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## Assessment of Obstetric and Neonatal Health Services in Developing Country Health Facilities

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### Abstract

**Objective**—To describe the staffing and availability of medical equipment and medications and the performance of procedures at health facilities providing maternal and neonatal care at African, Asian, and Latin American sites participating in a multicenter trial to improve emergency obstetric/neonatal care in communities with high maternal and perinatal mortality.

**Study Design**—In 2009, prior to intervention, we surveyed 136 hospitals and 228 clinics in 7 sites in Africa, Asia, and Latin America regarding staffing, availability of equipment/ medications, and procedures including cesarean section.

**Results**—The coverage of physicians and nurses/midwives was poor in Africa and Latin America. In Africa, only 20% of hospitals had full-time physicians. Only 70% of hospitals in Africa and Asia had performed cesarean sections in the last 6 months. Oxygen was unavailable in

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40% of African hospitals and 17% of Asian hospitals. Blood was unavailable in 80% of African and Asian hospitals.

**Conclusions**—Assuming that adequate facility services are necessary to improve pregnancy outcomes, it is not surprising that maternal and perinatal mortality rates in the areas surveyed are high. The data presented emphasize that to reduce mortality in these areas, resources that result in improved staffing and sufficient equipment, supplies, and medication, along with training, are required.

### Keywords

emergency obstetric and neonatal care; developing countries; perinatal mortality

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Developing countries have the highest burden of maternal, fetal, and neonatal deaths. Although progress is being made toward achieving the Millennium Development Goals 4 and 5 of reducing maternal mortality by three-quarters and under-5 mortality by two-thirds, respectively, these targets will not likely be met before 2015.<sup>1</sup>

Most of the maternal and fetal deaths and many of the neonatal deaths and long-term childhood neurological disabilities are due to obstetric complications, which include sepsis, hemorrhage, preeclampsia/eclampsia, and prolonged and obstructed labor.<sup>2</sup> Prediction of these conditions is not always possible and many cannot be prevented. Therefore, access to safe and effective obstetric and neonatal services in case of an emergency is crucial in preventing morbidity and mortality.

The International Federation of Gynecology and Obstetrics defines basic obstetric and neonatal services as the availability of antibiotics, oxytocics, anticonvulsants, manual extraction of the placenta, dilation and curettage, assisted vaginal delivery and ability to perform basic neonatal resuscitation (e.g., with bag and mask).<sup>3</sup> Comprehensive emergency obstetric care includes the availability of the components of basic care as well as cesarean delivery (CS) and blood transfusion capability.

To test the hypothesis that a package of care comprising community mobilization, teaching of home-based lifesaving skills to communities, and enhancing access to upgraded health facilities will improve neonatal and maternal pregnancy outcomes, the Global Network for Women's and Children's Health Research (Global Network) has undertaken a cluster-randomized clinical trial of Emergency Obstetric and Neonatal Care (EmONC).<sup>4</sup> To better understand the availability of obstetric and neonatal health services within its clusters, prior to the study, we surveyed each of the health facilities in the trial sites and that data are presented in this report.

### Methods

The Global Network EmONC trial, a cluster randomized control trial, is being conducted in 106 clusters in 6 countries (Kenya, Zambia, India—two sites, Pakistan, Guatemala, and Argentina).<sup>4</sup> A cluster is defined as a contiguous geographic catchment area with at least 300 deliveries per year. All health clinics within the clusters were in rural or semiurban settings except those in Argentina, which were urban. In preparation for the trial, site investigators identified all health facilities serving women located within the study clusters whether public or private. Trained health providers conducted a survey of each of these hospitals and health clinics to assess the staffing level, equipment and supply availability, and medical procedures as well as the communication practices prior to initiation of the trial. Some questions (i.e., equipment, staffing) were completed only through direct observation to ensure the quality of data. The baseline facility assessments were conducted prior to the

implementation of the interventions. For simplification of presentation, after providing descriptive information for each of the sites, we grouped the sites by continent. For the purpose of reporting survey results, each facility was self-identified as hospital or health clinic by the facilities themselves.

