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AVERTING MATERNAL DEATH AND DISABILITY

Emergency obstetric care as the priority intervention to reduce maternal mortality in Uganda

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Received 31 October 2006; accepted 15 December 2006

KEYWORDS

Emergency obstetric care;
Performance improvement process;
Uganda

Abstract

Purpose: We conducted a survey to determine availability of emergency obstetric care (EmOC) to provide baseline data for monitoring provision of obstetric care services in Uganda. *Methods:* The survey, covering 54 districts and 553 health facilities, assessed availability of EmOC signal functions. Following this, performance improvement process was implemented in 20 district hospitals to scale-up EmOC services. *Findings:* A maternal mortality ratio (MMR) of 671/100,000 live births was recorded. Hemorrhage, 42.2%, was the leading direct cause of maternal deaths, and malaria accounted for 65.5% of the indirect causes. Among the obstetric complications, abortion accounted for 38.9% of direct and malaria 87.4% of indirect causes. Removal of retained products (OR 3.3, $P < 0.002$), assisted vaginal delivery (OR 3.3, $P < 0.001$) and blood transfusion (OR 13.7, $P < 0.001$) were the missing signal functions contributing to maternal deaths. Most health facilities expected to offer basic EmOC, 349 (97.2%) were not offering them. Using the performance improvement process, availability of EmOC in the 20 hospitals improved significantly. *Conclusion:* An integrated programming approach aiming at increasing access to EmOC, malaria treatment and prevention services could reduce maternal mortality in Uganda. © 2007 International Federation of Gynecology and Obstetrics. Published by Elsevier Ireland Ltd.

1. Introduction

As previously reported, Uganda, using the Sector-Wide Approach (SWAP), identified maternal mortality as the

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highest priority [1,6]. Accordingly three interventions were identified as the most effective: scaling up of Emergency Obstetric Care (EmOC), strengthening family planning services and increasing deliveries at health units [7]. This article describes the impact of implementing these decisions.

Maternal mortality has declined only slightly in the last 10 years; and is currently estimated at 505/100,000 live births [2]. Factors related to maternal and infant mortality have been documented and classified into direct and indirect causes [3–5]. The direct causes of maternal mortality in Sub-Saharan Africa are widely known [3,4]. A recent government multi-sectoral task force to analyze maternal mortality and recommend strategies concluded investing in social services such as health, education, nutrition and safe water would improve maternal health. It also recommended specific programs addressing the health of adolescents, family planning and emergency care [5]. Reproductive health services were given priority and received increased funding although still inadequate to realize meaningful reduction in maternal mortality [6]. It was predicted that through the SWAP process and involvement of development partners, reduction of maternal mortality would be more likely to be realized [6].

The Health Sector Strategic Plan (HSSP) and the Reproductive Health Strategy identify 3 main interventions to reduce maternal mortality. These are:

- Revitalization of family planning;
- Increasing access to antenatal care
- Increasing access to emergency obstetric care (EmOC) [7,8].

Efforts to redefine current interventions and develop a road map to reduce maternal mortality followed the realization that many countries are unlikely to achieve the millennium development goals (MDGs) especially on child and maternal mortality. However, one of the problems met in developing countries is the lack of readily available data. This limits the capacity of programs to make evidence-based decisions in resource allocation and management of programs. To address this constraint, a needs assessment was carried out in Uganda to provide baseline data useful for scale-up of EmOC.

Emergency obstetric care refers to care given to complications that threaten the lives of the mother and newborn [9]. EmOC is monitored through signal functions. Availability of EmOC signal functions has been studied and found useful in reducing maternal mortality [9]. EmOC is categorized into basic and comprehensive. Basic signal functions can be performed at the level of health center and are composed of: parenteral antibiotics, oxytocics and anti-hypertensives, manual removal of placenta, removal of retained products and assisted vaginal delivery. Comprehensive EmOC is composed of basic signal functions in addition to cesarean delivery and blood transfusion [9].

