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# Quality of Care for Prevention and Management of Common Maternal and Newborn Complications:

A study of 12 regions in Tanzania



## Report 2: Findings on Labour, Delivery and Newborn Care

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### ABOUT MAISHA

MAISHA, meaning “life” in Swahili, promotes the philosophy that building solid foundations for high-quality services will empower providers at all levels of the health care system across the country to deliver targeted interventions that will make a real difference in keeping mothers and their newborn infants safe, healthy and alive.

The USAID/Tanzania-funded MAISHA programme is assisting the MoHSW to strengthen the platforms of focused antenatal care (FANC) and basic emergency obstetric and neonatal care (BEmONC). These platforms will address the prevention and treatment of postpartum haemorrhage (PPH) and other key contributors to maternal mortality, and essential newborn care including newborn resuscitation, prevention and treatment of sepsis, and immediate warming and drying. MAISHA is supporting the MoHSW in developing national- and district-level resources (e.g., guidelines, training package, trainers, supervision tools) for FANC and BEmONC, and in advocating and coordinating with district health management teams, donors and other key stakeholders to ensure that funding is allocated for implementing high-quality FANC and BEmONC, including training service providers at the district level (using the resources developed at national and district levels) throughout the country. MAISHA is also strengthening the platform of prevention of mother-to-child transmission of HIV (PMTCT) to address gaps in integrating maternal and newborn health services for HIV-positive women and children.

### ABOUT MCHIP

The Maternal and Child Health Integrated Program (MCHIP) is the USAID Bureau for Global Health flagship maternal, neonatal and child health programme. MCHIP supports programming in maternal, newborn and child health, immunization, family planning, malaria and HIV/AIDS, and strongly encourages opportunities for integration. Cross-cutting technical areas include water, sanitation, hygiene, urban health and health systems strengthening.

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## ABBREVIATIONS AND ACRONYMS

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AMTSL	Active management of the third stage of labour
ANC	Antenatal care
BEmONC	Basic emergency obstetric and newborn care
BP	Blood pressure
CCT	Controlled cord traction
CEmONC	Comprehensive emergency obstetric and newborn care
EDL	Essential drug list
EmOC	Emergency obstetric and newborn care
HBB	Helping Babies Breathe [Initiative]
HMIS	Health management and information system
IRB	Institutional Review Board
IU	International units
JHSPH	Johns Hopkins Bloomberg School of Public Health
L&D	Labour and delivery
MCHA	Maternal and child health aide
MCHIP	Maternal and Child Health Integrated Program
MGDs	Millennium Development Goals
MNH	Maternal and newborn health
MoHSW	Ministry of Health and Social Welfare
MTCT	Mother-to-child transmission of HIV
PE/E	Pre-eclampsia/eclampsia
PMTCT	Prevention of mother-to-child transmission of HIV
POPPHI	Prevention of Postpartum Hemorrhage Initiative
PPH	Postpartum haemorrhage
QoC	Quality of care
TDHS	Tanzania Demographic and Health Survey
USAID	United States Agency for International Development
WHO	World Health Organization

## EXECUTIVE SUMMARY

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The MAISHA Quality of Care for Prevention and Management of Common Maternal and Newborn Complications Quality of Maternal and Newborn Health Services Study was conducted in July and August 2010 to gather information on the quality of maternal and newborn care provided across 12 regions of Tanzania and Zanzibar. The observational study was conducted in 52 health facilities, including regional hospitals, health centres and dispensaries in mainland Tanzania. A separate study was conducted in Zanzibar. The study combined observation of service delivery with inventories, record reviews and health worker knowledge assessments. Results from the study serve as a baseline for the MAISHA programme and as an important source of information on the quality of maternal and newborn care for policymakers and other stakeholders in Tanzania. This report presents key findings on labour, delivery and newborn care. A separate report details findings on antenatal care (ANC).

**Routine Delivery.** Strengths related to routine delivery in the initial assessment included near universal checking of foetal position with palpation of the abdomen and performance of vaginal exams, supporting the perineum as the infant's head was delivered (86% of observed deliveries), and assessment for perineal and vaginal lacerations (92%) in the second and third stages of labour. Also, partographs were used in three quarters of deliveries.

Weaknesses in the initial assessment included limited checking of fundal height (61% of deliveries), taking pulse (48%), taking temperature (24%) and noting urine output (12%). In the second and third stages, assessment of placenta and membrane for completeness was conducted in a little more than half (57%) of births, the mother's vital signs were taken 15 minutes after birth in only one-third of births (37%) and palpation of the uterus 15 minutes after delivery was low (31%). Throughout the delivery, foetal heart tones and frequency and duration of contractions were recorded on a partograph for only 60% of all clients. Only one-third of the partographs included maternal pulse information.

Handwashing is the area of greatest weakness for infection prevention. Although 82% of providers washed their hands after procedures, before examination during initial assessment only 57% of providers washed hands. Before examination in the first stage of labour, only 54% of providers washed their hands—this gap can contribute to maternal and newborn infections. Another area of concern is the low percentage of providers wearing protective clothing other than gloves (51%).

**Obstetric complications.** The study provides valuable data on screening for and treatment of complications during delivery, including pre-eclampsia and eclampsia (PE/E) and postpartum haemorrhage (PPH). During the initial assessment, screening for danger signs was low, ranging from 1% of clients being assessed for shortness of breath to 32% of clients being assessed for vaginal bleeding. Early detection and treatment are key to preventing PE/E. Unfortunately, the two key screening elements (ask about danger signs for PE/E and check blood pressure) were done in only 14% of all admissions. Only 3% of maternity clients had urine tested for protein during the initial assessment.

Eleven cases of PE/E were observed, of whom eight should have been treated with magnesium sulphate and appropriate antihypertensives; however, only two received both of these medications. Diazepam was used in three cases (sometimes incorrectly given in combination with magnesium sulphate) and inappropriate antihypertensives in three cases.

Since PPH is the most common cause of maternal death in Tanzania, its detection and treatment is essential to decreasing maternal mortality. Active management of the third stage of labour (AMTSL) is the recommended standard practice for all births, requiring that health workers know how to prevent and treat PPH. Despite this requirement, in the knowledge assessment of health workers, providers responded correctly for only 29% to 48%



of the four questions on PPH, including actions, tests and interventions for PPH for atonic uterus.

Using the strictest definition of AMTSL—oxytocin administered IM within one minute of delivery, controlled cord traction (CCT) and uterine massage following delivery of the placenta—AMTSL was correctly performed in 26% of all deliveries observed (33% of deliveries in regional hospitals, 8% in health centres and dispensaries). The provision of AMTSL was somewhat higher than the 7% indicated in a 2006 study (POPPHI 2006), although our calculation did not include dosage restriction because of unreliability of those data. The least frequently executed component of AMTSL was uterine massage. In all deliveries observed in this study, a uterotonic was provided to the client, and the proportion of women who had a uterotonic within one minute, which was 9% in the POPPHI study, was 44% in this study (same limitations due to dosage data apply). Across maternity wards, availability of misoprostol was relatively high at 30% and 58% of health centres/dispensaries and regional hospitals, respectively. Misoprostol (or another prostaglandin) was used as a uterotonic for AMTSL in 11% of observed deliveries at health centres/dispensaries and in no cases in hospitals.

Of the 10 PPH cases observed, only five received oxytocin and massage of the fundus as the recommended first-line treatment. In the two cases with retained placenta, the procedure to manually remove it was generally performed well, but some important steps were neglected.

**Essential newborn care.** Observational data collected on essential newborn care highlighted both strengths and weaknesses. Umbilical cord cutting with a clean blade was universal, and drying and wrapping the infant immediately after birth were both high (91%–93%). Infants being placed in skin-to-skin contact with their mothers occurred infrequently at health centres and dispensaries (37%) and regional hospitals (43%), likely due in part to the traditional practice of taking the infant to be weighed and keeping the infant separated from the mother. Immediate initiation of breastfeeding (within first hour) was also low at 40% in regional hospitals and 55% in health centres and dispensaries, limiting the opportunities for mothers and infants to benefit from early initiation of breastfeeding.

Overall, findings from the study highlight areas of relative strength as well as significant gaps in the provision of maternal and newborn care. The study has identified specific recommendations for changes in training and service delivery to improve maternal and newborn health (MNH) outcomes, which will help guide policy and service delivery decisions of the Ministry of Health and Social Welfare (MoHSW) and other key stakeholders in Tanzania.



## 1. INTRODUCTION/BACKGROUND

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Improving quality of obstetric care in facilities is an essential strategy in reducing maternal and neonatal deaths (van den Broek and Graham 2009). To measure improvements in quality, objective baseline quality measurements must first take place. The study described in this report objectively measured key aspects of antenatal care (ANC), labour and delivery (L&D) care, and neonatal care in selected health facilities in Tanzania.

The overall goal of the study was to provide sound information on maternal and newborn care at facility levels in selected regions, by documenting the appropriate use and quality of implementation of key MNH interventions in the provision of facility-based maternal and newborn care. For the purposes of the study, “quality” was defined as services correctly performed per globally and nationally accepted evidence-based guidelines.

This study also serves as the baseline information source for the USAID/Tanzania-funded MAISHA (*Mothers and Infants, Safe, Healthy, Alive*) programme in Tanzania. MAISHA is a national programme to strengthen service delivery that, since 2008, has been working to improve the quality of MNH services through training of health care providers, provision of equipment and supplies, and implementation of quality improvement initiatives. MAISHA is being implemented in a phased approach in all 21 regions in mainland Tanzania as well as in Zanzibar (both Pemba and Unguja).

There are known, effective interventions for screening, preventing and treating obstetric and newborn complications in health care facilities. Improving the quality of facility-based care to prevent and treat frequent maternal and newborn complications is important to reduce maternal and newborn deaths globally and to assist countries to meet their targets for Millennium Development Goals (MDGs) 4 and 5. In Tanzania, approximately 50% of births take place in a health facility (Tanzania Demographic and Health Survey [TDHS] 2010), indicating that improving maternal and neonatal care in health facilities could potentially have a major impact on reduction of mortality.

The study specifically looked at lifesaving practices around the major causes of maternal death, including postpartum haemorrhage (PPH) and hypertensive disorders in pregnancy. In Tanzania, haemorrhage is the most frequent cause of maternal death, accounting for 28% of maternal deaths, followed by unsafe abortion (19%), hypertensive disorders in pregnancy (pre-eclampsia/eclampsia [PE/E]) (17%), infections/sepsis (11%) and obstructed labour (11%) (MoHHSW 2008). This situation is similar to the global causes of maternal death in developing countries (Khan et al. 2006).

The main approaches of this study were: 1) observations of health care providers during ANC consultations and provision of care in labour and deliveries, 2) health worker knowledge and skills assessments, including a demonstration of newborn resuscitation on a model, and 3) inventories of ANC clinics, maternity wards and the general facility pharmacies. The results of this assessment will be used as baseline data from which to measure progress of the MAISHA programme in Tanzania, and also to inform national programme and policy responses for assuring quality in ANC and maternity services.

**This report presents study findings related to labour, delivery and newborn care, including health worker knowledge assessments.** A separate report presents the findings on ANC.

## 2. STUDY OBJECTIVES

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This study attempted to determine the frequency of use and quality of interventions that address frequent causes of maternal and newborn deaths in Tanzania. Such causes of death include PE/E, PPH and sepsis for mothers, and birth asphyxia for newborns.

The obstetric and newborn care interventions assessed were screening for and management of PE/E, partograph use, use of active management of the third stage of labour (AMTSL) to prevent PPH, management of PPH, infection prevention and essential newborn care including newborn resuscitation.

## 3. METHODOLOGY

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### 3.1 STUDY DESIGN

The study used a combination of approaches, including observations of deliveries and ANC consultations, inventories of various areas of the health facility where drugs and supplies can be found, and knowledge and skills assessments of providers, including a simulated resuscitation of a newborn using a model.

### 3.2 DATA COLLECTION TOOLS

The following tools were used at facility level:

- **Facility inventory:** Reporting of infrastructure conditions and verification of availability and storage conditions of medications, supplies and equipment. The inventory is conducted once per facility, but includes inventories of the general pharmacy, the ANC clinic and the maternity ward.
- **Record review:** A tool that captured the number of ANC consultations, births (live and stillborn), and maternal and newborn deaths at each facility for the last year, based on the health management information system (HMIS) tools (e.g., MTUHA books). Up to 24 individual patient charts from the past three months were also reviewed for partograph use and completeness of filled-in partographs.
- **Clinical practice observation of ANC and labour and deliveries:** Structured clinical observation checklists for observation of ANC consultations and vaginal deliveries in the facilities. The content of the checklists was developed based on international (approved by the World Health Organization [WHO]) protocols for: screening for PE/E in ANC; management of PE/E and PPH in L&D; and other interventions in L&D—routine and correct use of the partograph, routine and correct use of AMTSL, infection prevention behaviours, provider-client interaction/communication, immediate essential newborn care and newborn resuscitation. Minor revisions were made to ensure that the tools were tailored to Tanzanian policies.
- **Health care worker interviews:** A series of questions to test workers' knowledge of how to identify, manage and treat common MNH complications. A simulated resuscitation with a newborn model was used to measure newborn resuscitation skills.

### 3.3 SAMPLE

Because the study was a baseline measurement for the MAISHA programme,<sup>1</sup> regions that hosted the first and second year of MAISHA (i.e., Year 1 and 2 regions) were selected. All regional hospitals within the selected regions were included in the sample. Based on 2009

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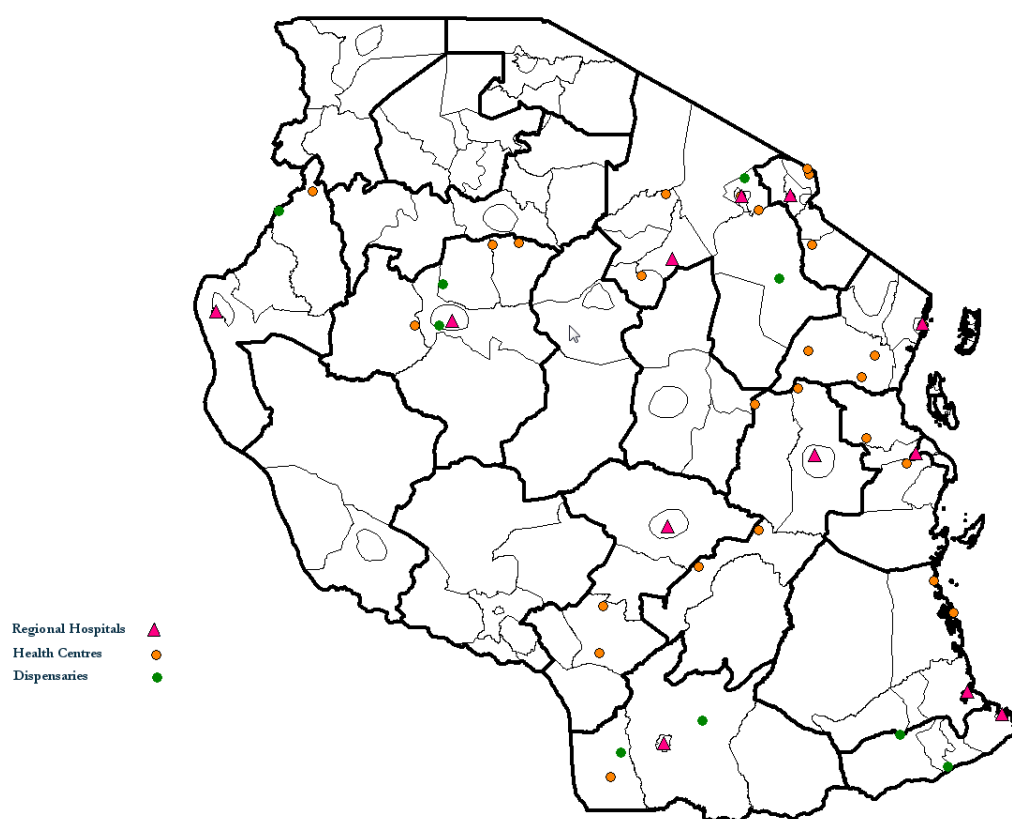
<sup>1</sup> Although this was a baseline, the timing of the study was such that in some regions, such as Mtwara and Lindi, the programme had been implemented for approximately a year, while in others, such as Tanga, the programme had not yet been introduced.

delivery data from all MAISHA-supported facilities that were conducting deliveries in those regions, all facilities with at least one delivery per day were included in the study.<sup>2</sup>

MAISHA primarily targets lower-level health facilities, including health centres and dispensaries, for quality improvement. The programme also works with regional hospitals to establish centres of excellence for training and high-quality referral care.