The study, including the survey results reported here, was approved by institutional review boards for every international study site, the United States university counterparts, and the data center at Research Triangle Institute International. The sites completed forms that provided information on availability of specific procedures, equipment, supplies, and communication devices at the facility. Items and activities were recorded as available always, sometimes, or never. The percent of hospitals and health centers with a specific health service available were computed for each site.

## Results

Descriptions of the geographic areas in which the surveys were conducted, the number of facilities surveyed, and the total number of deliveries for 2010 are shown in Table 1.

Altogether, 364 facilities were included in the initial survey, 136 hospitals and 228 health clinics. Data for the delivery rates in Table 1 were derived from the Maternal Newborn Health Registry, a population-based observational study using prospective pregnancy-related data for more than 100 clusters across the sites. Maternal and newborn data were collected during antenatal care visits, at delivery, and at 42 days postdelivery.<sup>5</sup> Across all the sites, the mean percent of deliveries occurring in a facility was 66%, with a range from 99% in Argentina to 30% in Guatemala. Sites in Africa had the lowest percentage of hospital deliveries compared with sites in Asia and Latin America. In the sites in Africa and Asia between 24% and 45% of the deliveries occurred in health clinics. Sites in Latin America had very few deliveries in health clinics.

### Birth Attendants

There was a wide range of physician and nurse staffing at the various sites (Table 2). In the African hospitals, physicians were always available in 20% of the hospitals and never available in 20%. In the Asian hospitals physicians were always available in 91% of the hospitals and never available in 2%. In Latin American hospitals, physicians were always available in 44% of the hospitals and never available in 0%. There was also wide variability in nurse and midwife hospital coverage. In the hospitals in Africa, a physician, nurse, or midwife was always available in 100% of the hospitals, in Asia 98%, and in Latin America 89%. In the health clinics, physician availability was far less than in hospitals, with physicians never available in 76%, 40%, and 71% in the health clinics in Africa, Asia, and Latin America, respectively. Nurse and midwife clinic coverage was variable across the sites but was generally higher in Africa and Asia than in Latin America.

### Equipment and Essential Medications

Availability of medical supplies varied in the hospitals and health clinics (Table 3). Anesthesia equipment, which is necessary for lifesaving surgery, was available in 70% of the African hospitals, 67% of the Asian hospitals, and 100% of the Latin American hospitals. Anesthesia equipment was available in 4%, 7%, and 4% in African, Asian, and Latin American health clinics, respectively. Oxygen was available at 60% of the African, 83% of the Asian, and 89% of the Latin American hospitals. Oxygen availability ranged from 8% in the Latin American clinics to 31% of the Asian clinics. Blood pressure cuffs, which are crucial to diagnose preeclampsia, were available in at least 78% of facilities at all sites with the lowest percentages in Africa. Bag and masks for newborn resuscitation were

available in 90% of the hospitals in Africa, 98% in Asia, and 89% in Latin America. They were also available in 73% of the clinics in Africa and Asia and 33% of the health clinics in Latin America.

Table 4 shows reported medication availability by region and type of facility. Antibiotics were not available in 11% of African hospitals and 32% of African clinics. Magnesium sulfate, a drug needed to prevent and to treat eclamptic seizures, was available in 70% of the African and in only 52% of the Asian hospitals. It was available in far fewer of the clinics. Most of the other medications were variably available with fewer of the clinics than hospitals having specific medications. Blood products had the lowest availability in hospitals and health clinics in all three continents. Availability was 20%, 18%, and 33% in African, Asian, and Latin American hospitals and 19%, 11%, and 4% in clinics in those locations, respectively.

Table 5 summarizes the percent of participating facilities in each region that reported performing a procedure at least once in the 6 months preceding the survey. In Africa and Asia approximately 70% of the hospitals had performed a CS and dilation and curettage in the last 6 months, and in Latin America, 100% of the hospitals did so. Use of forceps or vacuum extractors was less common, with 20%, 54%, and 22% of hospitals in Africa, Asia, and Latin America reporting their use in the last 6 months. These procedures were performed far less commonly in the health clinics with no use reported in Latin American health clinics.