A recent review of availability of basic EmOC in 13 developing countries showed that oxytocics and antibiotics are the most likely EmOC signal functions to be available in health units while assisted vaginal delivery is least likely [10,11]. Many health facilities have no infrastructure for cesarean sections and blood transfusion [14]. In Uganda, 94% of the health facilities *expected* to offer blood transfusion

and cesarean section did not do so. Similarly 80% of the health units were not able to remove retained products and 95% of them were not able to perform assisted vaginal deliveries [6,28].

In most countries of sub-Saharan Africa, EmOC is not the only intervention to reduce maternal mortality [13]. Several factors like access and utilization of existing interventions contribute to high maternal mortality in this region [12,14,15]. Low utilization of ANC limits access to key interventions to promote the health of pregnant women and is due to cost of services and long distances to health units [15–17] as well as to deficiencies in the health system [18–20]. Some research has concluded that health education, training of providers, explaining the side effects of drugs, giving instructions on how to follow the recommended dosage, affordability and dissemination of national treatment policies are also necessary to increase access and use of health interventions [21–25].

EmOC was piloted in Tanzania, Rwanda and Ethiopia through training staff, providing equipment, improving infrastructure and management information systems. This led to improved access to EmOC and increased the met need in these countries [26]. From a program perspective, availability of EmOC at health facilities is partly a management question related to the level of funding and resource allocation priority. We present data showing the significance of each of the EmOC signal functions in explaining maternal deaths at health facilities and how scale-up of EmOC has been achieved using the performance improvement framework. These data are useful in addressing maternal mortality at national, district and lower health units focussing on the key elements of EmOC where resources are limited.

2. Materials and methods

2.1. The EmOC needs assessment

The Ugandan Ministry of Health, UNICEF and other partners carried out an EmOC needs assessment during February and March 2003, using the UN Guidelines for monitoring obstetric service [9]. The details of the methods have been previously published [6]. Briefly, the country was divided into 4 zones: Central, Eastern, Western, and Northern. We surveyed 54 districts omitting 2 districts for security reasons.

The health care delivery system in Uganda includes national referral hospitals (public), district/rural hospitals (both public and private), as well as health centers (both public and private). Health centers are graded as II, III, or IV, according to the administrative zone served and by the types of services provided [28]. Health centers II (HC II) serve a parish and provide outpatient care, antenatal care, immunization and outreach. Health centers III (HC III) serve a sub-county and provide all the services of HC II, plus inpatient care and environmental health. In theory, an HC III should be able to provide basic EmOC. Health centers IV (HC IV) serve a health sub-district and provide all the services of HCs III, plus surgery, supervise the lower level HCs II and III, collect and analyze data on health, and plan for the health sub-district. In theory, an HC IV should be able to provide comprehensive EmOC. However, the actual staffing levels and services provided at health facilities often fall short of the guidelines described above.

Table 1 Maternal complications and deaths recorded in health units in Uganda

A) Maternal deaths	Number of cases	Proportion (%)
<i>Direct causes of maternal deaths</i>		
Hemorrhage	356	42.3
Obstructed/prolonged labor	187	22.2
Ruptured uterus	83	9.9
Postpartum sepsis	60	7.1
Pre-eclampsia/eclampsia	49	5.8
Complication of abortion	93	11.1
Ectopic pregnancy	14	1.7
Total	842	100.0
<i>Indirect causes of maternal deaths</i>		
Malaria	306	65.5
HIV/AIDS	59	12.8
Anemia	89	19.3
Sickle cell disease	6	1.3
Total	460	100.0

All hospitals and HCs IV were included in the survey because of their role in EmOC. A 50% representative sample of HCs III, both public and private health facilities, was taken. For the 54 districts, the needs assessment surveyed 553 health facilities (both public and private), which included 87 hospitals, 107 HCs IV, and 359 HCs III.