The study was powered on the number of deliveries to be observed. To achieve the power desired for analysis, it was determined that 214 deliveries in regional hospitals and 214 deliveries in health centres/dispensaries should be observed. The number of deliveries to be observed was then turned into a “quota” for each health facility, with lower-volume sites allocated fewer deliveries to be observed. This was done knowing that weights would be applied to the values to adjust for differences in volume. (See **Figure 1** below for study site locations.)

**Figure 1. Study sites**



Regional hospitals in Tanzania provide tertiary level care and serve as referral sites from district hospitals, while health centres and dispensaries provide primary health care. Regional hospitals and health centres/dispensaries were treated as two different strata; thus, if too few deliveries were observed in health centres, we did not “add” deliveries from a regional hospital. Most analyses are presented stratified by facility level because differences between the levels of health facility were significant. All aspects of essential maternal and newborn care should be available at each level of health facility.

The sample consisted of 52 health facilities: 12 regional hospitals, 29 health centres and 11 dispensaries (health centres and dispensaries were assigned a stratum together). In the tables, the total facilities reported on may be less than 52 because portions of the tools were not entered. Labour and delivery (L&D) services were not observed at nine facilities, either

<sup>2</sup> In Mtwara and Lindi, no facilities had a delivery volume of one delivery per day, so two facilities in the sample had a lower delivery volume.

because they did not provide these services or no deliveries occurred during the observation period. Therefore, the sample for almost all L&D calculations is 43 health facilities. **Table 1** shows the basic infrastructure characteristics of health facilities in the sample.

Facilities generally had fewer than 200 beds, with the average at 108 beds. Hospitals were better equipped to offer high-quality services in almost all cases.

**Table 1. Facility infrastructure characteristics of the sample**

FACILITY INFRASTRUCTURE CHARACTERISTICS	HOSPITALS n=12		HEALTH CENTRES/ DISPENSARIES n= 38		ALL FACILITIES n= 50*	
	n	%	n	%	n	%
Number of overnight beds per facility (mean)						
<200	3	25	37	97	40	82
200-399	6	50	0	0	6	12
400+	3	25	0	0	3	6
Ability to conduct surgery with general anaesthesia	12	100	6	16	18	50
Electric power (grid or functioning generator with fuel)	12	100	28	74	40	80
Safe water source within 500 metres of facility	10	91	18	53	28	62
Functional improved type toilet	11	92	27	73	38	78
Communication equipment	12	100	7	18	19	38
24 hour staff coverage (schedule observed or staff live onsite)	10	83	33	87	43	86
Emergency transport	9	75	18	47	27	54

\*Two health facilities did not complete information.

### 3.4 DATA COLLECTION PROCEDURES

Data collectors included 20 health care providers who were endorsed by the MoHSW as national Life Saving Skills trainers. Data collectors were given a two-day technical update in basic emergency obstetric and newborn care (BEmONC), followed by seven days of training in data collection, which included two days of practicum. The training also covered research ethics and consent, familiarization with all of the tools, familiarization with the mobile phone technology (all data collection was conducted using mobile phones), simulations with scoring, an inter-rater reliability exercise and two days of practical application at hospitals in the Dar es Salaam area.

Survey data were recorded by data collectors on Smartphones using custom-created, data entry programmes developed using the PocketPC Creations software package on a Windows mobile platform. Logic, skip and consistency checks were built into the programmes. Data collectors were trained to review records for missing or inconsistent answers before submission. Depending on whether phone coverage was available at the study site, data from each handheld device were either uploaded directly to a central database at the end of each day or backed up to a secure digital card to be uploaded upon returning from the field.

Data were uploaded from the phones to a database on a secure network. Once in the database, data were put into tables and made available for study team members via a Web site that was accessible only by password. Analysis was conducted both by the study's principal investigator and team in the U.S., and by the study team in Tanzania using SPSS.

Data collectors worked in teams of two to four people, depending on the size of the health facility. Fieldwork was conducted from July to August 2010, and a total of 18 days were used for fieldwork.

### 3.5 DATA ANALYSIS

Descriptive statistics were run, including frequencies and means, with data disaggregated by level of facility. Delivery cases (only) were weighted proportional to facility caseload. Different weighting values were applied when the data were disaggregated, compared to when presented for all facilities. Missing values / “don’t know” answers were excluded from the denominator in all calculations.

### 3.6 ETHICAL CONSIDERATIONS

The study protocol was submitted to and approved by the National Institute of Medical Research (NIMR) in Tanzania and the Institutional Review Board (IRB) of the Johns Hopkins Bloomberg School of Public Health (JHSPH). The JHSPH IRB ruled the protocol exempt from review under 45 CFR 46.101(b), Category (5). Informed consent was obtained from all participating health providers and patients, as well as from facility directors. If a woman was incapacitated, consent was to be obtained from next of kin or guardian. However, this situation did not occur in the course of the study.

The study team intervened to save the life of the mother or newborn when a life-threatening situation occurred.

### 3.7 LIMITATIONS

The sampling frame for this study was not nationally representative by design, since this study is intended to serve as a baseline for the MAISHA programme. Given that the data collection was large in scope, missing data occurred throughout many of the study tools. Since women come to deliver in different stages of labour and since data collectors sometimes were observing multiple cases at once, the number of women observed in each stage of labour differs. Some technical challenges were faced with the mobile phones for data collection.

Simulation of newborn resuscitation on models has limitations: extension of the models’ neck may need to be exaggerated to achieve simulated breathing and a standardized “mother” or “guardian” was not used to test the provider’s interpersonal skills during resuscitation. Some providers stopped after the stimulation and suction portion and did not perform bag and mask resuscitation. Additionally, the interpretation of the results should be considered in the context that the model was new for some providers. Finally, the scores on newborn resuscitation may be somewhat variable, since inter-rater reliability tests were not conducted on the assessment team.

Data on assessment of breastfeeding within the first hour also had limitations. The related question asked if the woman had assistance to start breastfeeding within the first hour, but did not ask whether the woman was assisted to position the infant or whether the infant was assisted to latch on. Consequently, the data do not provide a clear picture of what assistance the mother was provided. In many cases, the provider simply asked whether breastfeeding started, but did not provide any specific support.

Questions related to encouraging the woman to ambulate and to offering the woman to deliver in different positions were combined. The value of 56% most likely reflects the former, since discussion with observers revealed that practically no woman was offered the possibility of delivering in different positions.

## 4. FINDINGS ON FACILITY READINESS

### 4.1 PRESENCE OF SKILLED PERSONNEL

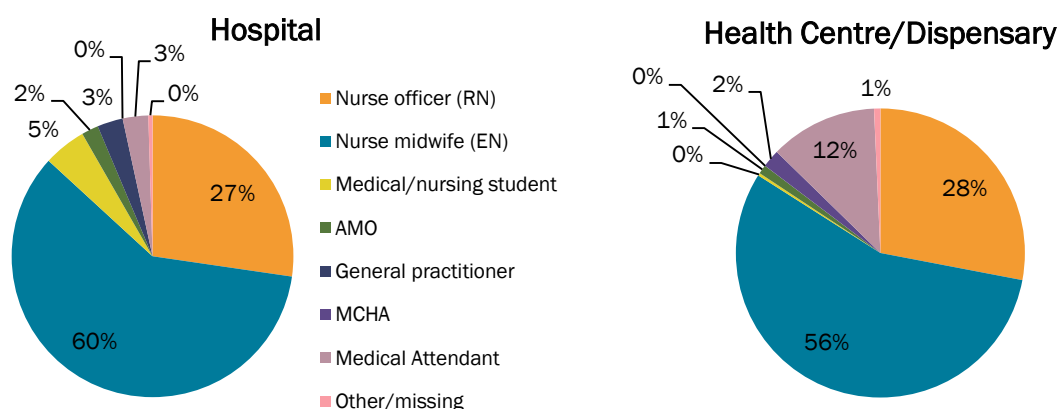
Human resources for health and, in this context, the attendance of a skilled health care provider, are critical factors for improving MNH and reducing maternal and newborn mortality (Lancet Maternal Mortality Series 2006). In Tanzania, all facility deliveries are supposed to be attended by a skilled birth attendant. Cadre training and background in midwifery are summarized in **Table 2**. Distribution of provider type is shown in **Figure 2**.

**Table 2. Cadres of health care providers providing maternity services**

CADRE	TOTAL YEARS OF TRAINING	TRAINING INCLUDES MIDWIFERY	AUTHORIZED BY MOHSW TO PROVIDE DELIVERY SERVICES
Nurse Officer	3	Yes	Yes
Nurse Midwife	2 - previously 3*	Yes	Yes
Maternal Child Health Aide (MCHA) (This course is no longer being offered in Tanzania.)	2 (minimum 7 in education as an entrance qualification)	Yes, on selected competencies	Yes, normal deliveries
Medical Attendant	0	No	No
Assistant Medical Officer	3	Yes	Yes
Clinical Officer	3	Yes	Yes
General Practitioner	5	Yes	Yes

\*Due to the human resource crises in Tanzania and the plan to increase number of health providers, the length of some training courses has been reduced.

**Figure 2. Distribution of provider type for observed deliveries**



A total of 489 deliveries were observed, with about 60% of deliveries occurring at the health centres and dispensaries and remaining 40% at regional hospitals. The majority of maternity clients observed were attended by skilled personnel providing L&D services—a nursing officer (28%) or nurse midwife (57%). However, in 9% of observations, a MCHA (1%) or medical attendant (8%) provided L&D services (see **Table 3**). The latter cadre is not authorized to provide care during labour and delivery. The deliveries by medical attendants were primarily at the health centres/dispensaries (12%), compared to only 3% at hospitals. Only five deliveries were conducted by a general practitioner and none by obstetricians. It was also surprising that so few observed deliveries were performed by students and none by residents.



**Table 3. Cadre of service providers providing L&D services**

CADRE OF L&D SERVICE PROVIDER	OBSERVATIONS IN HOSPITALS n=195		OBSERVATIONS IN HEALTH CENTRES/DISPENSARIES n=294		ALL OBSERVATIONS n=489	
	n	%*	n	%*	n	%
Nurse Officer (Registered Nurse)	54	28	83	28	137	28
Nurse Midwife (Enrolled Nurse)	118	61	162	55	280	57
Medical/Nursing Student	9	5	1	0.3	10	2
AMO	3	2	4	1	7	1
General Practitioner	5	3	0	0	5	1
MCHA	0	0	6	2	6	1
Medical Attendant	5	3	36	12	41	8
Other**/Missing	1	0.5	2	0.7	3	0.6

\*Total may not equal 100% due to rounding.

\*\*Other was not specified in the data collection tool but likely to include clinical officers.

## 4.2 AVAILABILITY OF ESSENTIAL MATERNAL AND NEWBORN HEALTH SUPPLIES

Facilities were assessed for supplies and equipment using a standardized inventory tool. The inventory of supplies and equipment for L&D is detailed in **Appendix A**. The following information will not be analysed in detail, but of note:

- Thirty-one percent of facilities did not have a functional bag and mask to perform newborn ventilation, which is unacceptable in any facility where women deliver.
- There was a serious lack of towels/blankets (90%), which are essential at the time of birth to ensure that the baby is dried properly. Although many mothers bring them, it is important that facilities can provide towels, especially for very poor women who may have not have the means to bring clean cloths.

## 4.3 HEALTH WORKER KNOWLEDGE OF MANAGEMENT OF OBSTETRIC AND NEWBORN COMPLICATIONS

Health care providers in ANC and maternity wards were given a knowledge assessment, after obtaining informed consent. This was a limited assessment of their competency and will not be linked to care given. **Table 4** presents the characteristics of the health care providers who participated in the knowledge assessment. A total of 206 providers participated, 38% of whom were stationed at regional hospitals; this is in line with the percentage of deliveries observed at hospitals (40%).

**Table 4. Health worker characteristics for knowledge assessment**

HEALTH WORKERS PARTICIPATING IN KNOWLEDGE TEST	REGIONAL HOSPITALS n=79		HEALTH CENTRES/DISPENSARIES n=127		ALL FACILITIES n=206	
	n	%	n	%	n	%
Nurse Officer	27	35	28	22	55	27
Nurse Midwife	42	54	66	52	108	53
Medical/Nursing Student or Resident	1	1	1	1	2	1
Assistant Medical Officer	0	0	2	2	2	1
Clinical Officer	0	0	6	5	6	3
General Practitioner	1	1	0	0	1	1
MCHA	1	1	11	9	12	6
Medical Attendant	1	1	13	10	14	7
Other/Missing	6	8	0	0	6	1



MEAN NUMBER OF DELIVERIES AS MAIN PROVIDER IN PAST 6 MONTHS	REGIONAL HOSPITALS n=40		HEALTH CENTRES/ DISPENSARIES n=67		ALL FACILITIES n=107	
	n	%	n	%	n	%
0-10	34	85	39	58	73	68
11-25	6	16	18	27	24	22
26-50	0	0	10	15	10	9

The majority of those interviewed were nurse midwives (53%), followed by nursing officers (27%). The number of deliveries conducted in the last six months was primarily in the range of 0–10 (68%), with no provider having more than 50 deliveries in that time period.

Surprisingly, providers in the health centres and dispensaries were much more likely to have a higher number of deliveries, as compared to providers in regional hospitals. The issue of staff providing services outside their routine workplaces will lead to poorer quality of care unless they are supported in the beginning. Moving staff around is common due to the acute shortage of human resources, as is using “unskilled” staff for service provision.

Around 68% of providers interviewed are performing 10 or fewer deliveries in six months, which has implications for maintaining competency.

### Maternal Health Knowledge

Scores were highest on routine procedures during L&D (90% of providers could correctly respond) and on recording of observations and monitoring (88%). Much lower scores were achieved by providers on actions to reduce mother-to-child transmission of HIV (MTCT) during L&D; postpartum care for a woman presenting 72 hours postpartum with general malaise (26%); and actions, tests and interventions for PPH for atonic uterus (34%). (Refer to **Table 5.**) Given that all of these are health priorities in Tanzania, providers should have the working knowledge outlined in the interviews (at a minimum)—indicating either a gap in knowledge or in motivation to perform. In most cases, the assessors translated the interviews into Kiswahili to clarify understanding of the questions being asked. Poor management of PPH in two-thirds of providers is a major gap; this skill can be considered the benchmark on which a provider “passes or fails” a basic maternal and newborn care training course.