## Communication

Finally, we evaluated the presence of communication tools (Table 6). Telephone lines were generally available in hospitals but were far less available in health clinics. Availability of cell phones was near 100% in hospitals but less so in the clinics. Radio communication was available in about 25% of hospitals in all locations, but was almost never available in health clinics. Computer/Internet availability was relatively high in the African and Latin American hospitals, less so in Asian hospitals, but rare in health clinics in all locations.

## Discussion

In many developing countries, maternal, fetal, and neonatal mortality rates remain unacceptably high. Most of these deaths are related to the events that occur around labor and delivery, and many could be prevented if the elements of basic and/or emergency obstetric and neonatal care were available.<sup>6-8</sup>

This study, which evaluated hospital and health clinic staffing, the availability of equipment and supplies, medications, communications equipment, and the performance of some key medical procedures, helps explain some of the very high rates of adverse pregnancy outcomes in some low-income countries. First, the availability of key personnel such as physicians, nurses, and midwives is poor in hospitals and worse in clinics. Anesthesia equipment was available in only about 70% of hospitals and approximately 5% of clinics in Africa and Asia. Other important lifesaving diagnostic and treatment interventions such as blood pressure cuffs, bag and masks for neonatal resuscitation, and oxygen were far from universally available. Blood products were available in only 20% of African and Asian hospitals, areas where hemorrhage is the major cause of maternal death. Availability of magnesium sulfate, uterotonics, and antibiotics, essential medications for emergency obstetric care, was also very low. The fact that CS was performed in only 70% of the African and Asian hospitals, and in less than 5% of the clinics, confirms that this important intervention is often not available to women and fetuses in need. Without staff with

equipment able to perform key procedures around the clock, 7 days a week, women, fetuses, and newborns will die unnecessarily.<sup>9,10</sup>

A limitation of the study was that the availability of equipment, supplies, and medication was recorded but actual use was not measured. We are aware of many cases in developing countries where various technologies are available but not actually used. We are also aware that various medications are in stock, but used either incorrectly or not at all. We also did not assess the skills of the health care providers. Not all physicians can perform a CS or perform one competently. Knowledge of the capabilities, knowledge, and skill levels of the providers would be an important addition to the availability of staff and use of equipment, supplies, and medications.

There is a push for more women to deliver in hospitals or health clinics,<sup>11</sup> but the availability of services in many of those facilities is still severely deficient. Factors such as community involvement and mobilization, access to financial resources, and level of education contribute to utilization of obstetric services.<sup>12</sup> Although community-based strategies may still have a role in reducing maternal mortality rate to a certain extent in geographic areas with very high mortality rates,<sup>13</sup> there exists no evidence that a maternal mortality rate below 100 per 100,000 live births can be achieved through community-based strategies alone without access to emergency obstetric care at health facilities.<sup>14</sup>

## Conclusion

Access to reproductive health services including emergency obstetric care is often considered a basic human right, yet neither basic nor comprehensive perinatal services are the norm in most resource-poor settings.<sup>9</sup> To improve maternal and newborn health care, there is need for more human resources in rural settings and a system to ensure their constant availability parallel with improved services.<sup>15,16</sup> Coverage of effective interventions is low, however, and many opportunities are missed to provide quality care within existing health systems. There is a growing consensus that building stronger health systems is vital to achieving better perinatal health outcomes, especially in countries where the health outcomes are very poor.

