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CLINICAL ARTICLE

# A hospital-centered approach to improve emergency obstetric care in South Sudan

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ABSTRACT

*Objective:* To assess provision of emergency obstetric care (EmOC) in Greater Yirol, South Sudan, after implementation of a hospital-centered intervention with an ambulance referral system. *Methods:* In a descriptive study, data were prospectively recorded for all women referred to Yirol County Hospital for delivery in 2012. An ambulance referral system had been implemented in October 2011. Access to the hospital and ambulance use were free of charge. *Results:* The number of deliveries at Yirol County Hospital increased in 2012 to 1089, corresponding to 13.3% of the 8213 deliveries expected to have occurred in the catchment area. Cesareans were performed for 53 (4.9%) deliveries, corresponding to 0.6% of the expected number of deliveries in the catchment area. Among 950 women who delivered a newborn weighing at least 2500 g at the hospital, 6 (0.6%) intrapartum or very early neonatal deaths occurred. Of 1232 women expected to have major obstetric complications in 2012 in the catchment area, 472 (38.3%) received EmOC at the hospital. Of 115 expected absolute obstetric indications, 114 (99.1%) were treated in the hospital. *Conclusion:* A hospital-centered approach with an ambulance referral system effectively improves the availability of EmOC in underprivileged remote settings.


## 1. Introduction

Improving reproductive health is a global priority. The fourth and fifth Millennium Development Goals aim at a reduction in the mortality of children younger than 5 years (the under-5 mortality rate) by two-thirds and a reduction in the maternal mortality ratio by three-quarters between 1990 and 2015 [1,2]. Big gains have been made for both targets. The global under-5 mortality rate dropped by 41% between 1990 and 2011, from 87 to 51 deaths per 1000 live births [3]. The maternal mortality ratio decreased by 47% between 1990 and 2010, from 400 to 210 maternal deaths per 100 000 live births [3]. However, despite these remarkable improvements, efforts must be intensified to meet these global targets [3,4].

Importantly, there are alarming disparities in maternal and child deaths between countries, and between urban and rural regions. Maternal and child deaths are concentrated in the poorest regions, and in particular in Sub-Saharan Africa and Southern Asia [3]. Worldwide, it has been reported that, by 2011, only half of the women in rural areas in the poorest regions received skilled attendance at delivery compared with 84% in urban areas [3]. In Sub-Saharan Africa and South Asia, the gap between urban and rural areas is even larger [3].

There is a general consensus regarding the priority interventions that are needed to reduce maternal deaths and improve reproductive health generally. These interventions include the provision of universally available and accessible emergency obstetric care (EmOC) of good quality, the presence of a professional skilled birth attendant at all births, and the integration of these key services into health systems [5–8]. To achieve these aims, the existence of an integrated and comprehensive hospital-/community-based health program is generally required [9,10]. However, the implementation of such an integrated approach is frequently unrealistic in neglected, remote settings. Stakeholders of nongovernmental organizations (NGOs) acting in these areas have to prioritize some of the interventions, at least in early phases of implementation.

South Sudan is an underprivileged country in Sub-Saharan Africa. In 2006, the under-5 mortality rate was 135 deaths per 1000 live births, and the maternal mortality rate was 2054 per 100 000 live births [11]. The aim of the present study was to assess provision of EmOC in 2012 in an area of South Sudan, after implementation of a project to improve EmOC in the local community in 2011.

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## 2. Materials and methods

The present descriptive study assessed EmOC in Greater Yirol (Fig. 1), which is part of the Lakes region, one of the 10 states of South Sudan. Pre-interventions evaluations and assessments of the area were performed by two of the authors (F.M. and G.P). Greater Yirol comprises the counties of Yirol West, Yirol East, and Awerial, with a total surface area of 15 084 km$^2$. The population was estimated to be 244 950 in 2012 [12], with 24, 14, and 11 inhabitants per km$^2$ in the three counties, respectively. All connecting roads are rough. There are two hospitals in the area, both of which provide comprehensive EmOC services. One is governmental and is located in Yirol town (where the study took place), and the other is private and located in Mapuordit. Mapuordit is close to the state boundary and connections are problematic, if not impossible during the rainy season, so the hospital there and its catchment area are excluded from the present analysis. Yirol County Hospital covers the remaining catchment area, which has 205 327 inhabitants [13]. In this catchment area, there are also three health centers, two in Yirol West and one in Awerial, but none fulfills the criteria for basic EmOC.

Since 2007, Yirol County Hospital has been run by Doctors with Africa CUAMM. The hospital was renovated in 2007–2008. It has a total capacity of 80 beds, 15 of which are dedicated to the maternity ward. The operating theater is available 24 hours a day and is equipped for cesarean deliveries. Blood transfusions are available 24 hours a day and the service relies on volunteer or family donors. The medical staff includes two permanent expatriate medical doctors, one of whom has experience in obstetrics, and several visiting doctors spending short periods of time at the hospital. The maternity ward is staffed by four qualified midwives, two auxiliary nurses, and seven traditional birth attendants. The hospital costs are covered entirely by Doctors with Africa CUAMM; no support from the Ministry of Health is provided. Direct hospital management costs in 2012 were equivalent to US$ 242 279. Doctors with Africa CUAMM act in strict collaboration with the local health institutions.

