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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 Yiro, 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 Yiro 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 Yiro 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.

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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 km². The population was estimated to be 244 950 in 2012 [12], with 24, 14, and 11 inhabitants per km² 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

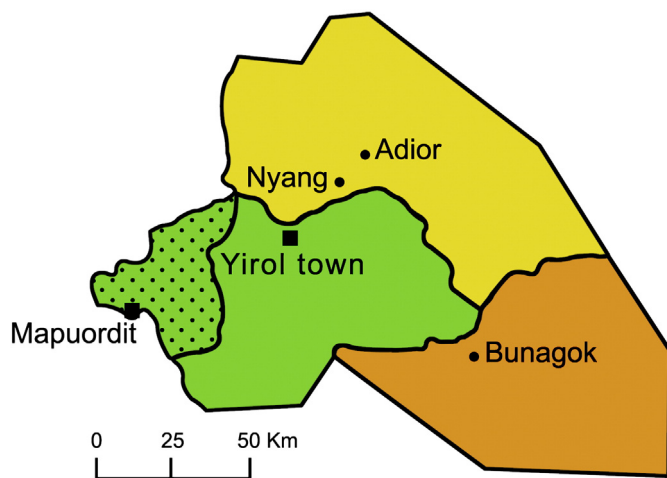


Fig. 1. Simplified map of the study area (Greater Yirol, South Sudan). Greater Yirol includes the counties of Yirol West (green), Yirol East (yellow), and Awerial (orange). The dotted area signifies the catchment area of the hospital in Mapuordit, which was not included in the present study. In the catchment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

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.

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

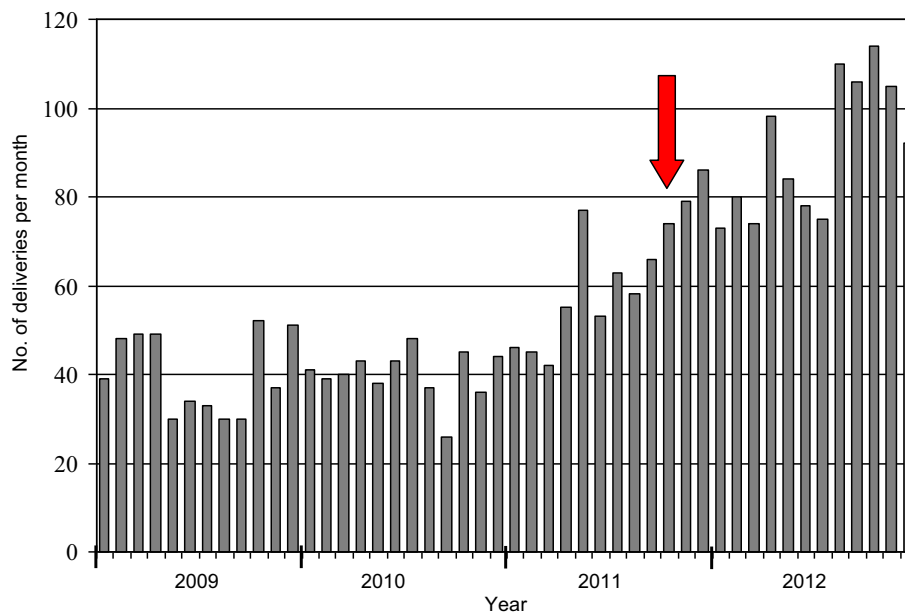


Fig. 2. Number of deliveries per month at Yirol County Hospital, South Sudan, 2009–2012. The red arrow indicates the starting point of the ambulance service.

the catchment area in 2012. The total number of women with an absolute obstetric indication treated in the hospital was 114 (13 placenta previa; 20 placental abruption; 19 uncontrollable postpartum hemorrhage; 22 cephalopelvic disproportion or scarred uterus; 35 transverse, brow, or face presentation; and five ruptured uterus). Therefore, 99.1% of the expected absolute obstetric indications were treated at the hospital.

