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Factors associated with fresh stillbirths: A hospital-based, matched, case–control study in Burkina Faso

Tieba Millogo [a,b,*], Gautier H. Ouédraogo [b], Adama Baguiya [b], Ivlabèhiré Bertrand Meda [b], Seni Kouanda [a,b], Blaise Sondo [a,c]

[a] African Institute of Public Health, Ouagadougou, Burkina Faso
[b] Research Institute for Health Sciences, Ouagadougou, Burkina Faso
[c] University of Ouagadougou, Ouagadougou, Burkina Faso

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ABSTRACT

Objective: To determine the risk factors for fresh stillbirths in hospitals in Burkina Faso. *Methods:* A hospital-based, matched (1:1), case–control study was conducted from July to August 2014 in 50 hospitals across the country. All cases of stillbirth that occurred during this period in the participating facilities were included, and an appropriate control was selected for each case from the same health facility. Cases and controls were matched for gestational age. Conditional logistic regression with robust standard errors was used to compute both unadjusted and adjusted conditional odds ratios. *Results:* Cases were 67% less likely to have been delivered by a midwife compared with a nonmidwife attendant (ACOR = 0.33; 95% CI, 0.12–0.84; $P = 0.02$). Use of a partograph to monitor labor lowered the odds of fresh stillbirth by 82% (ACOR = 0.18; 95% CI, 0.05–0.61; $P = 0.006$). Mothers who had been transferred from another health facility were five times more likely to experience a fresh stillbirth (ACOR = 5.36; 95% CI, 2.02–14.23; $P < 0.001$). *Conclusion:* Quality and timing of intrapartum obstetric care is key to preventing fresh stillbirths. Easy to implement and available interventions, such as use of a partograph for all laboring women and improving the referral system, have the potential to save the lives of many fetuses.

1. Introduction

Stillbirths concern late fetal deaths occurring after 28 weeks of gestation or among fetuses weighing more than 1000 g [1,2]. Around 3.2 million stillbirths occur worldwide each year [3], with the vast majority (98%) in low- and middle-income countries (LMICs) [1,4]. While the burden of overall perinatal mortality has decreased during the last decades, the decline in rates of stillbirths is slow and insufficient, particularly in LMICs [5,6].

Burkina Faso, as with many Sub-Saharan African countries, lacks data on stillbirths, but exhibits high rates of intrapartum and early neonatal deaths [7]; it has failed, in part due to this, to achieve Millennium Development Goal (MDG) 4. Poor reproductive health outcomes have long been blamed on lack of access and uptake of prenatal and obstetric care services [8]. Efforts have been focused primarily on the demand side of services: gradual augmentation of the number of primary healthcare facilities, implementation of outreach programs, and subsidization of health costs, etc. This has resulted in visible and gradual increases in the rates of health facility utilization for prenatal and obstetric care services over the last 10 years [9,10].

However, improvements in health facility utilization were not followed by sufficient improvements in health outcomes. Poor outcomes, such as stillbirths, are still common in healthcare facilities. A study conducted in 2010 reported similar rates of perinatal deaths among home deliveries and health facility deliveries (78.1per 1000 and 79.8 per 1000, respectively) [11], suggesting that the performance of the healthcare system is low.

Stillbirths form a heterogeneous group comprising fresh and macerated stillbirths [2,12]. For fresh stillbirths, the death-to-delivery interval is assumed to be short and the death likely occurred during labor (intrapartum death). Macerated stillbirths are conversely assumed to have occurred before labor (prepartum); the death-to-delivery interval is longer and the fetus shows skin and soft tissue changes [12] (skin discoloration or darkening, redness, peeling, and breakdown), all of which are absent in fresh stillbirths. The difference between the two groups goes beyond physical appearance. Fresh stillbirths are thought to be more preventable as they occur during labor, mostly in term pregnancies and generally without fetal abnormalities [13,14]. Despite this difference, the many studies that have investigated stillbirths in LMICs have looked at stillbirths as a whole and have failed to discriminate between fresh and macerated stillbirths [6,15–19], partly because of the inaccuracy of this classification in the data available [12, 20].

* Corresponding author at: 12, PO Box 199, Ouagadougou. Tel.: +226 25 40 26 78.
E-mail addresses: millogorod@gmail.com, tmillogo@irss.bf (T. Millogo).

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The aim of the present study was to assess the factors associated specifically with fresh stillbirths, here defined as fetuses that were admitted alive for labor but born dead, and for whom the status was declared to be fresh as judged by health workers.

2. Materials and methods

Burkina Faso is a land-locked West African country of more than 17 million inhabitants. The public health sector is divided into three complementary levels with specific activity packages. The first level is represented by the health district, which has two sublevels: the primary healthcare facility (PHC) and the district hospital. The latter is the reference center for the PHC. The second and third levels are represented, respectively, by the regional hospital and the university teaching hospital.