For most items on the knowledge test, there was almost no difference between health care providers in regional hospitals and those in health centres/dispensaries. The exception was actions, tests and interventions for obstructed labour, for which 44% of respondents in regional hospitals and 33% of respondents at health centres/dispensaries answered correctly. This exception is probably due to increased opportunities for practice and broader experiences in the hospital.

**Table 5. Maternal health scores (mean percentage scores, correctly answered questions)**

SIGNS AND MANAGEMENT OF L&D	REGIONAL HOSPITALS (MEAN SCORE)	HEALTH CENTRES/ DISPENSARIES (MEAN SCORE)	ALL FACILITIES (MEAN SCORE)
Observations and monitoring during L&D	52%	57%	55%
Recording of observations and monitoring*	99%	82%	88%
Routine procedure during L&D	90%	89%	90%
Actions to reduce MTCT during L&D	27%	30%	29%
Likely location of tears and lacerations	49%	48%	48%
Signs of to assess woman with heavy postpartum bleeding	42%	41%	41%
Actions, tests, interventions for heavy bleeding postpartum from atonic/poorly contracted uterus	37%	37%	37%
Actions, tests, interventions for retained placenta/products of conception	29%	29%	29%
Signs of obstructed labour	32%	33%	33%
Actions, tests, interventions for obstructed labour	40%	40%	40%
Tests or evaluations for woman who presents 72 hrs postpartum with general malaise	41%	42%	42%
Actions, tests, interventions for woman who presents 72 hrs postpartum with general malaise	26%	26%	26%

\*Value is percentage answering correctly, not mean score (only one correct answer).

Less than one-third of the questions on actions to reduce mother-to-child transmission of HIV (MTCT) during L&D were correctly answered, a surprising finding given the training and other national initiatives on this topic. Similarly, one-third of the questions on signs of obstructed labour—one of the five main causes of maternal death—were answered correctly. About one-quarter of questions on actions and interventions for postpartum sepsis (postpartum general malaise) were answered correctly. All of these knowledge areas are essential for all currently practicing maternal and newborn care staff.

The percentage of correct answers ranged from 26% of questions on actions/interventions for postpartum sepsis to 90% on questions on inappropriate routine practices. The level of correct answers did not appear to vary substantially between hospitals and health centres/dispensaries, except for the question on recording of observations and monitoring. Almost all of providers from hospitals answered this question correctly (on a partograph), while only 82% of health centre/dispensary providers were correct.

The information outlined in **Table 6** indicates many gaps in knowledge of PE/E. These include checking urine for protein (only one-third mentioned this); 14% of providers at hospitals and 34% at health centres/dispensaries would provide an antihypertensive, and a mean score of 68% would give magnesium sulphate. Monitoring of women who have received magnesium sulphate was very poor at 6% average, and no one (0%) listed the need to have calcium gluconate, the antidote<sup>3</sup> to magnesium sulphate, available. Although most providers could diagnosis severe PE (81%), they answered only one-third or less of the questions correctly for most other sections. More providers from hospitals knew the correct action to take for severe PE, while half of health centre/dispensary providers thought that the patient should be referred. Providers at the lower level should know the protocol for PE/E treatment; hospitals can be far away and transport difficult, so immediate action is needed to maintain control of the situation. For management of a patient with convulsions, results indicate that providers are confused about the correct treatment, with almost 40% of providers answering incorrectly that diazepam should be given. Knowledge of the correct medication, magnesium sulphate, was higher at district hospitals.

<sup>3</sup> In rare occasions, some women may develop severe respiratory depression due to magnesium sulphate, and calcium gluconate is the antidote to this.

**Table 6. PE/E case study scores (mean percentage scores, correctly answered questions)**

EXAMINATION ACTIONS	REGIONAL HOSPITALS (MEAN SCORE)	HEALTH CENTRES/ DISPENSARIES (MEAN SCORE)	ALL FACILITIES (MEAN SCORE)
Level of consciousness	16%	14%	15%
Any convulsions	19%	17%	18%
Check vital signs	93%	83%	87%
Check urine protein	28%	32%	30%
Mean percentage score (exam actions)*	36%	33%	34%
<b>Working diagnosis</b>			
Severe pre-eclampsia	81%	81%	81%
<b>Action to take</b>			
Stabilize with magnesium sulphate and antihypertensives	75%	47%	57%
<i>Wrong answer: refer immediately</i>	15%	51%	37%
<b>Action to take if presented with convulsion</b>			
Administer oxygen at 4–6 L per minute	10%	10%	10%
Give magnesium sulphate	78%	63%	68%
Provide antihypertensives	38%	16%	24%
Mean percentage score (actions for convulsions)*	41%	31%	34%
<i>Wrong answer: give intravenous diazepam</i>	32%	43%	39%
<b>Essential equipment and supplies must be available at the referral facility</b>			
IV with normal saline or Ringer’s lactate	62%	69%	66%
Urinary catheter and urinary bag	51%	39%	43%
Patellar hammer	12%	9%	11%
Suction machine and catheter	51%	37%	42%
Oxygen and adult mask	57%	30%	40%
Magnesium sulphate	79%	67%	71%
Calcium gluconate	0%	0%	0%
Injectable antihypertensives	35%	26%	30%
Mean percentage score (equipment)	43%	35%	38%
<b>Action to take one hour later</b>			
Repeat magnesium sulphate 4 hrs after last dose if reflexes, urine output and respirations are normal	56%	38%	45%
Maintain diastolic BP between 90–100 with antihypertensives	31%	30%	30%
Monitor her labour and begin partograph	52%	43%	46%
Record fluid intake and output hourly	35%	18%	25%
Check and record respirations and patellar reflexes hourly	9%	4%	6%
Mean percentage score (actions 1 hour later)*	31%	23%	26%
<b>PE/E case study mean percentage score**</b>	<b>36%</b>	<b>36%</b>	<b>36%</b>

\*Mean score includes additional variables not listed.

\*\*Case study score is mean score for four items (exam actions and diagnosis, action to take for convulsions, equipment, action one hour later).

## Newborn Health Knowledge and Skills

Providers were asked to perform a simulated newborn resuscitation using a NeoNatalie<sup>4</sup> newborn model. **Table 7** below presents findings from the providers' simulations. The findings represent the first attempt at resuscitation. If "breathing" of the model was not established in the first attempt, many providers tried again. (These data are not presented.)

Simulation on models is not perfect due to practical issues—for example, extension of the models' neck may be exaggerated to achieve simulated breathing, and the simulation does not allow for observing provider's interpersonal skills in communication with the mother or support person. Additionally, the interpretation of the results should be considered in the context that this model was new for some providers.

**Table 7. Provider correctly performs steps in newborn resuscitation during simulated resuscitation**

	HOSPITALS N=79		HEALTH CENTRES/ DISPENSARIES N=127	
	N	%	N	%
Quickly dries newborn	66	87	92	75
Wraps or covers the newborn with dry towel, except for the head, face and upper chest	63	84	88	71
Places the newborn on his/her back on a clean, warm surface	63	83	100	81
Places the head in a slightly extended position to open the airway	56	74	83	52
Clears the airway by suctioning the mouth first and then the nose	66	87	63	68
Introduces catheter no more than 5 cm into the newborn's mouth and suctions while withdrawing catheter	42	55	55	45
Introduces catheter no more than 3 cm into each nostril and suctions while withdrawing catheter	43	58	49	41
Places the correct-sized mask on the newborn's face so that it covers the chin, mouth and nose (but not eyes)	55	72	69	57
Squeezes the bag with two fingers only or with the whole hand, depending on the size of the bag	48	63	65	53
Ventilates at rate of 40 breaths/minute	39	37	28	32

The performance of the resuscitation was consistently (and in some cases, significantly) lower at health centres and dispensaries, as compared to hospitals. For example, hospital providers are 22 percentage points more likely to know how to extend the head during resuscitation than the staff at health centres. The difference between level of facility in "places the correct-sized mask on newborn's face so it covers the chin, mouth and nose" was 15 percentage points. Providers who perform a skill frequently (due to higher caseloads in hospitals) would be expected to be more competent.

Notably low were: places the head in a slightly extended position to open the airway (52% of providers in health centres and dispensaries correctly performed); introduces catheter no more than 5 cm into the newborn's mouth and suctions while withdrawing catheter (45% correctly performed at health centres/dispensaries); and ventilates at rate of 40 breaths/minute (32–37% correctly performed). Some of these low scores can be attributed to unfamiliarity with the model. However, they also suggest that staff at lower-level facilities are less competent in this essential skill.

<sup>4</sup> NeoNatalie models are used within the Helping Babies Breathe (HBB) programme <http://www.helpingbabiesbreathe.org/>.

## 5. FINDINGS FOR OBSERVED PERFORMANCE OF ROUTINE DELIVERY CARE

### 5.1 DESCRIPTION OF CLIENTS IN LABOUR AND DELIVERY OBSERVATIONS

Observations in the maternity ward of women in labour were conducted in all health facilities in the study. The resulting sample of clients comprised 489 observations. The number of clients observed by region is detailed in **Table 8** below. Pwani region had a high proportion of clients (21%) because it was visited twice by a study team and had high-volume facilities.

**Table 8. Facility characteristics of L&D sample**

REGION	N	%
Arusha	31	6
Iringa	76	16
Kigoma	8	2
Kilimanjaro	37	8
Lindi	15	3
Manyara	27	6
Morogoro	26	5
Mtwara	20	4
Pwani	104	21
Ruvuma	30	6
Tabora	30	6
Tanga	85	17
Total	489	100

### 5.2 INITIAL CLIENT ASSESSMENT

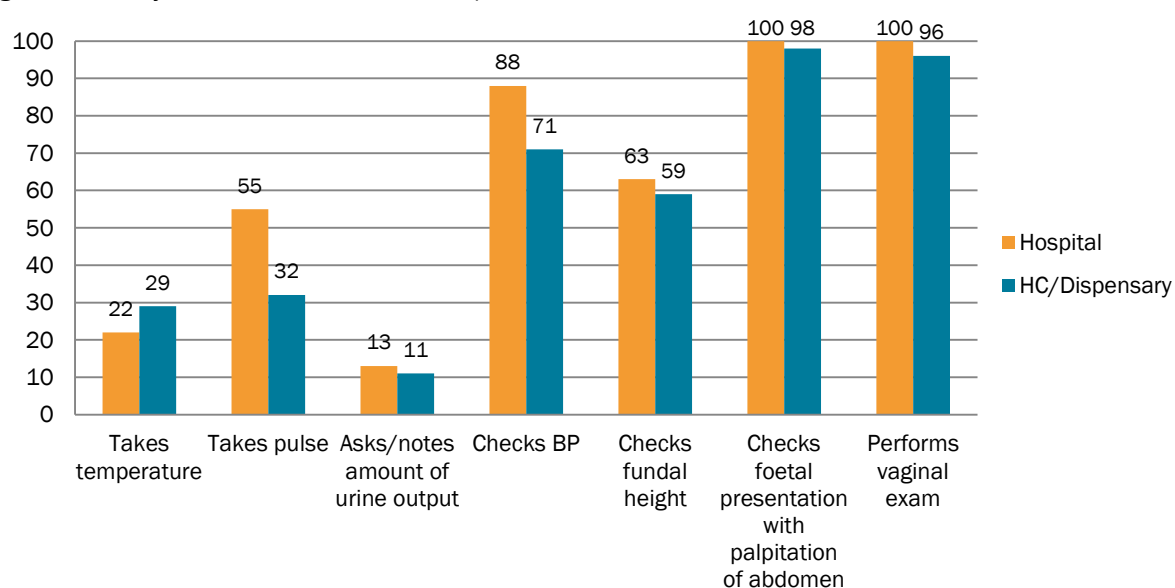
When a woman is admitted in labour, the provider has to undertake a full assessment to ensure that care is planned according to individual needs and to detect and manage any problems. The initial client assessment is critical to identifying problems, especially danger signs that require immediate attention. **Table 9** details performance in some of the key steps in initial client assessment.

**Table 9. Key steps in initial client assessment**

INITIAL CLIENT ASSESSMENT	REGIONAL HOSPITALS n=120		HEALTH CENTRES/ DISPENSARIES n=186		ALL FACILITIES n=306	
	n	%	n	%	n	%
Checks client card or asks for age, length of pregnancy, parity	110	97	179	99	289	97
Checks blood pressure	96	88	149	71	245	83
Takes temperature	31	22	57	29	88	24
Takes pulse	54	55	74	32	128	48
Asks/notes amount of urine output	15	13	17	11	32	12
Performs general examination (anaemia, oedema, etc.)	50	45	107	65	157	50
Checks fundal height	74	63	111	59	185	61
Checks foetal presentation with palpation of abdomen	112	100	185	98	297	99
Checks foetal heart rate	117	100	184	98	301	100
Performs vaginal examination (cervical dilation, foetal descent, position, membranes, meconium)	114	100	183	96	297	100
Mean percentage score for initial client assessment	68%		66%		67%	

In the initial assessment, checking foetal presentation with palpation of the abdomen, checking foetal heart rate and performing vaginal exams seem to be close to universal. Checking the fundal height was performed in approximately 61% of cases, and general examinations were done for approximately half of the clients. Taking pulse and temperature were performed for 42% and 24% of clients, respectively, and noting urine output was done for only 12% of clients. (See **Figure 3** below.) Women delivering at health facilities were much less likely to have their pulse or blood pressure checked.

**Figure 3. Quality of initial client assessment/examination**



## Assessment of Danger Signs

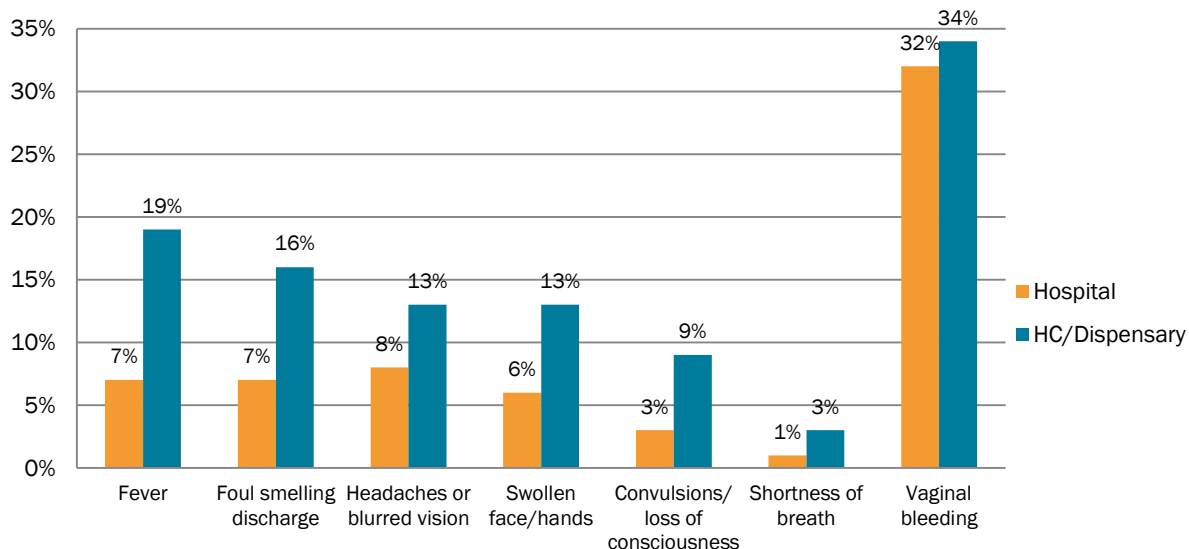
Assessment of danger signs during the initial client assessment in labour is critical to identify obstetric emergencies and triage clients to urgent care. **Table 10** details some of the key steps of assessing danger signs during the initial client assessment, called a “quick check,” and whether they were conducted.