Table 2 summarizes the indicators for EmOC in the area during the study period.

4. Discussion

The scenario emerging from the present analysis confirms that Greater Yirol is an underprivileged and neglected area in terms of maternal health. Only one indicator for EmOC was satisfied, and the results for some indicators were alarming. In particular, the number and geographic distribution of EmOC facilities is far below the acceptable level. These findings are even more worrying if the fact that Greater Yirol is a huge area with a low-density population and major transport limitations is considered. Accordingly, the proportion of births occurring in EmOC facilities is very low (13.3%). Moreover, only 38.3% of the need for EmOC is met, and the proportion of cesarean deliveries among all births is also insufficient (0.6% rather than $\geq 5\%$).

Nevertheless, the present analysis reveals some important achievements of the project implemented in 2011. Almost all absolute obstetric indications were treated in the EmOC facility, and the proportion of births in EmOC facilities increased from 5.8%–5.9% in 2009–2010 to 13.3% in 2012. This positive trend is confirmed by data from 2013 (unpublished). Moreover, considering the indicators of EmOC quality, the present performance was positive. The direct obstetric case fatality rate was 0.6% (below the recommended maximum level of 1%) and

the intrapartum and very early neonatal death rate was 0.6% (a target is not reported for this indicator but 0.6% is fairly low).

The current situation in Greater Yirol is obviously far from ideal, but a hospital-centered approach seems to be an effective initial step in the implementation of EmOC in disadvantaged areas. Notably, even though the met need for EmOC was below the recommended 100%, a percentage of 38.3% is satisfactory considering the demanding setting. Even if an unmet obstetric need close to 0% could be an overestimation, this result has to be viewed as positive.

The present efforts now need support from the local authorities and other donors to achieve further improvements in EmOC. Existing health centers need to be upgraded so that they can provide basic EmOC services and new, evenly distributed EmOC facilities should be set up to ensure better coverage of the whole area. The analysis of the area of residence for women with major obstetric complications pointed toward an unbalanced distribution. The vast majority of the treated women were from Yirol West, where the hospital is located.

Unfortunately, public health support for the development of local health resources in South Sudan is presently a weak possibility. The public health system collapsed following independence and health services are now mainly provided by NGOs and faith-based organizations. It is estimated that they now provide 80% of the minimum health service package for an estimated 25% of the population. Some progress may now take place with implementation of the Ministry of Health's Health Sector Development Plan 2011–2015 [11], but the role of NGOs and faith-based organizations will remain fundamental.

Identification of the factors that enabled the positive achievements is difficult because of the plurality and concomitancy of the provided measures. However, at least four main factors could have had a role. First, Yirol County Hospital guaranteed good standards of quality. It is qualified as a comprehensive EmOC facility and performed well in the context of quality indicators. Second, access to the hospital was free of charge—presumably one of the most important aspects considering the upset economic situation of the area [13]. Third, the ambulance service probably had an important role. Previous data [12] have demonstrated the outstanding cost-effectiveness of an ambulance service for reproductive health care in remote settings, and a recent independent study from Médecins Sans Frontières [14] confirms these findings. In the present study, an increase in the number of deliveries was observed after implementation of the ambulance service (Fig. 2) and almost half the women with major obstetric complications were referred by

Table 1

Major obstetric complications in Yirol County Hospital in 2012 (n = 525).

Obstetric complication	No. (%)
Abortion-related complication	162 (30.9)
Prolonged or obstructed labor	181 (34.5)
Postpartum sepsis	47 (9.0)
Hemorrhage	33 (6.3)
Pre-eclampsia or eclampsia	13 (2.5)
Retained placenta	26 (5.0)
Other	63 (12.0)

Table 2
Indicators for EmOC (adapted from the WHO/UN handbook for monitoring EmOC [8]) in Greater Yirol in 2012.