In October 2011, an ambulance-based referral system to Yirol County Hospital was implemented. The maternity ward was equipped with a mobile phone, allowing midwives on call to receive and triage phone calls from local citizens, and to contact the drivers to arrange a referral by ambulance when indicated. One ambulance is stationed at the hospital, and three drivers are used to ensure the service is available 24 hours per day. Time from the call for the ambulance to arrival varies substantially (from 5 to 90 minutes) depending on the distance and the weather conditions. All local citizens are allowed to call for the ambulance. The referral system was introduced through systematic provision of information during prenatal care visits and by informing traditional leaders, traditional birth attendants, and local authorities. The service was originally directed at maternal care. It was rapidly extended to sick children, unconscious adults, and accident casualties but remained under the maternity ward coordination. The service is free of charge.

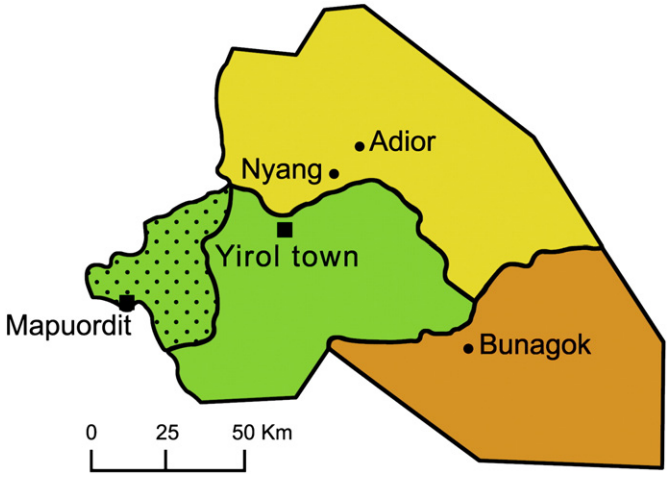


**Fig. 1.** Simplified map of the study area (Greater Yirol, South Sudan). Greater Yirol includes the counties of Yirol West (green), Yirol East (yellow), and Awerial (orange). The dotted area signifies the catchment area of the hospital in Mapuordit, which was not included in the present study. In the catchment area of Yirol Hospital, assisted deliveries could also occur in three non-EmOC health centers (Adior, Nyang, and Bunagok).

The present assessment included all women who were referred to the hospital for delivery between January 1, 2012, and December 31, 2012. On arrival at the hospital, all women were evaluated and managed by a senior expatriate medical doctor (V.P.), who had extensive experience in obstetrics in low-resource settings and had been active at Yirol County Hospital since 2009, and an expatriate resident in gynecology (L.G.). The study was approved by the local institutional review board, and patients or their relatives gave informed consent for participation.

Information about the cases was collected prospectively in a standardized way (L.G). Data regarding the health centers were obtained by regular monitoring of the facilities and using information from the local authorities. Major obstetric complications and absolute (life-threatening) obstetric indications that required obstetric surgery were defined according to the classifications included in the WHO/UN handbook for EmOC monitoring [8]. The data were analyzed using Excel 2010 (Microsoft, Redmond, WA, USA). No measures of statistical significance were calculated.

## 3. Results

The total number of deliveries at Yirol County Hospital was 482 in 2009, 480 in 2010, 744 in 2011, and 1089 in 2012 (Fig. 2). On the basis of an official birth rate of 4% [13], the number of expected deliveries in the hospital catchment area in 2012 was 8213. Assuming that the number of deliveries per year had remained steady, the proportion of all births occurring at the hospital—and so at EmOC facilities—was 5.9% in 2009, 5.8% in 2010, 9.1% in 2011, and 13.3% in 2012.

In 2012, 1089 women delivered in the maternity ward of Yirol County Hospital. An additional 282 women delivered at one of the three health centers offering non-EmOC maternity services. Therefore 1371 deliveries occurred in institutions, corresponding to 16.7% of the expected deliveries in the catchment area. Delivery was by cesarean in 53 (4.9%) of the women who delivered at Yirol County Hospital, corresponding to 0.6% of the expected number of deliveries in the catchment area in 2012. Among the 950 women who delivered a newborn with a birth weight of at least 2500 g in the hospital, 6 (0.6%) intrapartum or very early neonatal deaths occurred (two fresh stillbirths and four early neonatal deaths).

Considering that, based on WHO indicators, 15% of all deliveries are expected to be affected by major obstetric complications [8], 1232 women would have had such complications in the catchment area in 2012. In fact during the study period, 525 major obstetric complications were recorded among 472 women at Yirol County Hospital (Table 1). Therefore, 38.3% of women in the catchment area who would have needed EmOC received such care. Three (0.6%) deaths related to these 525 major obstetric complications were recorded (one prepartum hemorrhage from placental abruption; two postpartum hemorrhages). In addition, three indirect deaths of pregnant women were recorded in the hospital (due to severe anemia, uncontrolled diabetes, and acute heart failure). Blood transfusion was required for 57 (10.9%) major obstetric complications. Of the 472 women who had major obstetric complications, 333 (70.6%) declared their area of residence to be Yirol West, 130 (27.5%) came from Yirol East, and 9 (1.9%) came from Awerial. In total, 221 (46.8%) women with major obstetric complications had been referred by ambulance. This number corresponds to 22.0% of all 1005 ambulance referrals.

The expected proportion of deliveries with absolute obstetric indications is 1.4% [8], so 115 such indications would have been expected in