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CLINICAL ARTICLE

Predictors of stillbirths and neonatal deaths in rural western Uganda

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ABSTRACT

Objective: To explore pregnancy outcomes at a referral hospital in rural western Uganda. *Methods:* A retrospective study was undertaken using data for all deliveries at Virika Hospital, Fort Portal, Uganda, between July 1, 2009, and October 22, 2011. A detailed review of delivery logs was conducted. Categories were created for obstetric risk factors (e.g. grand multipara, history of hypertension), maternal delivery complications (e.g. eclampsia, hemorrhage), and neonatal complications (e.g. fetal distress, birth defects). *Results:* Overall, 4883 deliveries were included. Of the 517 neonates who did not survive, 430 (83.2%) had been stillborn. After controlling for parity, gestational age, obstetric risk factors, and neonatal complications, risk factors for stillbirth included maternal delivery complications (risk ratio [RR] 3.32, 95% confidence interval [CI] 2.34–4.71; $P<0.001$) and living 51–100 km from the hospital (RR 3.37, 95% CI 2.41–4.74; $P<0.001$). Risk factors for neonatal death included neonatal complications (RR 5.79, 95% CI 2.49–13.46; $P=0.001$) and maternal delivery complications (RR 3.17, 95% CI 1.47–6.82; $P=0.003$). *Conclusion:* Qualified providers need to be deployed to rural areas of Uganda to facilitate the prompt identification and management of pregnancy, delivery, and neonatal complications.

1. Introduction

Worldwide, approximately 6 million stillbirths and neonatal deaths occur annually [1,2], with the vast majority in low-income countries [2]. Although stillbirths and neonatal deaths are multifactorial in their cause, both are disproportionately influenced by the care received during labor and delivery [3]. According to certain estimates [4], nearly half of global stillbirths occur during labor.

In Uganda, an estimated 40 000 stillbirths occur annually—the 10th highest stillbirth rate worldwide [4]. In 2011, the perinatal mortality rate (stillbirths and neonatal mortality combined) in Uganda was 40 per 1000 live births [5]. However, stillbirths and neonatal mortality are often not reported or captured in areas with weak vital registration systems, and therefore the burden of perinatal mortality is likely to be largely underestimated.

In rural western Uganda, where the total fertility rate is 6.4, more than 13% of women aged 15–49 years are pregnant at any given time, and the mean number of children born to women aged 40–49 years is 7.4 [5]. Pregnancy-related complications are often the norm rather than the exception. The 2011 Uganda Demographic Health Survey [5] showed that, among women with a delivery in the past 5 years who attended any prenatal care, 61% had been diagnosed with some type of pregnancy complication. In such settings, it is important to understand the magnitude of the problem, as well as to identify the factors most strongly associated with stillbirth and neonatal death to ensure appropriately targeted interventions. Thus, the present study was conducted to explore pregnancy outcomes at one large referral hospital in rural western Uganda.

2. Materials and methods

A retrospective study was undertaken of all deliveries at Virika Hospital, Fort Portal, Uganda, between July 1, 2009, and October 22, 2011. There were no exclusion criteria; if the delivery was recorded in the hospital log book, it was entered into the study record. This research was reviewed and approved by the Institutional Review Board at the University of Michigan, as well as by management at Virika Hospital. Informed consent was not required given the anonymous, retrospective nature of data collection.

Virika Hospital is a Catholic hospital with 205 beds that serves as a rural referral center for more than 10 districts in southwestern Uganda. Situated in rural Kabarole district (population approximately 360 000), Virika Hospital is home to one of only four practicing obstetrician–gynecologists in the Western region of Uganda. In this region, 55.9% of women who delivered within the 5 years before 2011 reported using a facility for their most recent delivery [5]. Approximately

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2000 deliveries occur at the hospital per year, with one-quarter having been referred from elsewhere [6].

Data were collected from hospital registration books, which are overseen by the head physician and routinely reviewed for completeness. Information about admissions, maternal and neonatal characteristics, and deliveries had been recorded by the nursing staff or the attending physician. Data were recorded at the time of hospital discharge, typically within 1 day of delivery.

Trained research assistants entered the data into an Excel 2010 spreadsheet (Microsoft Corporation, Redmond, WA, USA), removing any information identifying either the mother or the neonate(s). A 10% subsample of data was identified and double-checked for quality control. If multiple errors were found, the data included in the specific page of the registration book was re-entered.

Delivery outcomes were categorized as live birth or stillbirth, with further subcategorization of stillbirth as fresh (skin still intact, appearance suggesting intrapartum death within previous 8–12 hours) or macerated (skin and soft tissue changes, including redness, peeling, or breakdown, suggesting death well before delivery) [7]. Deaths of neonates occurring before hospital discharge were categorized as neonatal deaths. These variables were combined to yield four possible outcomes: live birth (survived to discharge), fresh stillbirth, macerated stillbirth, and neonatal death.