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## References

1. Islam M, Yoshida S. MDG 5: how close are we to success? *BJOG*. 2009; 116(Suppl 1):2–5. [PubMed: 19740160]
2. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. *Lancet*. 2006; 367:1066–1074. [PubMed: 16581405]
3. FIGO Committee Report. Essential interventions for maternity care in low resource countries. *Int J Gynaecol Obstet*. 2009; 104:80.
4. Pasha O, Goldenberg RL, McClure EM, et al. Communities, birth attendants and health facilities: a continuum of emergency maternal and newborn care (the global network's EmONC trial). *BMC Pregnancy Childbirth*. 2010; 10:82. [PubMed: 21156060]
5. McClure EM, Pasha O, Goudar SS, et al. Global Network Investigators. Epidemiology of stillbirth in low-middle income countries: a Global Network Study. *Acta Obstet Gynecol Scand*. 2011; 90:1379–1385. [PubMed: 21916854]

6. Paxton A, Maine D, Freedman L, Fry D, Lobis S. The evidence for emergency obstetric care. *Int J Gynaecol Obstet.* 2005; 88:181–193. [PubMed: 15694106]
7. McClure EM, Goldenberg RL, Bann CM. Maternal mortality, still-birth and measures of obstetric care in developing and developed countries. *Int J Gynaecol Obstet.* 2007; 96:139–146. [PubMed: 17274999]
8. AbouZahr C, Wardlaw T. Maternal mortality at the end of a decade: signs of progress? *Bull World Health Organ.* 2001; 79:561–568. [PubMed: 11436479]
9. Casey SE, Mitchell KT, Amisi IM, et al. Use of facility assessment data to improve reproductive health service delivery in the Democratic Republic of the Congo. *Confl. Health.* 2009; 3:12. [PubMed: 20025757]
10. Kongnyuy EJ, Hofman J, Mlava G, Mhango C, van den Broek N. Availability, utilisation and quality of basic and comprehensive emergency obstetric care services in Malawi. *Matern Child Health J.* 2009; 13:687–694. [PubMed: 18581221]
11. Lim SS, Dandona L, Hoisington JA, James SL, Hogan MC, Gakidou E. India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: an impact evaluation. *Lancet.* 2010; 375:2009–2023. [PubMed: 20569841]
12. Bhutta ZA, Darmstadt GL, Haws RA, Yakoob MY, Lawn JE. Delivering interventions to reduce the global burden of stillbirths: improving service supply and community demand. *BMC Pregnancy Childbirth.* 2009; 9(Suppl 1):S7. [PubMed: 19426470]
13. Anwar I, Kalim N, Koblinsky M. Quality of obstetric care in public-sector facilities and constraints to implementing emergency obstetric care services: evidence from high- and low-performing districts of Bangladesh. *J Health Popul Nutr.* 2009; 27:139–155. [PubMed: 19489412]
14. Koblinsky MA, Campbell O, Heichelheim J. Organizing delivery care: what works for safe motherhood? *Bull World Health Organ.* 1999; 77:399–406. [PubMed: 10361757]
15. World Health Organization. Geneva, Switzerland: World Health Organization; 2005. *The World Health Report 2005. Make Every Mother and Child Count*; p. 219
16. World Health Organization. Geneva, Switzerland: World Health Organization; 2006. *The World Health Report 2006: Working Together for Health*; p. 209

**Table 1**

Facilities Surveyed and Delivery Location by Geographic Region

	Africa		Asia			Latin America		Total
	Kenya	Zambia	Karnataka, India	Nagpur, India	Pakistan	Argentina	Guatemala	
Clusters (n)	16	10	20	20	24	6	10	106
Facilities surveyed (n)	26	10	143	71	81	6	27	364
Hospitals	8	2	104	6	7	6	3	136
Health clinics	18	8	39	65	74	0	24	228
Deliveries in clusters in 2010 (n)	8,630	7,163	21,573	10,305	14,583	2,832	5,808	70,894
Delivery location (%)								
Home	64	49	11	13	51	1	70	34
Facility	36	51	89	87	49	99	30	66
Hospital	11	6	61	63	25	99	26	41
Health clinic	25	45	28	25	24	0	4	25