2.1.1. Statistical analyses

Data were entered into EpiInfo version 6.0 (CDC, Atlanta, GA, USA), cleaned and transferred to Stata version 8.2 (Stata Corp. College Station, Texas, USA) for analysis. Univariate and bivariate analyses were performed to calculate the availability of EmOC. Probit regression models were constructed to assess the importance of EmOC signal functions in explaining maternal deaths.

Table 2 Obstetric complications recorded in health units in Uganda

Cause of complication	Number of cases	Proportion (%)
<i>Direct causes</i>		
Hemorrhage	5766	13.7
Obstructed/prolonged labor	14,824	34.3
Ruptured uterus	590	1.4
Postpartum sepsis	1628	3.9
Pre-eclampsia/eclampsia	2603	6.4
Complication of abortion	16,394	38.9
Ectopic pregnancy	584	1.4
Total	38,677	100.0
<i>Indirect causes</i>		
Infectious hepatitis	275	1.0
Malaria	23,657	87.4
HIV/AIDS	287	1.1
Anemia	2794	10.3
Sickle cell disease	61	0.2
Total	27,074	100.0

Table 3 Availability of EmOC signal functions in health units in Uganda

Missing EmOC signal function	Proportion of facilities with missing function	Proportion of facilities with signal function
<i>A) Facilities offering basic EmOC (n= 359)</i>		
Parental antibiotics	71(19.8)	288(80.2)
Parental oxytocics	92(25.6)	267(74.4)
Parental sedatives	223(62.1)	136(37.9)
Manual removal of retained products	234(65.2)	125(34.8)
Removal of retained products	225(62.7)	134(37.3)
Assisted vaginal delivery	341(95.0)	18(5.0)
Total	349(97.2)	10(2.8)
<i>B) Facilities offering comprehensive EmOC (n= 194)</i>		
Basic EmOC		
HC IV	99(92.5)	8(7.5)
Hospital	41(47.1)	46(52.9)
Comprehensive EmOC		
<i>Blood transfusion</i>		
HC IV	93(86.9)	14(13.1)
Hospital	12(13.8)	75(86.2)
<i>Cesarean section</i>		
HC IV	97(90.7)	10(9.3)
Hospital	12(13.8)	75(86.2)

The construction of the regression models involved transforming health units into a dummy variable with two categories; those which reported at least one maternal death and those with none in the 12 months prior to the survey. The independent variables (EmOC signal functions) were also transformed into dummy variables: whether a health unit performs a given service or not. The models were constructed using the enter method and only significant variables with $P < 0.05$ were

Table 4 Factors related to maternal deaths in comprehensive EmOC health units in Uganda

Covariate (EmOC signal function)	Odds ratios (95% CI)	P-value
Parental antibiotics	1.0 (0.1–8)	$P > 0.97$
Parenteral oxytocics	0.3 (0.1–1.7)	$P > 0.18$
Parenteral sedatives/ anticonvulsants	2.6 (0.9–8.1)	$P > 0.09$
Manual removal of placenta	0.5 (0.1–1.8)	$P > 0.28$
Removal of retained products	4.6 (0.8–5.3)	$P > 0.08$
Assisted vaginal delivery	1.1 (0.5–2.5)	$P > 0.89$
Blood transfusion	13.7 (2.9–16.2)	$P < 0.001$
Cesarean section	1.0 (0.2–4.1)	$P > 0.99$

Table 5 Factors related to maternal deaths in basic EmOC health units in Uganda

Covariate (EmOC signal function)	Odds ratios (95% CI)	P-value
Parenteral antibiotics	6.4 (0.8–8.7)	$P>0.08$
Parenteral oxytocics	0.8 (0.4–1.8)	$P>0.59$
Parenteral sedatives/ anticonvulsants	1.4 (0.7–2.7)	$P>0.30$
Manual removal of placenta	1.6 (0.9–3.1)	$P>0.17$
Removal of retained products	3.3 (1.5–7.0)	$P<0.002$
Assisted vaginal delivery	3.3 (1.8–6.0)	$P<0.001$

retained. The model fit was assessed for robustness using the log-likelihood ratio test and considered sufficient if the P -value was less than 0.05. The performance improvement between successive visits at health units was assessed using a two-sample proportion test.