**Table 10. Assessment of danger signs during initial assessment**

CLIENT ASSESSED FOR	REGIONAL HOSPITALS n=120		HEALTH CENTRES/ DISPENSARIES n=186		ALL FACILITIES n=306	
	n	%	n	%	n	%
Fever	10	7	22	19	32	10
Foul-smelling discharge	10	7	24	16	34	9
Headaches or blurred vision	12	8	19	13	31	9
Swollen face/hands	7	6	14	13	21	7
Convulsions/loss of consciousness	4	3	9	9	13	5
Shortness-of-breath	2	1	3	3	5	1
Vaginal bleeding	35	32	55	34	90	32
Mean percentage score for assessment of danger signs	9		15		11	

The assessment of danger signs during the initial assessment was low, ranging from 1% of clients being assessed for shortness of breath (breathing difficulties) to 32% of clients being assessed for vaginal bleeding. The provider’s check of some of these danger signs may have been difficult to observe; however, this is definitely an area of concern (**Figure 4**).

**Figure 4. Assessment of danger signs during initial assessment**



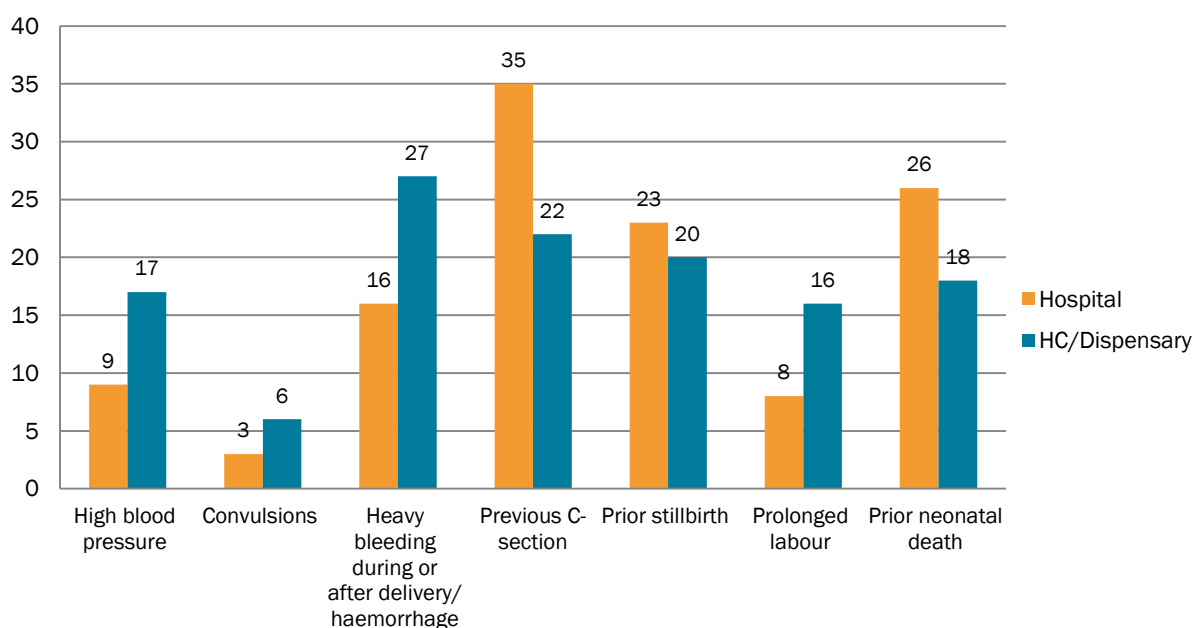
During the initial assessment of the client in labour, it is also important to assess previous complications that may affect the management of the current labour, such as in the case of a previous caesarean section. **Table 11** and **Figure 5** detail the assessment of previous complications (via comprehensive history-taking using closed questions) for multiparous clients during the initial assessment. Overall, there were low levels of assessment of clients for previous complications, with no specific conditions asked about in more than 35% of cases. Health centres and dispensaries scored slightly higher than district hospitals on many of the specific complications.



**Table 11. Assessment of previous complications during admission for labour (multiparous clients only)**

CLIENT ASSESSED FOR	REGIONAL HOSPITALS n=63		HEALTH CENTRES/ DISPENSARIES n=134		ALL FACILITIES n=197	
	n	%	n	%	n	%
High blood pressure	7	9	17	17	24	11
Convulsions	3	3	7	6	10	4
Heavy bleeding during or after delivery/ haemorrhage	10	16	24	27	34	17
Previous caesarean section	20	35	30	22	50	28
Prior stillbirth	15	23	24	20	39	20
Prolonged labour	5	8	12	16	17	10
Prior neonatal death	12	26	24	18	36	21
Abortion	13	26	34	20	47	21
Prior assisted delivery	10	15	19	20	29	15
Mean percentage score for assessment of previous complications	18		19		16	

**Figure 5. Assessment of previous complications during initial assessment**



### 5.3 USING THE PARTOGRAPH TO MONITOR LABOUR

Partograph use is critical in monitoring maternal and foetal well-being and the progress of labour, as it allows providers to make appropriate decisions on when to take actions to save a woman/newborn’s life. WHO recommends using a partograph to help birth attendants make better decisions for the diagnosis and management of prolonged and obstructed labour, as well as help detect foetal distress and other complications of labour (WHO 2000, WHO 2006a).

Partograph use during observation was evaluated by reading of the partograph after delivery and not necessarily based on observations during partograph use (some clients were not observed during that stage of labour). Overall, partographs were used for 74% of maternity clients. In the overwhelming majority of cases, this was the “old WHO partograph,” where the active stage of labour starts at 3 cm dilation and includes the latent phase of labour—which is the correct partograph to use according to current Tanzanian national policy. A handful of facilities (4%) were using the WHO “modified partograph”

(which does not include the latent phase and in which active labour is considered to begin when cervical dilatation is 4 cm). (Refer to **Table 12.**)

**Table 12. Partograph usage from observation**

	ALL FACILITIES n=438	
	n	%
Partograph used during labour	283	74
Partograph use by type (only recorded amongst those clients who had partograph used)		
	n	%
Old WHO partograph*	270	94
New WHO partograph**	10	3
Other partograph	8	3
Correct filling of the partograph		
	n	%
Partograph initiated at the right time	197	88
Partograph filled every half hour with		
Frequency and duration of contractions correctly filled	125	60
Foetal heart tones correctly filled	130	60
Maternal pulse correctly filled	66	35
All three items filled in at least every half hour during labour	59	33
Blood pressure recorded every 4 hours	130	61
Partograph filled in after delivery with		
Birth time correctly filled	233	100
Delivery method correctly filled	236	100
Estimated blood loss correctly filled	202	96
Partograph filled in after delivery	197	95

\*"Old partograph" is the partograph where the active stage starts at 3 cm dilation and includes latent phase.

\*\*"New modified partograph" is the partograph where the active stage starts at 4 cm dilation.

The quality of partograph use was poor. Approximately one-third (33%) filled the partograph every half hour during the labour. Important areas such as "was maternal pulse correctly filled" and "blood pressure recorded every four hours" were only correctly filled 35% and 61% of the time, respectively.

### Retrospectively Reviewed Partographs

In addition to the observations of providers completing partographs when caring for a woman in labour, a retrospective review of partographs was also conducted. A total of 206 partographs (an average of four per facility) were reviewed in this way. **Table 13** presents the findings on the availability of partographs for review in the different health facilities.

**Table 13. Partograph review**

NUMBER OF PARTOGRAPHS AVAILABLE FOR REVIEW	HOSPITALS	HEALTH CENTRES/DISPENSARIES
Mean	9	2
Range	1-15	1-8

Storage of partographs was generally found to be disorganized and unsystematic. Originally, the team was supposed to review 24 partographs (eight for each of the previous three months). No facility had 24 partographs filed and available for review, and in four health facilities, there was not even one available for review.

Very few of the reviewed partographs were correctly filled in all areas. The strongest areas for partograph use were delivery method, birth time and estimated blood loss, where 89%, 88% and 76% of reviewed partographs, respectively, had this area filled.

For the areas of monitoring maternal and foetal well-being, less than half recorded foetal heart tones and frequency and duration of contractions, and maternal pulse was recorded in only a quarter of the partographs.

## 5.4 PERFORMANCE OF INFECTION PREVENTION (PREVENTION OF PUERPERAL SEPSIS) PRACTICES

### Infection Prevention Measures

Use of standard infection prevention and hygiene measures is a core concept for the prevention of infection transmission in health care settings. Standard infection prevention practices recommended during delivery care are aimed not only at preventing maternal and neonatal infection, but also infection of the health worker, other workers and the public. Given an HIV prevalence of 5.7% in Tanzania, infection prevention is particularly important (THMIS).

Adherence to infection prevention practices was assessed against a set of standard measures that are proven to be effective, including handwashing practices, use of personal protective barriers, instrument processing starting with decontamination of reusable items in 0.5% chlorine solution, and disposal of contaminated items into appropriate containers. See **Table 14** below for details.

**Table 14. Infection prevention practices**

INFECTION PREVENTION IN INITIAL ASSESSMENT	REGIONAL HOSPITALS n=121		HEALTH CENTRES/ DISPENSARIES n=187		ALL FACILITIES n=306	
	n	%	n	%	n	%
Washes his/her hands before any examination	60	56	106	62	166	57
INFECTION PREVENTION IN FIRST STAGE OF LABOUR	REGIONAL HOSPITALS N=112		HEALTH CENTRES/ DISPENSARIES N=179		ALL FACILITIES N=291	
	N	%	N	%	N	%
Washes his/her hands before any examination	53	52	97	62	150	54
Wears high-level disinfected or sterile gloves for vaginal examination	104	100	173	98	277	97
Puts on clean protective clothing for birth (protecting face, hands, body)	70	62	40	26	110	51

INFECTION PREVENTION IN IMMEDIATE NEWBORN AND POSTPARTUM CARE	REGIONAL HOSPITALS N=170		HEALTH CENTRES/ DISPENSARIES N=256		ALL FACILITIES N=426	
	N	%	N	%	N	%
Disposes of all sharps in puncture-proof container immediately after use	163	98	239	90	402	95
Decontaminates all reusable instruments in 0.5% chlorine solution	168	98	215	89	383	95
Disposes of all contaminated waste in leakproof containers	165	99	239	82	404	95
Removes apron and wipes with 0.5% chlorine solution	61	39	49	29	110	36
Washes hands thoroughly with soap and water and dries them	135	83	220	79	355	82
Mean percentage score for infection prevention	76		69		74	

In terms of infection prevention, areas of strength were in wearing gloves for vaginal examination, sharps disposal, decontamination of instruments, and disposal in leakproof containers in immediate newborn and postpartum care (97%, 95%, 95% and 95%, respectively).

An area of weakness in infection prevention is handwashing. Handwashing after procedures was highest at 82%. Before any examination, only 54% of providers washed hands in the initial assessment, and only 53% of providers washed their hands before examination in the first stage of labour. Another weakness was use of protective clothing other than gloves (51%) and decontamination of aprons (36%).

Almost all infection prevention practices were more common during deliveries at hospitals rather than health centres/dispensaries, especially use of protective clothing, which was 62% at hospitals versus 26% at other facilities.

## 5.5 WOMEN-FRIENDLY CARE DURING LABOUR AND DELIVERY (INTERPERSONAL COMMUNICATION)

The MAISHA programme is providing targeted inputs to health care providers on improved interpersonal skills with clients. Provider attitudes are one of the most important determinants of a woman accessing facility-based care (Kruk et al. 2009); therefore, this component is also critical to women's and communities' perceptions of quality of care. **Table 15** below presents the findings from maternity observations on components of woman-friendly care for the initial assessment of the woman in labour and the first stage of labour.

**Table 15. Woman-friendly care during labour**

INITIAL ASSESSMENT	REGIONAL HOSPITALS n=123		HEALTH CENTRES/ DISPENSARIES n=190		ALL FACILITIES n=313	
	n	%	n	%	n	%
Respectfully greets pregnant woman	115	98	181	98	296	97
Encourages the woman to have a support person present throughout labour and birth	33	30	90	42	123	33
Asks woman (and support person if present) if she has any questions	23	21	60	22	83	21
Explains procedures to woman (support person) before proceeding	75	71	147	82	222	73
Informs the pregnant woman of findings	73	66	141	73	214	67
FIRST STAGE OF LABOUR	REGIONAL HOSPITALS N=114		HEALTH CENTRES/ DISPENSARIES N=179		ALL FACILITIES N=293	
At least once, explains what will happen in labour to pregnant woman and her support person	60	52	114	53	174	51
At least once, encourages woman to consume fluids/food throughout labour	79	74	153	78	232	75
At least once, encourages/assists woman to ambulate and assume different positions during labour	62	59	97	54	159	57
Supports the woman during labour in a friendly way	99	93	173	98	272	93
Drapes woman	51	45	80	55	131	47
Mean percentage score for woman-friendly care	61		66		63	

Although the mean percentage score for woman-friendly care was over half of clients (63%), some aspects of good interpersonal skills were performed well while others were not. The areas of relative strength included respectfully greeting the pregnant woman (97% of clients) and supporting the woman during labour in a friendly way (93%). In 73% of cases, pregnant women were informed of the findings from investigations or procedures. It is encouraging to see that women are urged to consume fluids in 75% of cases as avoiding dehydration is important in reducing complications.

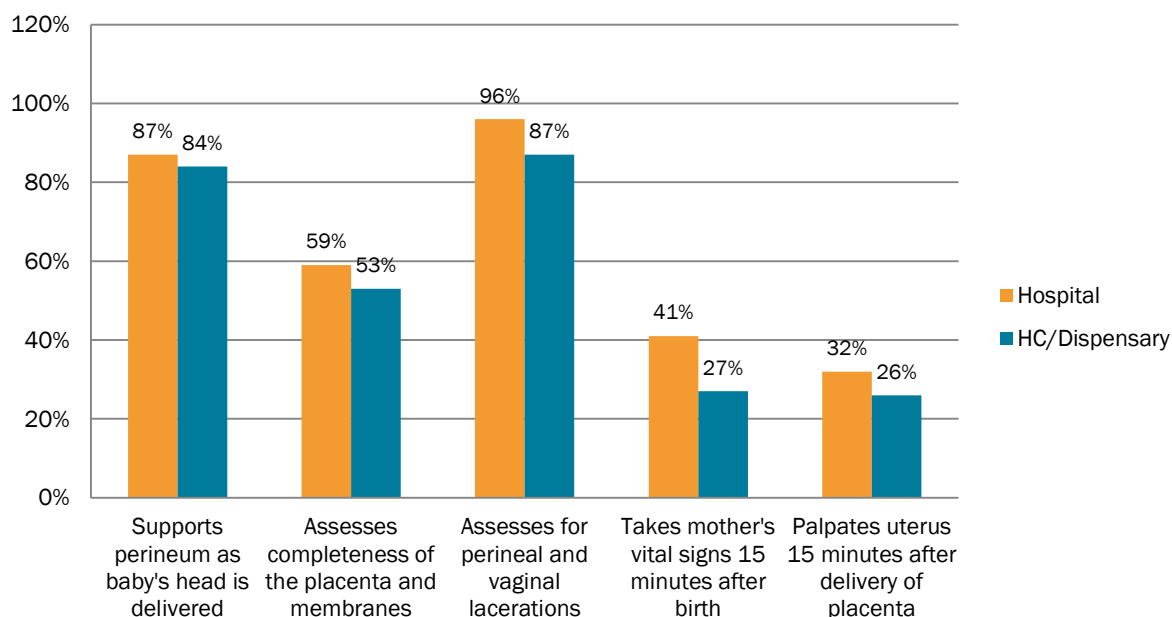
There is sound evidence that the presence of a support person in labour improves birth outcomes (Hodnett et al.), and this is more important when staffing levels are insufficient to provide continuous care in labour. Client load at lower-level facilities is generally low, often with few clients in labour at the same time, a situation that assists providers to encourage companion's support. However, providers infrequently encouraged the involvement of a support person (33%) and this was particularly low for clients in hospitals. Asking the client if she has any questions was overall very low, at 21%.