Documented risk factors and complications were categorized as history of obstetric risk factors (including previous cesarean delivery), grand multiparity, or history of hypertension or pre-eclampsia during pregnancy. Maternal delivery complications included premature rupture of membranes, prepartum hemorrhage, cephalopelvic disproportion, eclampsia, impending uterine rupture, uterine rupture, postpartum hemorrhage, or retained second twin. Neonatal complications included fetal distress, umbilical cord wrapped around the neck, birth asphyxia, or birth defects.

Distance to facility was estimated by comparing the mother's district of origin to a map of Uganda and categorizing the districts as closest to Virika (<50 km; Kabarole), within 50–100 km (Kyenjojo, Bundibugyo, Ntoroko, Kamwenge, Kasese), and further than 100 km away (Mbarara, Kanungu, Mubende, Kyegegwa, Kibaale) (Fig. 1). This categorization, although not accounting for exact distances within each district, was discussed and confirmed by Ugandan staff as the most appropriate categorization given that consistently recorded village data or coordinates of women's home villages were not available.

Data were cleaned, prepared for analysis, and entered into Stata 13.0 (StataCorp, College Station, TX, USA). Frequencies and descriptive statistics were calculated for key variables, including maternal age, parity, neonatal gestational age and birthweight, type of delivery, delivery outcome, and complications. $P<0.05$ was considered statistically significant.

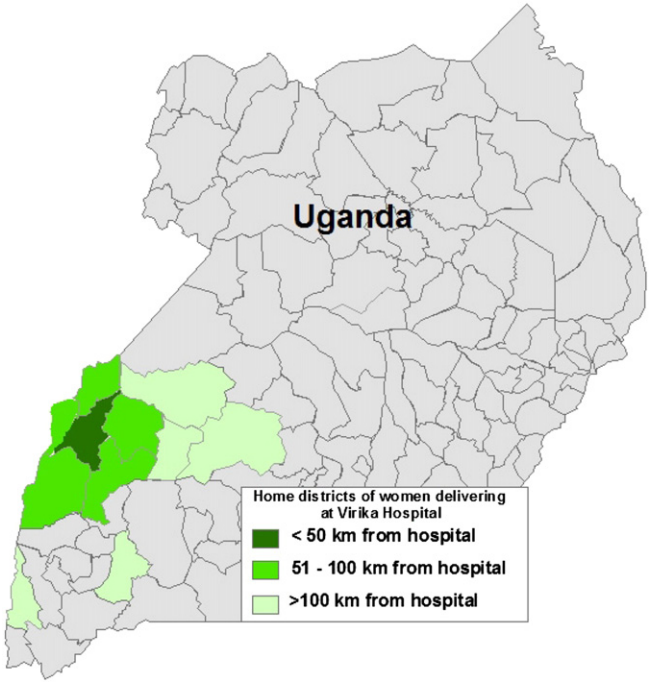

Fig. 1. Districts in western Uganda from where women were referred to Virika Hospital.

3. Results

A total of 4883 births were recorded in the hospital birth registry during the relevant period. Table 1 illustrates the characteristics of the mothers and their neonates. The distance travelled to hospital was greater than 50 km for 1697 (36.1%) of the 4696 births with information

Table 1
Characteristics of the births included (n = 4883).

Characteristic	Value[a]
Maternal	
Age, y	25.7 ± 0.9 (12–48)
<18	712 (14.6)
19–24	1897 (38.8)
25–34	1739 (35.6)
>35	535 (11.0)
Parity	
1	73 (1.5)
2–4	1657 (33.9)
≥5	3153 (64.6)
Neonatal	
Gestational age at birth, wk	
<28 (spontaneous/induced abortion)	18 (0.4)
28–37 (preterm)	584 (12.0)
37–42 (term)	3468 (71.0)
>42 (post-term)	1 (<0.1)
No information available	812 (16.6)
Birthweight, kg	
<1.5 (very low birthweight)	42 (0.9)
1.5–2.5 (low birthweight)	451 (9.2)
2.5–4.0 (normal birthweight)	4079 (83.5)
>4.0 (macrosomia)	311 (6.4)
Type of delivery	
Vaginal	3388 (69.4)
Cesarean	1465 (30.0)
No information available	30 (0.6)
Outcome at discharge	
Neonate alive	4366 (89.4)
Neonate dead	517 (10.6)
Stillbirth	430 (83.2)
Fresh stillbirth	250 (48.4)
Macerated stillbirth	170 (32.9)
Unclassified stillbirth	10 (1.9)
Neonatal death	87 (16.8)
Multiple pregnancy	313 (6.4)
Fetal sex	
Male	2582 (52.9)
Female	2198 (45.0)
No information available	103 (2.1)
1-min Apgar score ≤8	1823 (37.3)
5-min Apgar score ≤8	724 (14.8)
Any obstetric risk factors	383 (7.8)
Any maternal delivery complications	938 (19.2)
Obstructed labor	307 (6.3)
Any neonatal complications	469 (9.6)
Fetal distress	390 (8.0)
HIV-positive mother	1353 (27.7)
Antiretroviral usage	961 (71.0)
Distance to nearest hospital, km	
<50	2999 (61.4)
51–100	1617 (33.1)
>100	80 (1.6)
No information available	187 (3.8)
Any prenatal care	3240 (66.4)

[a] Values are given as mean ± standard error (range) or number (percentage).