)
Diarrhea	0	(0,0)	0	(0,0)	0	(0,0)	7.5	(2,26)
Severe acute malnutrition	0	(0,0)	0	(0,0)	0	(0,0)	21	(7, 96)
HIV/AIDS	0	(0,0)	0	(0,0)	0	(0,0)	3	(0,7)
Other causes	0	(0,0)	0	(0,0)	0	(0,0)	36.5	(11,57)

CONCLUSIONS AND RECOMMENDATIONS

Facility infrastructure

Gaps in infrastructure availability exist and vary across and within types of facilities.. For facilities to perform effectively, the MDGi program should address these gaps with interventions that are facility type specific and appropriately tailored to the services being provided at particular facilities. The MDGi program should take the following actions to improve facility infrastructure:

- Improve the availability of electricity in heath posts and prospective and non-prospective EmONC facilities that provide delivery services.
- Enhance back up power supplies at all current EmONC sites and hospitals.
- Ensure access to running water at all health facilities.
- Ensure consistent availability of all necessary facility registers.

Human resources, training and supervision

The MDGi program should take the following actions to improve human resources:

- Address gaps in adequate staff coverage especially at lower levels of the health system.
- Invest more in clinical mentoring as a means of providing high quality supportive supervision which has the potential to resulting in long term improvements in knowledge and behaviors.
- Improve infection prevention knowledge and practices.
- Strengthen documentation to ensure completeness of routine data entry and consistency across patient registers

Laboratory, blood bank, and pharmacy

The MDGi program should take the following actions to improve facility support services:

- Increase lab capacity for both candidate and current EmONC facilities (e.g. DBS tests, Hb measurement).
- Improve drug supply for both candidate and current EmONC facilities especially for essential drugs and important 2nd line agents for potentially life-threatening illnesses like puerperal and neonatal sepsis.
- Improve blood transfusion capacity across all types of health facilities that provide transfusions.

Maternal and newborn health

The MDGi program should take the following actions to improve maternal and newborn health service delivery:

- Strengthen EmONC capacity in all health facilities that conduct deliveries especially those that are designated EmONC health centers.
- Instruct relevant health staff in the use of partographs to monitor labor and implement quality improvement interventions in the appropriate use of partographs.
- Strengthen postnatal care in non-EmONC health centers.
- Determine why there are stock outs in essential medications and supplies at the health facilities and put in place appropriate interventions to address them.

Adolescent health

The MDGi program should take the following actions to improve adolescent health service delivery:

- Increase availability of family planning counseling and contraceptives for adolescents.
- Expand clinician training in Integrated Management of Adolescent Illness.
- Expand access to adolescent ART.

Child health and nutrition

The MDGi program should take the following actions to improve child health and nutrition service delivery:

- Expand clinician training in IMCI, malaria case management, IYCF, and treatment of SAM.
- Improve availability of length boards at health centers and encourage growth monitoring to track chronic malnutrition.
- Improve access to therapeutic feeding for acute malnutrition.

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ANNEXES

Annex 1. Human Resources Data for Hospitals

	Facility Type				
	Hospital (n = 13)				
	N	Mean	Median	Min	Max
Nutritionists	13	1.8	1	0	6
Doctors	13	44.2	10	2	355
Medical licentiates	13	0.8	0	0	3
Clinical officers	13	11.2	10	3	21
Registered nurses	13	88.6	36	8	507
Enrolled nurses	13	71.9	43	8	322
Registered midwives	13	14.2	8	3	63
Enrolled midwives	13	12.1	10	2	28
Certified midwives	13	8.2	10	0	19
Pediatric specialists	13	2.2	1	0	18
Trained birth attendants	13	1.4	0	0	18
Untrained birth attendants	13	0	0	0	0
Community health workers	12	1.5	0	0	7
Community health assistants	12	0.1	0	0	1
Environmental health technicians	12	1.6	1	0	4
Classified daily employees	13	121.2	31	0	900
Radiology staff	12	6.3	4	1	20
Radiologists	13	0.6	0	0	3
Laboratory staff	12	10.6	9	3	30