## 5.6 CARE DURING SECOND AND THIRD STAGE OF LABOUR

Because the majority of maternal deaths occur during labour, childbirth and immediately postpartum (60% of maternal deaths occur in the first 48 hours following birth), it is vital that care around this time is optimal (WHO 2006a). Additionally, the time of birth should be an occasion of great joy for the woman and her family, and the health care provider has a

key role in ensuring best practices in maternal and newborn care. Observations are noted in **Figure 6**.

**Figure 6. Observations of second and third stage of labour for hospitals and health centres\***



\*Practices observed 15 minutes after birth and after delivery of placenta may underestimate the true percentage of women receiving these practices because data collectors were sometimes busy with other cases, patient was not available having been moved to another room, or data collectors may have incorrectly estimated the 15 minute time period.

Areas of relative strength included assessment for perineal and vaginal lacerations and supporting perineum as baby's head is delivered, which did not differ greatly between hospitals and health centres and dispensaries. In 59% of the hospital and 53% of health centre/dispensary deliveries, the placenta and membrane were assessed for completeness—this is a significant gap in care as retained pieces of the placenta can cause PPH. The mother's vital signs were taken 15 minutes after birth in only 41% of the observed deliveries in hospitals and 27% of observed deliveries in health centres and dispensaries. Palpation of the uterus 15 minutes after delivery was similarly low, with 32% of observed deliveries in hospitals and 26% of observed deliveries in health centres/dispensaries. Hospital performance was similar but slightly higher than health centre/dispensary performance for most competencies. Immediate postpartum care is a time when care should not be neglected and increased vigilance is required.

## 5.7 PERFORMANCE OF IMMEDIATE AND ESSENTIAL NEWBORN CARE

At the time of birth, the newborn has to make a rapid transition to extra-uterine life, and certain key activities can facilitate this and, if performed effectively, can minimize complications that lead to newborn death and morbidity. These activities revolve around clean childbirth and cord care, thermal protection through warming, and early and exclusive breastfeeding.

All of the immediate newborn care interventions observed in this study are simple to perform and use minimal resources, yet results were variable. **Table 16** presents findings on immediate newborn care practices.

**Table 16. Key findings on immediate newborn care**

	REGIONAL HOSPITALS n=168		HEALTH CENTRES/ DISPENSARIES n=251		ALL FACILITIES n=419	
	n	%	n	%	n	%
Places newborn on the mother's abdomen skin to skin	60	43	107	37	167	42
Immediately dries baby with towel	157	94	222	84	379	91
Discards wet towel and covers with dry towel	155	94	222	85	377	93
Cuts cord with clean blade	167	100	248	100	415	100
Helps initiate breastfeeding within one hour	62	40	144	55	206	44

The universal adherence to the practice of cord cutting with a clean blade is expected in all facility births and means this standard has been fully met.

Although wrapping and drying of the infant was relatively high at 91% and 93%, placing the baby skin-to-skin was low at regional hospitals (43%) and even lower at health centres and dispensaries (37%). This suggests that about 60% of babies are separated from their mothers after birth, which is unnecessary and may lead to delayed initiation of breastfeeding and the baby getting too cold (hypothermia is a risk even in warm climates). In addition, if not with the mother, the newborns are at risk of other complications as they may not be observed by anyone.

Helping to initiate breastfeeding was similarly low, at 40% in regional hospitals and 55% in health centres and dispensaries. This is a key lifesaving intervention for newborns (UNICEF 2008) and deprives both the mother and baby of benefits as early breastfeeding may also reduce postpartum blood loss.

## 5.8 PERFORMANCE OF NON-INDICATED AND NON-BENEFICIAL PRACTICES

During the observations of deliveries, a number of harmful and un-indicated practices were observed. Harmful practices are those that evidence shows to have no benefit or in some cases may cause harm. Un-indicated practices are those that should be used only with specific indications, and otherwise may be harmful or unnecessary. These are presented in **Table 17**.



**Table 17. Harmful and un-indicated practices observed during delivery**

HARMFUL PRACTICES OBSERVED	REGIONAL HOSPITALS n=176		HEALTH CENTRES/ DISPENSARIES n=241		ALL FACILITIES n=417	
	n	%	n	%	n	%
Use of enema	0	0	0	0	0	0
Pubic shaving	1	1	0	0	1	1
Applying fundal pressure	9	4	8	3	17	4
Lavage of the uterus after delivery	8	7	18	6	16	7
Slap newborn	3	2	3	0.3	6	1
Hold newborn upside down	9	5	14	5	23	5
Milking the newborn's chest	6	4	2	1	8	3
Stretching of the perineum	39	16	35	15	74	16
UN-INDICATED PRACTICES OBSERVED	REGIONAL HOSPITALS n=176		HEALTH CENTRES/ DISPENSARIES n=256		ALL FACILITIES n=432	
	n	%	n	%	n	%
Manual exploration of the uterus after delivery	8	6	10	4	18	5
Use of episiotomy	5	2	4	1	9	2
Aspiration of newborn mouth and nose at birth	4	2	3	1	7	2
Restrict food and fluids in labour	1	1	0	0	1	0.4
Other	7	4	7	1	14	3
COMBINED	REGIONAL HOSPITALS n=174		HEALTH CENTRES/ DISPENSARIES n=241		ALL FACILITIES n=415	
	n	%	n	%	n	%
At least one harmful or un-indicated practice observed	51	29	59	34	110	28

Overall, a lower proportion of women received at least one harmful or un-indicated practice in regional hospitals (29%), as compared to health centres and dispensaries (34%). The most frequently occurring harmful practice was stretching of the perineum, which occurred in 16% of deliveries. It is disappointing to see cases of “slapping” the newborn or holding the newborn upside down (especially when providers were being observed) as these are very outdated practices and indicate staff have not been updated or supervised for some time.

For the un-indicated practices, the most frequently occurring was manual exploration of the uterus after delivery, occurring overall in 5% of deliveries. At 2%, there is a positive shift in reducing the number of unnecessary episiotomies performed.

## 6. PREVENTION AND MANAGEMENT OF SELECTED MAJOR MATERNAL AND NEWBORN HEALTH COMPLICATIONS

Three types of complications at birth were observed: PE/E, PPH and birth asphyxia (newborn resuscitation). Overall, 11 cases of PE/E were observed, 10 cases of PPH were observed and 35 newborn cases were observed.

There was one maternal death while the study team was present in a health facility, which according to medical staff was due to “cardio-respiratory failure.” Details of this case study can be found in **Appendix B**.

### 6.1 REPORTED PROVISION OF SIGNAL FUNCTIONS FOR EMERGENCY OBSTETRIC AND NEWBORN CARE

#### Facilities That Have Performed Signal Functions in the Last Three Months

The information in **Table 18** is based on reports of the maternity in-charges related to the provision of signal functions for EmONC. There are seven signal functions for basic emergency obstetric and newborn care (BEmONC) and an additional two signal functions for comprehensive emergency obstetric and newborn care (CEmONC).<sup>5</sup> Signal functions were established by WHO/UNFPA/UNICEF and AMDD in 1997, and updated in 2009, in an attempt to identify interventions needed to manage emergencies and life-threatening complications (WHO 2009). They also demonstrate facility functioning. Signal functions are usually evaluated based on provision within the last three months.

**Table 18. Provision of signal functions for BEmONC**

SIGNAL FUNCTION	HOSPITALS n=12		HEALTH CENTRES/ DISPENSARIES n=38*		ALL FACILITIES n=50	
Assisted delivery (ventouse or forceps)	4	33	2	5	6	12
Removal of retained products of conception	6	50	15	39	21	42
Use of parenteral oxytocic drugs	11	92	20	53	31	62
Use of parenteral anticonvulsants for PE/E	11	92	12	32	23	46
Parenteral antibiotics for pregnancy-related infections**	11	92	24	67	35	73
Manual removal of placenta**	10	83	17	47	27	56
Newborn resuscitation**	11	100	13	37	24	52
Basic emergency obstetric and newborn care score	77%		40%		49%	
Blood transfusion	12	100	4	11	16	32
Caesarean section	11	92	3	8	14	28
Comprehensive emergency obstetric and newborn care score (all 9 items )	70%		32%		41%	

\*Data from two health centres/dispensaries are missing for this section for all questions.

\*\*Data on antibiotics for pregnancy-related infections and manual removal of placenta are missing from two health centres/dispensaries; data on newborn resuscitation are missing from one hospital and three health centres/dispensaries.

Seventy-seven percent of hospitals had performed all of the BEmONC signal functions, while 70% of hospitals had conducted all nine signal functions. For health centres/dispensaries, the BEmONC and CEmONC scores are 40% and 32%, respectively.

For health centres and dispensaries to score only 40% for signal functions of BEmONC is low. This may be due to a low caseload, meaning that facilities simply did not encounter

<sup>5</sup> Tanzania has added an additional signal function for CEmOC anaesthesia that was not assessed in the study.

clients in the last three months in need of these services, or that EmONC cases are often referred to a higher level without being registered in the lower-level health facility. It is to be expected that health centres and dispensaries would score low on CEmONC, since blood transfusion and caesarean section would often not be regularly offered at these levels, rather cases are referred. However, all facilities should provide BEmONC. In the national EmOC assessment in 2006, about 64.5% of public hospitals provided CEmOC, whereas only 5.5% of public health centres were providing BEmOC (MoHSW 2006).

The areas of lowest report for health centres and dispensaries included assisted delivery and use of parenteral anticonvulsants for PE/E. This is possibly due to lack of equipment (vacuum or forceps, magnesium sulphate) in health facilities or lack of knowledge of how and when to use these methods.

## 6.2 PREVENTION AND MANAGEMENT OF POSTPARTUM HAEMORRHAGE

PPH is the main cause of maternal death globally and in Tanzania, and many efforts are focused on reducing mortality due to PPH. The most common cause of PPH is uterine atony or failure of the uterus to contract after delivery. In Tanzanian health care facilities, AMTSL is the recommended standard practice for all births to prevent PPH (MoHSW 2008). According to the policy of MOHSW (2008), oxytocin is the drug of choice for AMTSL, followed by ergometrine and thirdly misoprostol.

### Active Management of the Third Stage of Labour

Large-scale efforts in many countries have focused on prevention of PPH with AMTSL, which has three components (ICM/FIGO 2006):

1. Administration of a uterotonic within one minute of birth (relaxed definition is a uterotonic within three minutes of birth)
2. Delivery of the placenta by controlled cord traction (CCT)
3. Uterine massage

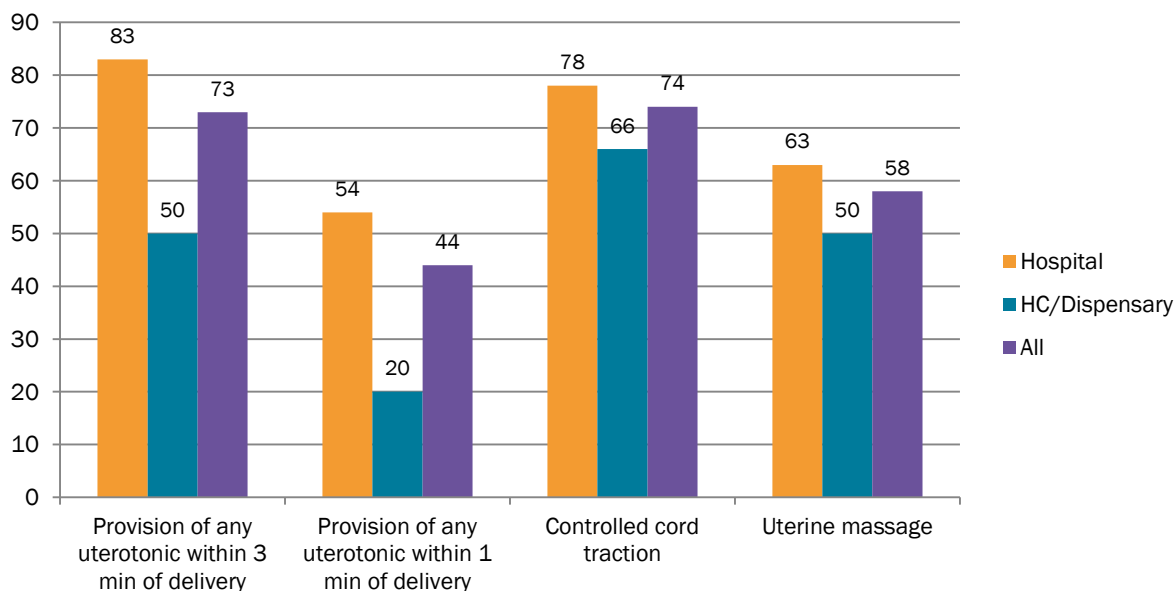
The practice of AMTSL was assessed based on these three criteria, and included observation of provision of a uterotonic (which could be oxytocin, ergometrine, syntometrine<sup>6</sup> or misoprostol) and the timing of the provision based on internal clock on Smartphones (within one minute or within three minutes), CCT and uterine massage immediately follow placenta delivery. The uterotonic of choice for PPH globally is oxytocin (WHO 2006b) at 10 IU delivered intramuscular injection and for optimum use oxytocin requires refrigeration, intramuscular injection and skilled providers. If oxytocin is not available, ergometrine or syntometrine intramuscular or oral misoprostol is recommended.

**Figure 7** shows the proportion of births observed in which the components for AMTSL were done correctly, not taking into account whether the other components were performed correctly. Taken individually, the woman was given a uterotonic within one minute of birth in 44% of births, CCT was performed in 74% of births, and uterine massage following the delivery of the placenta was conducted in 58% of observed deliveries. Provision of each of these AMTSL elements was lower at the health centre/dispensary level, and there is a clear difference in practice between regional hospitals and health centres/dispensaries with regard to timing of administration of a uterotonic. Women delivering in hospitals were close to three times more likely to receive a uterotonic within one minute, as compared to women delivering in health centres and dispensaries ( $p < 0.01$ ). More than 80% of observed deliveries in hospitals and 50% of health centres/dispensaries had uterotonic within three minutes of delivery.

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<sup>6</sup> Syntometrine is a combination of oxytocin 5 IU with ergometrine 0.5 mg. It requires refrigeration and is contraindicated in women with hypertension (due to ergometrine).

Figure 7. Proportion of births observed in which AMTSL tasks were done correctly\*



\*Any uterotonic includes oxytocin, ergometrine and misoprostol.

Universally, a uterotonic was given to the woman in the third or fourth stage of labour during the deliveries observed for this study. In 75% of the cases, the uterotonic was oxytocin. However, this differed greatly between levels of health facility: for regional hospitals, the uterotonic used was always oxytocin, whereas for health centres and dispensaries, oxytocin was used in 58% of the births. Misoprostol was used in 11% of deliveries at health centres/ dispensaries, probably due to availability of uterotonics as well as availability of cold storage for oxytocin. Although ergotmetrine is a second-choice uterotonic per MoHSW policy, it has unwelcome side effects (e.g., hypertension, nausea and vomiting), and WHO (2006) recommends it as the third-choice drug. However, it is excellent to see that 84% of women observed in this study received a uterotonic in the stage of labour (after birth and before delivery of the placenta). (See **Table 19**.)