2.2. Scaling up of EmOC services using performance improvement process

Performance improvement is a process for achieving desired institutional and individual results. The goal of performance improvement is the provision of high quality, sustainable health services where results are achieved through a step-wise process. The 8 key elements of the performance improvement process are:

- Developing an institutional context that involves assessing the mission, goals, strategies, culture, client and community perspectives as well as obtaining and maintaining stakeholder agreement;
- Defining the performance problem; this focuses on the improvement effort and involves a number of people with a stake in the problem, including the performer;
- Defining the desired performance; this includes identifying the critical tasks, then preparing the desired performance statements and indicators;
- Describing the actual performance by collecting data, through a variety of methods in order to identify the performance gap in tasks currently being performed;
- Identifying the performance gap by analyzing the data collected, selecting priority gaps and conducting a root

cause analysis or determine what performance factors are causing them;

- Selecting and designing interventions by developing criteria to determine the most appropriate and cost beneficial steps to resolve the performance;
- Implementing the selected interventions according to the planned schedule;
- Monitoring and evaluating performance by reviewing the interventions throughout the implementation phase and allowing for mid-course modifications as required, and then assessing the impact of the interventions on the performance gap.

2.2.1. Selection and training of EmOC teams

The team to scale-up EmOC was composed of an obstetrician, anesthetist, a senior midwife, a blood bank representative, a hospital administrator and a reproductive health specialist. Team members were selected based on their experience in delivery of health services. The team was trained (1 week) in the performance improvement tool designed for Uganda. The tools were pre-tested.

2.2.2. Performance improvement visits to the health facilities

Two visits were made to 20 district hospitals with poor EmOC signal functions based on the earlier needs assessment [6]. The 1st visit was in October 2005, followed by the 2nd visit in March 2006. The 1st visit was to reassess the situation and identify the gaps in service delivery. Action plans were drawn and discussed with service providers. The plans identified persons responsible for each activity. The 2nd visit aimed to assess the availability of EmOC as agreed in the action plans.

3. Results

Causes (direct and indirect) of maternal deaths were recorded in 553 health units (Table 1). Hemorrhage was the most common direct cause (42.3%) of maternal deaths, followed by obstructed labor. Complications of abortion were responsible for 11.1% and ruptured uterus accounted for 9.9% of the deaths. Among the indirect causes of deaths, malaria accounted for the majority of the cases, 65.5% followed by anemia (19.3%) and HIV/AIDS (12.8%).

Among direct obstetric complications, however, abortion accounted for most (38.9%) followed by obstructed labor (34.3%) and hemorrhage (13.7%) (Table 2). Malaria was the cause of 23,657 (87.4%) of the indirect complications. Health

Table 6 Performance improvement in EmOC in 20 district hospitals in Uganda

Area of quality	Number of standards	Proportion of health units providing quality care (October 2005) (%)	Proportion of health units providing quality care (March 2006) (%)	P-value
Antenatal care	18	60	81	$P<0.0001$
Labor and delivery care – basic	27	59	75	$P<0.0001$
Labor and delivery care – comprehensive	37	56	71	$P<0.0001$
Postnatal and neonatal care	15	34	67	$P<0.0001$
Post-abortion care	10	43	90	$P<0.0001$
Infrastructure	15	73	85	$P<0.005$
Essential obstetric drugs/supplies	15	77	86	$P<0.03$

units in low and high malaria transmission areas were identified and grouped. Health units in high malaria transmission areas recorded a high prevalence of malaria-caused complications; almost double that in low transmission areas (48% and 29.5%; data not shown).