The equipment available and the qualifications of health workers vary across these different levels. The PHC is the point of entry to the health system and is only equipped for basic care. The district hospital, the regional hospital, and the university teaching hospital have surgical units and more qualified health workers. The regional hospital is the highest level of care at the regional level, while the university teaching hospital is the highest level of care at the country level. In Burkina Faso there is a shortage of human resources for health, in particular those in charge of reproductive health. For instance, in 2013 there was a ratio of one midwife for 10 888 inhabitants [21]. Due to this shortage of human resources, not all facility-based deliveries are attended by midwives, and may be attended by nurses, nurse-assistants, and midwife-assistants.

2.1. Study design and sampling

We conducted a hospital-based, matched (1:1), case–control study. The data was collected from July 7, 2014, to August 20, 2014, in 50 hospitals across the country. The study was part of a large countrywide investigation: the Emergency Neonatal and Obstetric Care (EmONC) needs assessment in Burkina Faso. The EmONC needs assessment was conducted in all referral hospitals (national, regional, and district hospitals), all PHC facilities located in towns and rural cities, and in a random sample of rural PHC facilities outside of the main cities of Burkina Faso. A total of 792 health facilities were included in the survey. The inclusion criterion was the provision of obstetric care during the previous 12 months. Our study was conducted in a subsample of public hospitals, all of which were included. We did not consider PHC facilities for this study as patient management tools at this level of the health system do not provide full information on the history of each pregnancy, or details on intrapartum management. In each hospital included in our study all deliveries that occurred between June 1, 2013, and May 31, 2014, were reviewed in the birth registries to identify eligible cases.

2.2. Definition of cases and controls

A case was defined as a fetus whose mother was admitted in labor (gestational age more than or equal to 28 weeks) with at least one vital sign (fetal heart rate, active fetal movements) present at the time of admission, who was born dead and recorded by the birth attendants as a fresh stillbirth. All cases that occurred in the study period were included in the study and an appropriate control was matched from the same health facility. A control match was a neonate born alive at the same gestational age as the case ($\pm$ 1 week of gestation) whose date of birth was closest to that of the case.

2.3. Exposure variables

The independent variables included:

- Maternal sociodemographic factors: age, occupation.
- Obstetric history: number of previous pregnancies and deliveries, history of perinatal death, history of abortion, fetal and maternal outcome of the previous pregnancy.
- Maternal pregnancy-related conditions (pre-eclampsia/eclampsia, placenta and cord related disorders) and maternal nonpregnancy-related medical conditions such as hypertension, diabetes, malaria, and HIV status.
- Fetus-related factors: sex, fetal distress, birth weight.
- Factors related to timing and labor/intrapartum management: duration of the labor, referal from another health facility, qualification of the birth attendant, utilization of the partograph to monitor the labor.

2.4. Data collection, management, and analysis

Data were collected by fieldworkers with a medical background (medical student, midwives, and nurses) using a structured questionnaire adapted from the tools developed by the Averting Maternal Death and Disability (AMDD) group for the needs assessment of EmONC [22]. The fieldworkers were trained by investigators for one week, including a two-day pilot test of the study tools using a sample of 80 health facilities in the capital city of Ouagadougou and its surrounding area. The quality of the data was continuously checked by field supervisors. The same data sources were reviewed for cases and controls. We performed a triangulation between birth registries, cesarean delivery registries (where relevant), and patient charts to find and ascertain all relevant and available information on cases and controls.

The data collected were double entered using CSPro version 5.0 (US Census Bureau) and thereafter exported into Stata version 13.1 (StataCorp LP, College Station, TX, USA) for analysis. Consistency checks were used to explore the quality and clean the data. Maternal age was grouped into five-year age bands. Duration of labor was also recoded into three levels: less than one day, one day, and two days and more. The analysis was restricted to cases and controls that had a birth weight greater than or equal to 1500 g to target fetuses with a better chance of survival in this setting [19].

Descriptive statistics were computed as percentages for categorical variables and means and standard deviations for continuous variables. Paired sample *t* test was used to assess the association between outcome and continuous covariates in univariate analysis. We used conditional logistic regression with robust standard errors (to account for the clustering within a hospital) to compute both unadjusted and adjusted conditional odds ratios and their 95% confidence intervals. Only covariates with a *P* value less than or equal to 0.2 in univariate analysis were tested in multivariate analysis. Consecutive models were compared using the likelihood ratio tests and the overall goodness of fit of the final model was checked. All the analyses carried out were based on complete case analysis.

The large research protocol for the EmNOC needs assessment was reviewed and approved by the Ethics Committee for Health Research in Burkina Faso.

3. Results

A total of 367 cases of fresh stillbirth were recorded in the 50 participating hospitals over the study period. Our analyses were performed on 338 pairs of cases and controls. A flow diagram of the cases identified and the matched controls is presented in Fig. 1. The background characteristics of the study sample are presented in Table 1.

Cases and controls were comparable with respect to maternal age, health status of the mother, parity, history of stillbirth, proportion of outcomes during the previous pregnancy, and the time of childbirth (weekdays versus weekends and public holidays). The mean duration of labor was longer in cases (0.96 days; 95% CI, 0.46–1.45) compared with controls (0.57 days; 95% CI, 0.45–0.68).

The birth attendant was a midwife in 70.1% of the controls compared with 52.37% of the cases ($P<0.001$). Placenta and cord-related disorders were found in 5.0% of the controls compared with 13.1% of the cases