Table 19. Uterotonics used administered for AMTSL

UTERONIC	HOSPITALS n=164		HEALTH CENTRES/ DISPENSARIES n=239		ALL FACILITIES n=403	
	n	%	n	%	n	%
Oxytocin	164	100	139	58	303	75
Ergometrine	0	0	71	30	71	18
Prostaglandin (misoprostol)	0	0	26	11	26	6
Syntometrine*	0	0	3	1	3	1

\*Syntometrine is a combination of oxytocin 5 IU with ergotmetrine 0.5 mg. It requires refrigeration, is contraindicated in women with hypertension (due to ergotmetrine) and is the drug of choice for AMTSL in the U.K.

### Uterotonic Availability

The difference in availability of uterotonics is also evident in the stock audit that was conducted in the maternity wards. For the medication to be considered available, it must be observed, with at least one valid dose, in the delivery room or adjacent room (not in the pharmacy).

**Table 20. Availability of uterotics in health facilities**

	HOSPITALS n=12		HEALTH CENTRES/ DISPENSARIES n=37	
	n	%	n	%
Oxytocin	12	100	21	57
Ergometrine/methergine**	4	33	21	57
Misoprostol	7	58	11	30

While only half (57%) of the health centres/dispensaries had oxytocin, 100% of the regional hospitals had it. Conversely, 57% and 33% of the health centres/dispensaries and regional hospitals, respectively, had ergometrine. Misoprostol was available at 30% and 58% of health centres/dispensaries and regional hospitals, respectively. (See **Figure 8.**)

**Figure 8. Proportion of deliveries with correct provision of AMTSL with oxytocin**

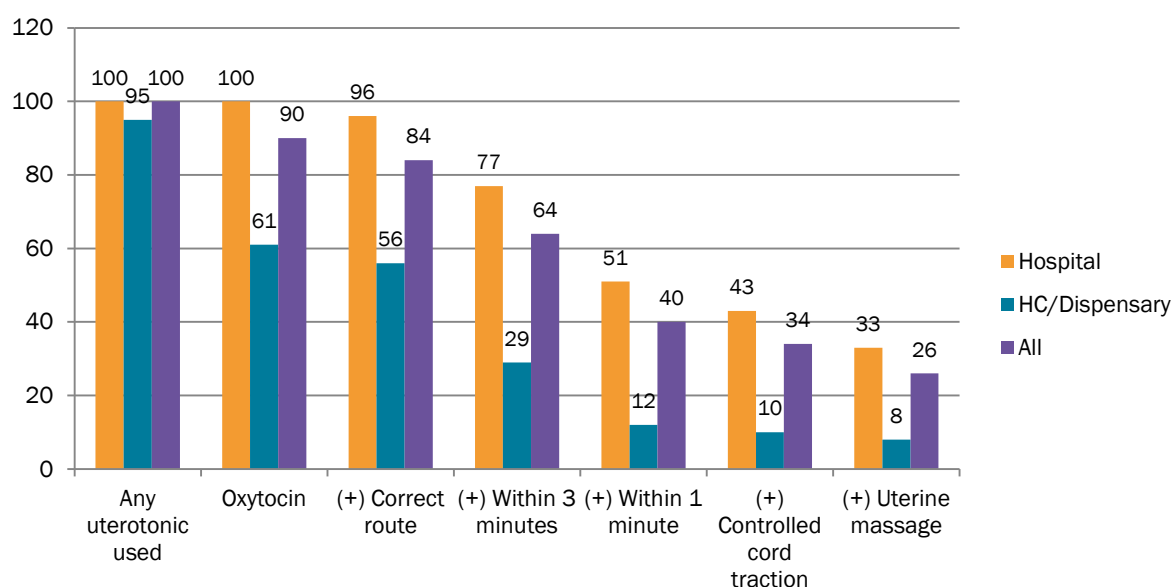
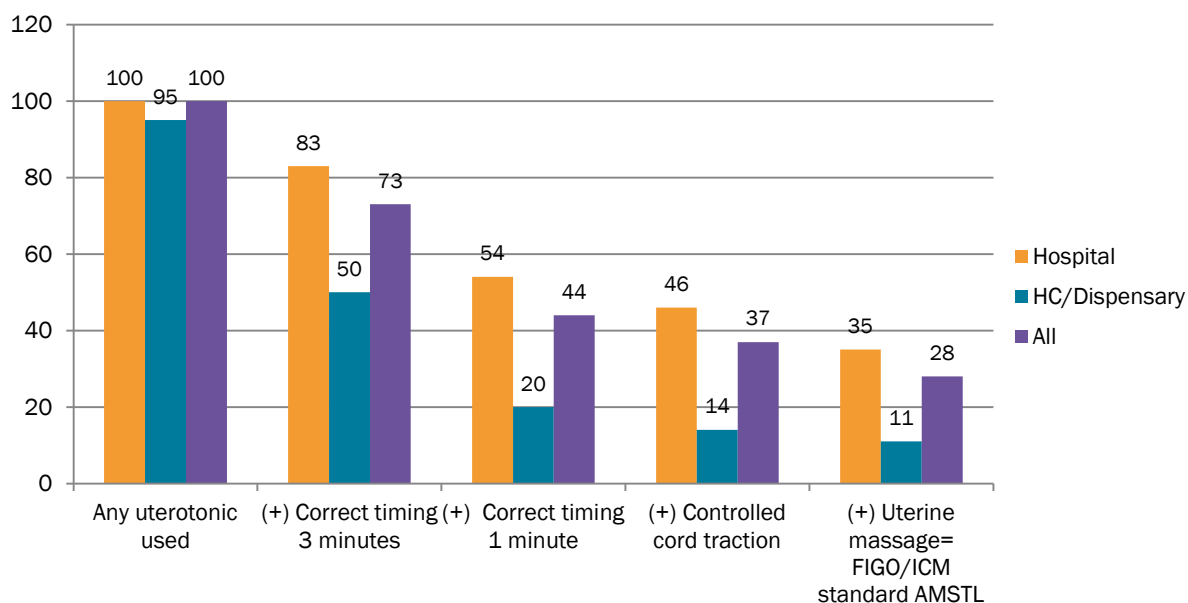


Figure 8 shows the proportion of births observed in which different components of AMTSL were performed correctly, with a focus on the use of oxytocin rather than other uterotonics. The items are additive as the bars move from left to right and the denominator changes for each bar as cases that do not meet the criteria are dropped. From Figure 8, we can observe that in regional hospitals, while 100% of deliveries had use of oxytocin, 96% of clients received oxytocin IM (correct route), 77% received oxytocin IM within three minutes and 51% received it via IM within one minute. In health centres/dispensaries, there was a large decrease from 100% to 61% of deliveries when we restrict to oxytocin usage, with 56% of clients received oxytocin IM, 29% received oxytocin IM within three minutes and only 12% received it via IM within one minute.

Using the globally accepted definition (with oxytocin), AMTSL was correctly performed in 26% of all deliveries observed: 33% of deliveries observed in regional hospitals and 8% of deliveries observed in health centres and dispensaries. With the relaxed definition (within three minutes), the percentage increases to 37% of deliveries.

**Figure 9. AMTSL with any uterotonic**



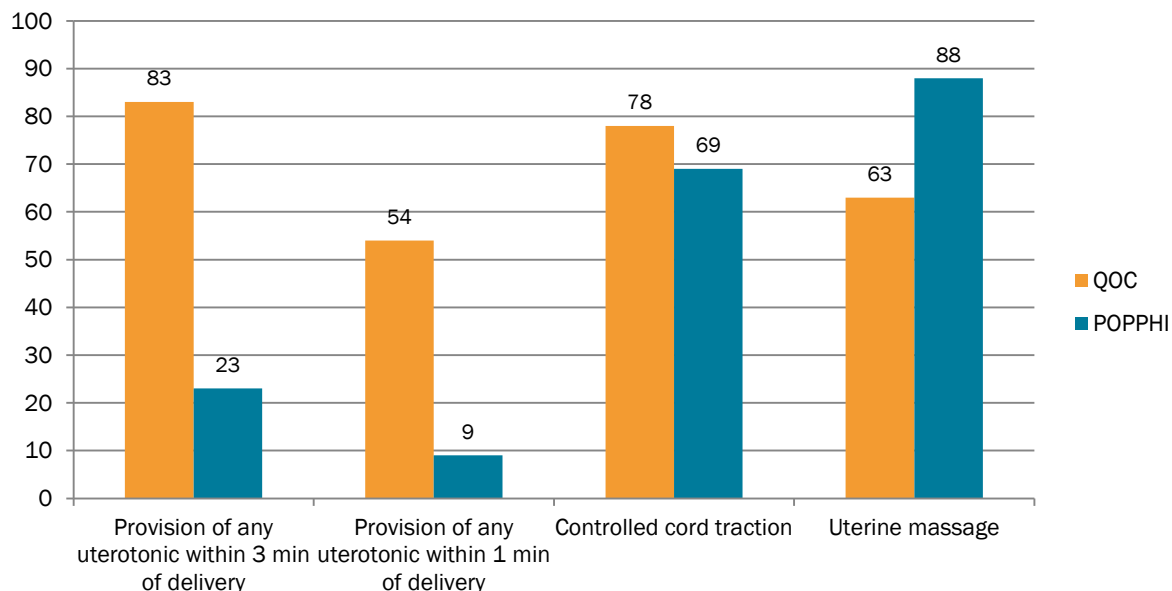
**Figure 9** shows the same data as **Figure 8**, but for the use of any type of uterotonic. The percentage for hospitals is very similar to the oxytocin figure because no other uterotonics were used in these facilities. For health centres and dispensaries, the comparison shows that the percentage of women with any uterotonic given within three minutes (relaxed definition) is much higher (50%) compared to when looking only at oxytocin usage within three minutes (29%). There is a need to promote oxytocin, the preferred drug for AMTSL, over other less effective uterotonics at the lower-level facilities. This is an important factor contributing to the low oxytocin AMTSL one-minute value of 8%. With the one minute timing, the “any uterotonic” value falls by more than half for health centres/dispensaries from three minutes (50% to 20%). By the time all tasks are added (far right bar), there is not much difference from what we see in the figure for oxytocin usage—35% for any uterotonic in hospitals vs. 33% for oxytocin; for lower-level facilities it is 11% vs. 8%. Again, when we compare the three-minute AMTSL values, there is not a great different between usage of any uterotonic and usage of oxytocin (hospitals 49% vs. 46%; health centres/dispensaries 22% vs. 15%; all facilities 49% vs. 46%).

### AMTSL Comparative to Previous Studies

In 2006, the Prevention of Postpartum Hemorrhage Initiative (POPPHI) conducted a study in Tanzania that used a similar methodology to this study. The POPPHI study, however, did not include lower-level health facilities in the sample. The sampling of these studies does not allow for analysing trends over time, although a comparison of two point-in-time estimates is informative. This analysis is limited to data from hospitals to minimize differences related to sampling.

**Figure 10** shows that between the current study (labelled Quality of Care [QoC]) and the 2006 POPPHI study, a noticeable difference can be seen in provision of uterine massage, which was lower in the current study, and provision of a CCT, which is higher in the current study.

**Figure 10. Difference in proportion of AMTSL tasks completed, QoC versus 2006 POPPHI study (hospitals only)\***



\*Uterotonic was either oxytocin or ergometrine.

Compared to the 2006 POPPHI study, in which 7% of observed deliveries had correct provision of AMTSL, this study found that 33% of deliveries had correct provision of AMTSL (hospitals only). It is important to keep in mind that these numbers are not a like-to-like comparison since the dosage data were unreliable in our study, so are not included, but are part of the POPPHI estimate. According to the relaxed definition (three minutes), our study found 46% of women receiving AMTSL and 17% for POPPHI. It is encouraging that overall performance of AMTSL appears to be improving. A striking difference between the findings is that the use of the preferred drug oxytocin appears to have greatly increased (100% in our study); in 2006, only 31% of women received oxytocin and the majority (67%) received ergometrine.

### Postpartum Haemorrhage Observations

Eleven cases of PPH were observed during the study; however, one record did not have any data. Only two of the 10 cases received AMTSL. Six of the 11 cases were due to trauma (perineal/vaginal/cervical lacerations), although only five were repaired (not sure why one was not repaired, possibly the laceration was small or bleeding slowed). Administering a uterotonic and massaging the uterus are first-line actions in all cases of PPH, and both these actions were done in five cases. Two cases had retained placenta and the steps for manual removal were performed correctly, except the providers did not check the placenta for completeness after removal and did not re-explore the uterus afterwards to look for fragments. Neglect of these two steps could lead to additional bleeding if fragments of the placenta remain unnoticed. Both cases received antibiotics to prevent postpartum sepsis but no anaesthesia for the procedure. In one case, the observers intervened because they felt that the woman's life was in danger and care was inadequate. Overall, management of PPH was mostly adequate, but with some significant gaps in care. (See data in **Table 21**.)



**Table 21. Summary of PPH cases observed**

CATEGORY	N
Postpartum haemorrhage cases observed	11 (10 with data)*
Number of cases with AMTSL performed	2 (3 not observed, 3 oxytocin only, 2 partial AMTSL)
Number of cases where fundus was massaged	7
Number of cases where oxytocin was used	8
Number of cases with massage and oxytocin (first-line treatment for PPH)	5
Number of cases where ergometrine (or prostaglandins) was used	1 (given to woman who also received oxytocin)
Number of cases with lacerations	6 (5 were repaired)
Number of cases with retained placenta	2 (both had manual removal)
Number of cases with parenteral analgesia (pethidine or morphine) given during manual removal of placenta	0
Number of cases with prophylactic antibiotics given during manual removal of placenta	2
Number of cases with bimanual compression	0
Number of cases with aortic compression	0
Number of cases with blood transfusion	0
Number of cases referred for surgery	0
Number of cases ending in woman's death	0

\*There were 11 records for PPH; however, 1 record is either missing data or was not filled in correctly.

### Case Study A

The following case study illustrates some common challenges in the case management of PPH. This case occurred in a health centre.

A woman, Mrs. A (para 1), was attended by a nurse/midwife. During the initial assessment, the provider did not ask about bleeding during previous pregnancies, did not prepare a uterotonic before delivery and the mother entered the second stage of labour with a full bladder (predisposes to PPH). She had a spontaneous vaginal delivery at **4:30 p.m.** AMTSL was not conducted: the correct dose of oxytocin was given 17 minutes after delivery of the baby; CCT or uterine massage was not performed, though the provider did palpate the uterus 15 minutes after delivery of placenta. The provider did not assess completeness of placenta and membranes, but did assess for perineal/vaginal lacerations, and did not check mother's vital signs 15 minutes after birth. PPH occurred at **5:16 p.m.** The provider massaged the uterus and gave incorrect dose of oxytocin at **5:16 p.m.**, checked and found a laceration that was repaired at **5:35 p.m.**, and bleeding stopped. Outcome: mother and baby went to recovery ward together.

Issues arising in this case:

- Preparations for birth were inadequate.
- Provider checked for laceration but not thorough; immediate postpartum care was poor.
- AMTSL, although not given, would not have prevented this PPH, which appeared to be due to laceration; it was helpful that Mrs. A did receive a uterotonic, if late.