Missing signal functions were assessed in all the 553 health units. In most facilities that should be expected to offer basic signal functions, 349 (97.2%) were not offering all six. Assisted vaginal delivery was the most commonly missing signal function (95.0%). Similarly, most (92.5%) facilities expected to offer comprehensive EmOC were not even able to provide basic EmOC. For facilities expected to offer comprehensive EmOC, HC IV was almost non-functional with only a few offering blood transfusion and cesarean section. Majority of the hospitals were able to offer both blood and cesarean section (Table 3).

The contribution of missing signal functions to maternal deaths in basic and comprehensive EmOC health facilities was assessed. For facilities expected to offer comprehensive EmOC services, the only missing signal function significantly related to maternal death was blood transfusion (OR 13.7, $P < 0.001$) (Table 4).

Among health facilities expected to offer basic EmOC services, only 2 missing signal functions were significantly related to maternal deaths: removal of retained products (OR 3.3, $P < 0.002$), and assisted vaginal delivery (OR 3.3, $P < 0.001$) (Table 5).

Performance improvement in 20 district hospitals was assessed. For all the 7 areas of quality of care related to EmOC; there was improvement between the 1st and 2nd visits (Table 6). Post-abortion care increased most dramatically due to the introduction of the MVA kits. Postnatal and neonatal care also increased due to reorganization of services and counselling by the health workers.

4. Discussion

Our results show that there is high unmet need for basic and comprehensive EmOC. Signal functions are missing from many health units in Uganda. Over 86% of health facilities expected to offer basic EmOC were not able to provide emergency care to pregnant women at the time of the study [27]. Consequently most maternal deaths that occurred in the health facilities were due to inadequate care especially lack of blood transfusion, inadequate skills to perform assisted vaginal deliveries and removal of retained products. Previous studies also documented inadequate availability of the signal functions in most parts of Africa [14]. These data should provide renewed attention to scaling up EmOC services to reduce maternal mortality in Africa.

Emphasis is usually placed on direct causes of maternal mortality. In this study, however, the significance of malaria in pregnancy as an indirect cause of maternal morbidity and mortality is highlighted. Tables 1 and 2 show that malaria was the leading indirect cause of maternal deaths and most of the obstetric complications. The epidemiology and clinical features of malaria in pregnancy have been previously described [32]. In malaria endemic areas, the frequency and severity of malaria are greater in pregnant women [29–32]. Prevalence of malaria infection is highest among primigravidae and the risk decreases with increasing

gravidity [32]. Our results confirm this pattern and highlight the need to intensify malaria treatment and prevention, especially during pregnancy, if maternal mortality reduction is to be realized. Furthermore, an integrated programming strategy consisting of improving the quality of antenatal care, especially effective communication, and provision of intermittent preventive treatment (IPT_p) of malaria in pregnancy could also increase the number of women who deliver in health units and, of those, the proportion who seek EmOC services [33].

The data we present are based on a needs assessment using UN process indicators [9]. The scoring system is based on a set of indicators (EmOC signal functions). If a health facility does not offer any of the signal functions for basic and comprehensive, then it is scored zero. This scoring system is rigorous and is useful in advocating and mobilizing resources for EmOC services. Alternatively, analyzing causes of maternal mortality both direct and indirect from locally available data is a useful tool in decision making at district and health units levels for planning and resource allocation. Tables 3 and 4 show that availability of blood transfusion, removal of retained products and assisted vaginal delivery should be given priority to address maternal mortality.

Performance improvement process is a new strategy which focuses on identifying, and addressing problems in the provision of quality care. Using this approach, quality of care at 20 hospitals improved significantly (Table 6). The challenge with this approach, however, is that it requires enough experienced professionals who dedicate time to this process. To be effective, several performance improvement visits must be made to assess the progress in quality improvement at health facilities. One of the constraints in developing countries is inadequate staffing at health units and this has implications for the provision of services and supervision at all levels. Thus scale-up of EmOC requires the Ministries of Health and Finance to allocate more resources to recruit skilled personnel, facilitating the performance improvement process to address the burden of maternal mortality in Uganda.

Acknowledgements

Funds for this study were provided by UNICEF, USAID, WHO and the Ministry of Health, Uganda.

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