**Table 2**

Medical Staff Availability (%) at Facilities by Geographic Region

	Hospital			Health clinic		
	Africa (n = 10)	Asia (n = 117)	Latin America (n = 9)	Africa (n = 26)	Asia (n = 178)	Latin America (n = 24)
<b>Physician</b>						
Always	20	91	44	16	38	0
Sometimes	60	8	56	8	21	29
Never	20	2	0	76	40	71
<b>Nurse</b>						
Always	50	83	67	63	44	0
Sometimes	20	6	33	17	7	25
Never	30	11	0	21	49	75
<b>Midwife</b>						
Always	100	31	22	58	56	0
Sometimes	0	12	22	25	7	0
Never	0	56	56	17	37	100
Physician, nurse or midwife always available	100	98	89	69	85	0

Note: n represents number of facilities surveyed.



**Table 3**

Availability of Equipment and Supplies (%) at Facilities by Geographic Region

	Hospital			Health clinic		
	Africa (n = 10)	Asia (n = 117)	Latin America (n = 9)	Africa (n = 26)	Asia (n = 178)	Latin America (n = 24)
Anesthesia equipment	70	67	100	4	7	4
Oxygen	60	83	89	15	31	8
Stethoscope	70	99	100	88	99	100
Bag and masks	90	98	89	73	73	33
Equipment sterilization	80	91	100	69	53	92
Blood pressure cuff	78	98	100	85	97	100
Thermometer	20	33	56	23	57	96
Gloves	60	97	100	69	88	96

Note: This table displays the number (n) of facilities and percent with equipment and supplies always available.

**Table 4**

Availability of Medications (%) at Facilities by Geographic Region

	Hospital			Health clinic		
	Africa (n = 10)	Asia (n = 117)	Latin America (n = 9)	Africa (n = 26)	Asia (n = 178)	Latin America (n = 24)
Antibiotics	89	96	100	68	74	96
Magnesium sulfate	70	52	89	35	24	8
Misoprostol	50	72	22	31	38	4
Oxytocics	80	95	89	58	68	4
Antihypertensives	90	82	89	46	39	8
Anesthetics	50	59	100	19	25	92
Antiseptics	70	97	100	81	91	96
Blood products	20	18	33	19	11	4

Note: This table displays the number (n) of facilities and percent of those with equipment and supplies always available.

**Table 5** Facilities (%) by Geographic Region that Performed at Least One of the Listed Medical Procedures in the 6 mo Prior to the Survey

	Hospital			Health clinic		
	Africa (n = 10)	Asia (n = 117)	Latin America (n = 9)	Africa (n = 26)	Asia (n = 178)	Latin America (n = 24)
Dilation and curettage	70	74	100	15	35	0
Forceps/vacuum Extraction	20	54	22	4	12	0
Cesarean delivery	70	73	100	4	7	0
Manual removal of placenta	90	57	22	19	29	0

Note: This table displays the number (n) of facilities and percent of those with medical procedures.

**Table 6**

Availability (%) of Types of Communication at Facilities by Geographic Region

	Hospital			Health clinic		
	Africa (n = 10)	Asia (n = 117)	Latin America (n = 9)	Africa (n = 26)	Asia (n = 178)	Latin America (n = 24)
<b>Telephone</b>						
Always	90	91	78	8	44	25
Sometimes	10	2	0	0	4	0
Never	0	8	22	92	52	75
<b>Fax line</b>						
Always	44	21	67	0	0	21
Sometimes	22	8	11	4	0	0
Never	33	71	22	96	100	79
<b>Public phone</b>						
Always	33	72	33	0	21	0
Sometimes	0	2	0	4	9	4
Never	67	26	67	96	70	96
<b>Internet</b>						
Always	67	34	67	8	10	25
Sometimes	22	11	11	0	1	0
Never	11	55	22	92	89	75
<b>Radio</b>						
Always	22	19	33	0	3	0
Sometimes	11	4	0	16	1	0
Never	67	77	67	84	96	100
<b>Cell phone</b>						
Always	100	96	100	50	89	38
Sometimes	0	1	0	12	2	63
Never	0	4	0	38	9	0