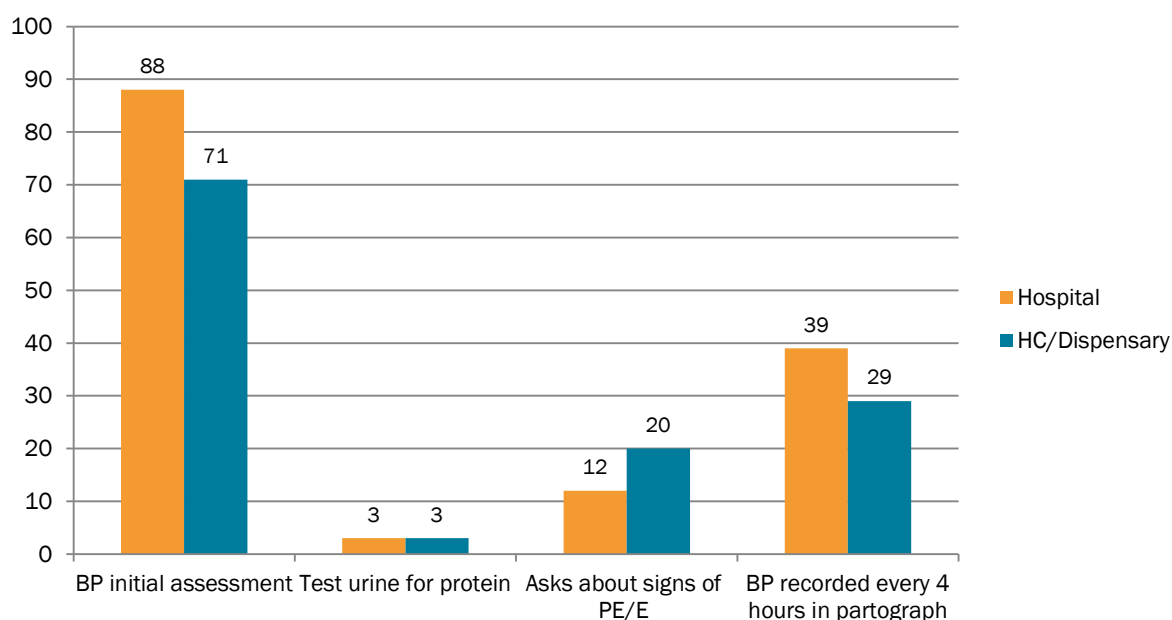
## 6.3 PERFORMANCE OF SCREENING FOR MANAGEMENT OF PRE-ECLAMPSIA AND ECLAMPSIA

### Pre-Eclampsia/Eclampsia Screening

PE/E are amongst the most dangerous complications of pregnancy. Eclampsia, the advanced stage of this disorder, is a major cause of maternal deaths. PE/E can occur in pregnancy, labour and postpartum in previously normotensive women, so it is important that detection continues in labour and postpartum.

To date, there is no conclusive evidence on interventions that can prevent the occurrence of PE/E. Early detection and treatment of pre-eclampsia, however, is beneficial to the woman and foetus as it permits clinical monitoring and prompt therapeutic intervention for severe PE/E. Once providers identify PE/E, they must be competent to provide such initial management and ensure timely referral for cases that cannot be further managed at their facility level.

Figure 11. PE/E screening



As shown in **Figure 11** and **Table 22**, blood pressure measurement at initial assessment was carried out for the majority of admissions (83%) but just 37% had blood pressure recorded every four hours on the partograph as per guidelines. As screening for high blood pressure is the single most important step for prevention of morbidity and mortality from PE/E, this is a major gap in care. While the initial assessment of blood pressure was conducted for 88% of clients in hospitals and 71% of women in health centres/dispensaries, urine testing for protein was virtually nil—only 3% of clients had their urine tested for protein. The two key screening elements (ask about danger signs of PE/E and blood pressure check) were done in only 14% of women observed during initial assessment.

**Table 22. PE/E screening**

	REGIONAL HOSPITAL N=120		HEALTH CENTRES/ DISPENSARIES N=186		ALL FACILITIES N=306	
	N	%	N	%	N	%
Asks about signs of PE/E*	17	12	28	20	45	14
Checks blood pressure (initial assessment)	96	88	149	71	245	83
Both PE/E screening elements	17	13	24	20	41	14
Tests urine for protein	3	3	9	3	12	3
Blood pressure recorded on partograph at least every 4 hours during labour	65	39	65	29	132	37

\*Asks about either headaches/blurred vision or swollen face/hands or convulsions/loss of consciousness (at least 1 sign).

Availability of a functioning, accurate blood pressure machine is requisite for measuring blood pressure. The inventory revealed that all of the regional hospitals and 69% of health centres/dispensaries had at least one functioning blood pressure machine present in L&D during the assessment.

### Pre-Eclampsia/Eclampsia Observations

Eleven cases of PE/E were observed during the study period.

**Table 23. PE/E cases observed**

CATEGORY	n
Cases of PE/E observed	11
Description of problem	
Seizure (presumptive eclampsia)	5 (3 were convulsing and unconscious)
Unconscious	4
Severe pre-eclampsia*	4 (1 was also unconscious)
Mild pre-eclampsia**	2
Treatment	
Unconscious cases	4
Correct management	Average 1.5 of 4 steps performed
Seizure cases	5
Correct management	Average 2.6 of 5 steps performed
Magnesium sulphate and appropriate antihypertensives given	1 (3 received only magnesium sulphate)
Diazepam given	1 (no antihypertensive)
Severe PE cases	3
Magnesium sulphate and appropriate antihypertensives given	1 (1 received only magnesium sulphate)
Diazepam given	2 (no antihypertensive)
Type of delivery	
Spontaneous vaginal	5

CATEGORY	n
Caesarean	3
Unknown	3
Outcome	
Maternal deaths	0
Newborn deaths	0

\*Diastolic BP >110, proteinuria >3+ and not unconscious or convulsing.

\*\*By process of elimination, these cases were not unconscious or convulsing or did not meet the PE definition.

Of the 11 PE/E cases observed, five had eclampsia, four had severe pre-eclampsia, and two had mild pre-eclampsia. Both the management and treatment of the cases is of great concern, with few women receiving correct management, only one of five women with eclampsia receiving both magnesium sulphate and a correct antihypertensives (the recommended treatment), and only one of three women with severe PE receiving the right medication. Diazepam was given in three cases, rather than the drug of choice (magnesium sulphate) and inappropriate antihypertensives in two cases. Women generally did not receive both doses (IV and IM) of magnesium sulphate and did not receive follow-up doses four hours later. In two cases, the observers commented that there was a significant delay in management/medication. Overall, management of PE/E was poor.

In terms of medications to treat PE/E, magnesium sulphate was available in only about half of facilities and severely lacking at health centres/dispensaries (35%) and antihypertensives were also not widely available.

### Case Study B

The following case study of an eclamptic patient illustrates some problems arising in management of PE/E seen during the study. Case study B below occurred in a hospital.

A woman, Mrs. B (para 2), was attended by a nurse midwife. Observations were commenced postpartum (first through third stages of labour were not observed) at 5:14 p.m (8 hours postpartum) when patient was found unconscious. She had a spontaneous vaginal delivery at 9:00 a.m., with convulsions noted (eclampsia) during delivery. She was given an initial dose of magnesium sulphate at 9:00 a.m.; Lasix 80 mg bd and methyldopa (Aldomet) 50 mg were given at 12.00 p.m. At 5:14 p.m., the patient's vital signs were evaluated (diastolic BP >110) and she was turned into a left-lying position. The patient was given an additional dose of magnesium sulphate and diazepam at 5:49 p.m. It is not clear if the hypertension was managed. The patient survived, however, and should be noted as a "near miss," per WHO (2009). It is likely she convulsed alone before being found unconscious. Additionally, the issue of who was caring for the newborn is not clear.

The gaps in this case include:

- Following eclampsia, maintenance doses of magnesium sulphate should continue for 24 hours (WHO 2006b). If this policy had been implemented, it is less likely that further convulsions would occur.
- There was a lack of monitoring of a seriously ill woman.
- Using diazepam and magnesium sulphate risk over-sedation and respiratory depression
- There was a lack of observation; a relative could have done this and alerted staff to problems.
- Inappropriate antihypertensive was used at noon.
- Lasix should not have been given.

## 6.4 MANAGEMENT OF BIRTH ASPHYXIA (NEWBORN RESUSCITATION)

A total of 35 newborn asphyxia cases were observed in Tanzania. There were six perinatal deaths observed during the study: four stillborn babies (three fresh stillbirths and one macerated) and two neonatal deaths.

It was noted that resuscitation was attempted in three cases where the baby was then considered stillborn; this is a classification issue and also reflects the indecision that exists surrounding signs of life in the newborn and the decision to resuscitate. There is also a possibility that these babies were alive and resuscitation efforts were unsuccessful. In one case, it was noted that there was no Ambu bag.

### Newborn Resuscitation

Of the 37 cases of newborn resuscitation observed, two were missing data (see **Table 24**). In 21 cases, the baby began breathing with drying and suction. Of the eight cases where drying and suction did not lead to breathing (excluding stillborn), six cases had correct bag and mask use (place mask, squeeze bag, chest rises); in one case, it appears the provider made adjustments and then was able to ventilate; and in another, it appears that baby recovered despite incorrect bag and mask use.

With regard to the cause of asphyxia, six cases mentioned some form of obstructed labour (breech, contracted pelvis or second twin). In six cases, “resuscitated” newborns were born via caesarean section (possibly routine rather than emergency). Lack of equipment played a role in seven cases where it was noted that newborn resuscitation equipment was missing or non-functional.

There were six neonatal deaths, with four classified as stillbirths (three fresh, one macerated). The distinction between a death and a stillbirth is subject to provider and observer knowledge and may not be accurate according to recent definitions. It is difficult to say whether incorrect practices were directly responsible for any deaths or whether the cases would have been successfully resuscitated under ideal conditions.

**Table 24. Newborn resuscitation observations**

CATEGORY	N
Newborn resuscitation cases observed	37 (35 with data)*
Number of cases with successful resuscitation using stimulation and suction	21
Number of cases with successful resuscitation using bag and mask correctly	7
Number of cases where oxygen was given	2
Number of cases ending in newborn death	6 (4 were stillbirths)

\*Two cases were either missing data or mistakenly marked as resuscitation cases.

## 7. DISCUSSION

Care in labour and delivery is at the core of MNH services everywhere, and this study has identified some strengths and various gaps in the provision of essential lifesaving maternal and newborn care in the facilities observed in Tanzania. Tanzania is making “insufficient progress” towards MDG 5 (WHO 2010) and MDG 4 (Countdown 2008), and with just over three years until the 2015 deadline to achieve MDGs, the way forward includes the provision of high-quality pregnancy and delivery care, including emergency obstetric care for mothers and infants. Findings on the coverage of BEmONC suggest that there is an unmet need as well as poor performance of some of the interventions. The majority of maternal deaths are avoidable, as UNICEF (2008) explains:

“There is no mystery about why most women die. They are dying because they have no access or limited access to health care, or because the quality of care is poor. They die due to haemorrhage, sepsis, hypertensive disorders, unsafe abortion and prolonged or obstructed labour—complications that can often be effectively treated in a health system that provides skilled personnel, facilities to handle emergencies when they occur and postpartum care.”

There was an extremely low rate of assessment of danger signs of a client when the client first arrived at the hospital. Assessment for important danger signs in the current pregnancy and complications in previous pregnancies were very low. This indicates that assessment of dangers signs, while possibly somewhat under-reported, is still extremely low as compared to desired standards. This issue is important in identifying women who need urgent attention and triage into care, and contributes to the “third delay” linked to maternal deaths (Mbakuru et al. 2009). Delay in receiving appropriate care once at the health facility is due to:

- Inadequate facilities, infrastructure, medical equipment, drugs, supplies and trained personnel
- Poor training and poor attitudes amongst health personnel
- Lack of finances

The factors listed as part of the third delay impacted the findings of this study to greater or lesser degrees.

For the purposes of the discussion, the focus will be on high-priority areas including:

- Prevention and management of PPH
- Prevention and management of PE/E
- Essential newborn care

As many of the recommendations are cross-cutting, they will be listed at the end of the discussion.

## 7.1 PREVENTION AND MANAGEMENT OF PPH

PPH is the main cause of maternal death globally and in Tanzania, and many efforts are focused on reducing mortality due to PPH. It is recommended that all women receive AMTSL (WHO 2006b) consisting of administration of a uterotonic within one minute after birth of the baby, CCT to deliver the placenta, followed by uterine massage.

One of the strongest findings was that all women received a uterotonic, which even in the absence of other components of AMTSL will have benefits. Using the strictest definition of AMTSL with oxytocin, performance of AMTSL was low at 26%; however, it improves to 37% when using the “relaxed” definition (uterotonic within three minutes), which may be a more appropriate measure.

There is a considerable difference in provision of AMTSL with oxytocin IM between regional hospitals and lower level health facilities: whereas 77% of deliveries in hospitals had oxytocin IM administered within 3 minutes, 29% of deliveries in lower level facilities did (within 1 minute, 51% and 12%, respectively). This likely reflects stock problems of oxytocin in lower level facilities in addition to provider practice, because only 57% of lower-level health facilities had oxytocin in stock.

An increase in AMTSL can be seen from the 2006 POPPHI study that used a similar methodology to this study (hospitals only). In the 2006 POPPHI study, overall correct provision of AMTSL was 7%, compared to this study’s 26% (the current study had limitations on dosage of uterotonic, which may limit the comparability). It is notable that

between the current study and the 2006 POPPHI study, CCT rose somewhat, massage of the uterus dropped from 88% to 63%, and use of oxytocin went from 31% to 100%.

Most PPH deaths should be avoidable by appropriate diagnosis and management (Khan et al. 2006). Observations in the management of the 10 cases of PPH indicate major gaps in care, with only two cases receiving AMTSL. In the two cases with retained placenta, the procedure to manually remove it was generally performed well, but some important steps were neglected. Closer vigilance of women in the immediate postpartum period is vital to address this complication.

## 7.2 PREVENTION AND MANAGEMENT OF PE/E

Hypertensive disorders of pregnancy including PE/E are characterized by hypertension and proteinuria during pregnancy from the twentieth week until 42 days after delivery. Hypertensive disorders in pregnancy, especially severe PE/E, are a major contributor to maternal mortality worldwide, and are one of the five main causes of maternal death in Tanzania.

All the necessary policies for ensuring that cases of PE/E are managed according to recent evidence are in place in Tanzania. The findings from this study, however, suggest that provider practice is not at an appropriate level. In addition, magnesium sulphate, the drug of choice for treatment, was available in only about half of facilities overall and severely lacking in health centres/dispensaries (35%), and antihypertensives were also not widely available. Provider knowledge and skills are problematic as evidenced in the observations of admission of women in and through labour and in the 11 cases of PE/E observed, as well as provider scores on the PE/E case study. Of the 11 cases of PE/E observed, eight should have been treated with magnesium sulphate and appropriate antihypertensives; however, only two received both of these medications. Diazepam was used in three cases (sometimes incorrectly given in combination with magnesium sulphate) and inappropriate antihypertensives in three cases.

Screening on admission is secondary prevention of PE/E and tertiary prevention includes recognition and effective management of a complication such as rising blood pressure. While the initial assessment of blood pressure was conducted for 83% of clients, it was lower in health centres/dispensaries (71%) compared to hospitals (88%). This means almost a third of women at health centres/dispensaries were not checked for one of the main complications of pregnancy and childbirth.