Indicator	Acceptable level	Situation in Greater Yirol	Conclusion
Coverage of EmOC services	≥ 5 EmOC facilities (including ≥ 1 comprehensive) per 500 000 population	Comprehensive EmOC: 4.1 facilities per 500 000 Basic EmOC: 0 facilities per 500 000 Total EmOC: 4.1 facilities per 500 000 ^a	Indicator not met
Geographic distribution of EmOC facilities	All subnational areas should have ≥ 5 EmOC facilities (including ≥ 1 comprehensive) per 500 000 population	Comprehensive EmOC: 2.4 facilities per 500 000 Basic EmOC: 0 facilities per 500 000 Total EmOC: 2.4 facilities per 500 000 ^b	Indicator not met
Proportion of births in EmOC facilities	To be set locally (no target set for Greater Yirol)	13.3% (1089/8213)	NA
Met need for EmOC	100% of women with major obstetric complications should be treated in EmOC facilities	38.3% (472/1232)	Indicator not met
Cesarean delivery as a proportion of all births	5%–15%	0.6% (53/8213)	Indicator not met
Direct obstetric case fatality rate	< 1%	0.6% (3/525)	Indicator met
Intrapartum and very early neonatal death rate	To be set locally (no target set for Greater Yirol)	0.6% (6/950)	NA
Proportion of deaths attributable to indirect causes in EmOC facilities	No standard can be set	50.0% (3/6)	NA

Abbreviations: EmOC, emergency obstetric care; NA, not applicable.

^a Calculated as the number of EmOCs (n = 2) divided per the population of greater Yirol (n = 244 950) and multiplied per 500 000.

^b Refers to the catchment area of Yirol hospital. It is calculated as the number of EmOCs (n = 1) divided per the population of the area (n = 205 327) and multiplied per 500 000.

ambulance. Fourth, the local community was included and the local culture respected, which meant that the ambulance service could be implemented rapidly. For instance, blood transfusions and cesarean deliveries are poorly tolerated in the area. Therefore, it was decided to limit their use as much as possible.

Some strengths and limitations of the present study should be acknowledged. A complete baseline assessment before initiation of the intervention was not possible. Only data on the number of deliveries in the hospital were reliably available. Nevertheless, a consistent baseline evaluation would require a long period of observation (several months if not more) without modifying the context. Even though this approach would be more scientifically valid, it would be unacceptable in practice in view of the scarce resources and the urgent need for interventions.

Additionally, the data used for the estimations of community indicators are based on official data from the Ministry of Health, which might be unreliable. The last census was performed in 2008. However, this source of information was the only one available.

A further limitation is related to the area of residence of the referred women. At hospital admission, women stated the payam (administrative level below counties) where they spent the last days before being admitted as their area of residence and not the payam where their family house was located. Therefore, women who had been staying at a relative's house in Yirol town to wait for delivery were erroneously classified as originating from Yirol West. This situation is not uncommon in Greater Yirol, considering the nomad culture of the population. This misclassification would have led to an overestimation of the number of referrals from Yirol West. A more precise picture of the flow of the women would have led to clearer indications for future interventions. Finally, this study is descriptive and no definite conclusions can be drawn regarding a causal relationship between the interventions and the outcome.

Nevertheless, the present study has some strengths. The data are reliable because they were collected by a dedicated gynecology resident at the only EmOC facility in the intervention area. Moreover, because the study period covered a whole year, the sample was large and the confounding effects of seasonal variation could be excluded.

In conclusion, the present study indicates that a hospital-centered approach can be an effective first-step intervention to improve EmOC availability in underprivileged and neglected remote settings provided that it is free of charge, supported by an ambulance service, and properly integrated in the local community. Although valuable as an initial step, a more comprehensive intervention is warranted to improve EmOC indicators.

Conflict of interest

The authors have no conflicts of interest.

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