Urine testing for protein was virtually nil—only 3% of clients had their urine tested for protein. In addition, approximately one-third of clients had their blood pressure recorded at least every 4 hours on the partograph. There are missed opportunities for screening and history-taking for PE/E danger signs for maternity clients.

## 7.3 ESSENTIAL NEWBORN CARE

Each year in Tanzania, 62,000 newborn babies die and an additional 43,000 are stillborn. Most of these babies die from preventable or treatable causes, and it is estimated that up to two-thirds could be saved if essential care reached all mothers and newborns (SC 2010). Maternal and newborn survival is interconnected and the most dangerous time in a child's life is during birth, as the majority of newborns die due to stressful events surrounding delivery. Newborn babies account for more than 40% of deaths amongst children under age five. The Lancet Newborn Series (Darmstadt et al. 2005) emphasizes essential newborn care—including hygienic cord care, maintenance of warmth, and immediate and exclusive breastfeeding as a means to reducing newborn deaths. All of the immediate newborn care interventions observed in this study are simple to perform and use minimal resources, yet results were variable. Delayed cord clamping and cutting is relatively new, so this practice, although included in BEmONC training in Tanzania, was not evaluated.



Optimal breastfeeding of infants under two years of age has the greatest potential impact on child survival of all preventive interventions. The results of a study conducted in Ghana show that breastfeeding babies within the first hour of birth can prevent 22% of neonatal deaths.<sup>7</sup> UNICEF (2008) and WHO (2006) emphasize the importance of “skin-to-skin contact ... immediately following birth for at least an hour and breastfeeding during this period.” The fact that less than half of all babies observed received all key essential interventions is a major concern and may contribute to the high levels of newborn mortality and morbidity in Tanzania. With only 23% of four- to five-month-old infants being exclusively breastfed (TDHS 2010) much needs to be done to promote early breastfeeding.

Many of the essential newborn care practices we observed were performed in more than 90% of deliveries. However, skin-to-skin care (42%) and breastfeeding within 1 hour (44%) are in need of improvement.

The findings on newborn care in the current study, including resuscitation, confirm similar findings in Tanzania (Mbakuru et al. 2009) that perinatal deaths were associated with the third delay, and sub-standard care has been recognized as a major cause of perinatal death.

#### 7.4 SKILLED PERSONNEL

Health worker shortages are estimated to be 88,700 in Tanzania (SC 2010). It is unavoidable that a shortage of health care providers is a contributing factor to the results presented in this report. Countries with the most child and maternal deaths (includes Tanzania) also have the greatest health worker shortages (SC 2010).

This study found that there were major gaps in key competencies in managing routine care in labour and delivery as well as managing complications. “Skilled birth attendant” does not necessarily mean skilled care is being provided, as highlighted in the two complication case studies.

To perform effectively, skilled providers need to work within an enabling environment. Shortages of skilled staff, equipment and supplies were observed in this study. This was also a common complaint by the community in a recent study on ANC and postnatal care in Tanzania (Mrisho et al. 2009). Some women value technical quality, as proxied by drugs or equipment, whereas others are more strongly influenced by nontechnical quality, such as a caring provider attitude (Kruk et al. 2009).

The low assessment of clients for previous history of high blood pressure (8% of clients) and prolonged labour (5%) of clients is troubling. However, it also should be noted that women may not be aware of specific complications in previous pregnancies and labours as information often is not shared.

Taking pulse and temperature were performed for 42% and 29% of clients, respectively, and noting urine output was only done for 11% of clients. These data highlight an approach to care that focuses on tasks (stage in labour) and not in truly establishing a holistic assessment of the woman’s condition or in establishing a relationship with her, where the health care provider, the woman and the support person work towards a positive outcome.

There is no single best position for birth as labour is a dynamic, interactive process and the woman will want to follow her physiological instincts and assume various positions for childbirth (as she would at home). Alternative positions have psychological and physiological advantages and indeed can reduce problems such as foetal distress and shoulder dystocia. Offering the woman the possibility of assuming a different position for labour occurred in virtually none of the observations.

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<sup>7</sup> [http://www.unicef.org/nutrition/index\\_24824.html](http://www.unicef.org/nutrition/index_24824.html) Accessed 1 September 2011.

The most frequently occurring harmful practice was digital stretching of the perineum, which occurred in 6% of deliveries but as high as 8% of deliveries in regional hospitals. This has largely been a historical practice and can be addressed through refresher training.

The current consensus that health care systems should be responsive to individuals' legitimate expectations regarding, for example, waiting time, health communication, and patient choice (Kruk et al. 2009) needs to be addressed as a key component of quality care.

## 7.5 INFECTION PREVENTION

The area of weakness in infection prevention is handwashing. Most health care-associated infections are preventable through good hand hygiene—cleaning hands at the right times and in the right way.<sup>8</sup> It is recommended that hands be washed before and after patient contact, with plain soap and water at a minimum. Handwashing after delivery was completed was highest at 82%, but handwashing before examination in the initial assessment was only 57% and before examination in the first stage of labour, only 54% of providers washed their hands. It is disappointing to find that this simple practice is rarely adhered to, not only because it is cost-effective, but also because failure to do so increases the risk of maternal sepsis, and also because of the possibility of cross-infections with HIV and HBV.

Manual exploration of the uterus after deliveries observed as a harmful practice could contribute to maternal infection.

## 7.6 WOMEN-FRIENDLY/HUMANIZED CARE

Health providers' attitudes need to be improved. Although some areas of women-friendly care scored well, items such as asking if woman has questions (21%) and draping the women to provide privacy during delivery (47%) need improvement. The importance of positive and caring attitudes in health care providers towards the women in their care cannot be over-emphasized. A study by Kruk et al. in Tanzania (2009) found that consistent with other research, women preferred more-highly trained providers (i.e., doctors to other providers, and clinical officers to nurses), but overall, the type of provider was less important than the provider's attitude and performance. This view is echoed by Mrisho et al. (2009), who quote patients as saying: "We request that health care providers behave more kindly so as to respond positively and politely to their clients."

Although only a limited number of women were encouraged to have a support person (33%), the fact that it was present at all is promising. Staff should be assisted to adopt more flexible ways of working that address what women want from reproductive health services. Allowing support persons to be present at birth is an evidence-based practice that improves birth outcomes (Hodnett et al.). However, presence of support persons at birth remains challenging to implement, with some reasons being overcrowded facilities, and resistance of staff who do not want to be watched by relatives. Client load at lower-level facilities is generally low, often with few clients in labour at the same time, a situation that assists providers to encourage companions' support. The presence of support persons is a promising practice that has been observed in Tanzania, where staff provide the tea to be given to women in labour, thus minimizing the chance of women taking herbal substances brought in by relatives, which cause hypertonic contractions. Identifying promising/best practices, which are contextualised to facilitate involvement of families and support persons who can contribute to improved caregiving, is a need. This can also extend to encouraging and institutionalizing caring behaviours and rights-based approaches to care to include support for adopting different positions in L&D.

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<sup>8</sup> [http://www.who.int/gpsc/country\\_work/en/](http://www.who.int/gpsc/country_work/en/) Accessed 5 September 2011.

## 7.7 PARTOGRAPH USE

Despite providers' good knowledge of the partograph and frequent usage (74% of deliveries), there exists poor utilization to monitor women in labour (Opiah 2001). This was evident in the findings from this assessment, which generally indicate inadequate performance. Less than two-thirds of the partographs recorded foetal heart tones and frequency and duration of contractions, and in only one-third of the partographs was maternal pulse filled. The areas where partograph are being filled-in in higher proportion (delivery time, type of delivery and blood loss) are not the areas to track in order to save the life of the newborn. In a record review of previously completed partographs, in four facilities, it was not possible to find 24 partographs for the review. The lack of storage and filing of partographs precludes the use of partographs for record review or any sort of internal audit system that reviews partographs.

## 8. CONCLUSIONS

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There has been a resurgence of initiatives to address the slow progress on reducing the maternal mortality rate especially in sub-Saharan Africa, but addressing maternal mortality through improving maternal health is far from easy (UNICEF 2008). Effective and efficient quality of care for pregnant women is becoming a rights-based issue.<sup>9</sup>

The MoHSW, with support from donors, international and national nongovernmental organisations, is making substantial efforts to address MDGs 4 and 5 in Tanzania. The policy environment for maternal and newborn care is mostly in place. Many best practices have been implemented to scale, such as AMTSL, and the Helping Babies Breathe (HBB) initiative to improve skills in newborn resuscitation are underway.

The findings in this study indicate much still needs to be done to improve the quality of maternal and newborn care in Tanzania. A combination of factors, some explored within related sections in this study, inhibit the provision of quality care:

- Provider knowledge and skills appear to be inadequate and out-of-date in key areas such as managing PPH and PE/E.
- There are inadequate numbers of “skilled personnel.”
- Medicines, equipment and supplies were lacking in some cases in the service delivery areas, e.g., magnesium sulphate and oxytocin at the health centre level.

These factors can be addressed. We know what to do to save the lives of women and newborns—the challenge is in implementation and health system strengthening.

Kruk (2009) states the issues clearly, “women are willing to trade longer distance, higher cost, having to find transport, and higher-level providers for **higher-quality of care**,”—a salient point as Tanzania’s government decides how to allocate funds from the health budget. Investing in provider training, supervision, and improving equipment and drug supply systems as well as continuing initiatives to improve quality of care at all levels of the system are core “big picture” recommendations from this study.

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<sup>9</sup> <http://www.everywomaneverychild.org/> Accessed 6 September 2011.

## 9. RECOMMENDATIONS

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- Encourage providers to perform a “quick check” on every contact with a pregnant or postpartum woman to identify complications quickly and thereby initiate appropriate care.
- Ensure that all supplies for routine delivery care, management of complications and newborn resuscitation are available and functional is essential—for example, equipment for newborn resuscitation and oxytocin at all facilities.
- Provide regular supportive supervision of staff and support to address staff and patient concerns.
- Allow for competency-based in-service/refresher training that can be offsite, as well as more flexible on-the-job training. Training should include clinical simulations and other activities to encourage teamwork and improve efficiency in dealing with clinical emergencies.
- Ensure that up-to-date job aids are disseminated to all facilities, especially those linked to emergency situations such as managing eclampsia and newborn resuscitation.
- Strengthen pre-service education of *all* health care providers to ensure competency-based approaches that lead to stronger performance in and retention of knowledge and skills as well as evidence-based practices that meet the priority health care needs of Tanzania.
- Reinforce skills and practice of providers at lower-level facilities, where opportunities for practice are less (as the HBB initiative).
- Facilities should implement regular clinical simulation training on the main maternal and newborn complications to maintain provider skills and knowledge.
- Address accountability of providers in relation to performance, delays in providing care and recording/reporting of information, such as use of the partograph. The professional associations and regulatory bodies (e.g., Tanzania Nurses and Midwives Council) have a key role to play.
- Address infection prevention challenges through behaviour change that is supported and recognized by managers.



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## APPENDIX A: LABOUR AND DELIVERY SUPPLY AND EQUIPMENT INVENTORY

### Pharmacy stock, Hospitals, n=12

STOCK CARDS MATCH FOR KEY DRUGS	# PRESENT IN PHARMACY	# PRESENT IN L&D
Ampicillin, injectable	8	8
Gentamicin, injectable	10	8
Magnesium sulphate	11	10
Oxytocin	11	10
Hydralazine or apresoline	10	9
Nifedipine	8	6
Labetolol	1	1
Mean percentage score for stock card matching		
	# present in Pharmacy	
No expired medicines	9(81%)	
	# present in Pharmacy	
FEFO system	10	
Physical conditions adequate	# present in Pharmacy	
Off the floor and protected from water	9	
Protected from sun	10	
Room clean of evidence of rodents or pests	11	
Mean percentage score for adequate physical conditions		
Adequate control of stock	# present in Pharmacy	
Received recent supply (within 3 months)	9	
Always receive accurate orders (within 3 months)	1	
Mean percentage score for adequate control of stock		

**Pharmacy stock, Health Centres/Dispensaries, n=38**

STOCK CARDS MATCH FOR KEY DRUGS	# PRESENT IN PHARMACY	# PRESENT IN L&D
Ampicillin, injectable	9	9
Gentamicin, injectable	18	11
Magnesium sulphate	18	13
Oxytocin	21	21
Hydralazine or apresoline	6	5
Nifedipine	10	6
Labetolol	0	1
Mean percentage score for stock card matching		
	# present in Pharmacy	
No expired medicines	9(81%)	
	# present in Pharmacy	
FEFO system	10	
Physical conditions adequate	# present in Pharmacy	
Off the floor and protected from water	26	
Protected from sun	36	
Room clean of evidence of rodents or pests	33	
Mean percentage score for adequate physical conditions		
Adequate control of stock	# present in Pharmacy	
Received recent supply (within 3 months)	30	
Always receive accurate orders (within 3 months)	6	
Mean percentage score for adequate control of stock		

## Equipment Inventory

	HEALTH CENTRES/ DISPENSARIES n=38		HOSPITALS n=12		ALL FACILITIES n=50	
	n	%	n	%	n	%
Spotlight for pelvic exam flashlight or exam light acceptable	10	26	6	50	16	32
Table or bed for delivery	37	98	12	100	49	98
Sterile scissors or blade	33	87	11	92	44	88
Suture material with needle	27	71	12	100	39	78
Needle holder	24	63	9	75	33	66
Intravenous Infusion set	27	71	12	100	39	78
Clean or latex gloves	32	84	12	100	44	88
Availability of blank partograph	28	74	11	92	39	78
Functional manual vacuum aspirators	9	24	5	42	14	28
Guidelines for normal delivery	13	34	5	42	18	36
Intravenous solutions (Ringer's lactate, NS, DNS infusions)	26	68	12	100	38	76
Sharps containers	34	90	12	100	46	92
At least five or more 2-mL or 3-mL syringes with 21 gauge needles)	34	90	11	92	45	90
Already mixed decontamination solution (0.5% chlorine)	33	87	11	92	44	88
Waste receptacle with lid and plastic liner	21	55	10	83	31	62
Single use handwashing towel	9	24	3	25	12	24
Bag and mask (infant size) for resuscitation	16	57	11	92	27	69
Functional incubator	3	10	2	17	5	10
Other source of heat for premature infants	2	5	5	42	7	18
Functional suction tube for mucus extraction	11	29	3	25	14	28
Functional suction apparatus for use with catheter	19	50	8	67	25	50
Resuscitation table for baby	14	37	11	92	25	50
Infant scale	27	71	10	83	37	74
Towel or blanket to wrap baby	4	14	1	10	5	10
Disposable cord ties and clamps	19	50	4	33	23	46

## APPENDIX B: MATERNAL DEATH CASE STUDY

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One maternal death occurred while the study team was present. A woman was admitted to the labour ward around 9:00 a.m. On admission, cervical dilatation was 7 cm and foetal heart rate was heard. She was then assessed (by medical attendant) at 1:00 p.m. and the cervix was fully dilated. At this stage a urinary catheter was inserted and an IV infusion was commenced. The membranes were ruptured but the progress of second stage was slow.

At 5:00 p.m., a nurse on duty called a doctor to review and he proposed to perform a caesarean section. The patient was prepared for theatre; however, she progressed to a spontaneous vaginal delivery of a stillborn male baby at 5:32 p.m. Third stage was managed actively and appeared to be normal.

An episiotomy had been performed and during repair of episiotomy the patient seemed drowsy—IV Ringer's lactate was given with oxytocin 10 IU but the patient collapsed soon after, and resuscitation efforts were unsuccessful. There was no evidence of abnormal vaginal bleeding. Cause of death according to medical staff was cardio-respiratory failure.