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# A case–control study of risk factors for maternal mortality in Burkina Faso in 2014

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ABSTRACT

*Objective:* To analyze the factors associated with maternal mortality in hospitals in Burkina Faso in the context of emergency obstetric neonatal care. *Methods:* A case-control study was conducted in 812 health facilities in the public and private sectors, involving all categories of health facility in the 13 regions of Burkina Faso. The study population included all women with obstetric complications from May 2013 to April 2014. For any identified case of maternal death, a control counterpart (living woman) was matched according to the obstetric complication. Conditional logistic regression was used to assess factors associated with maternal mortality. *Results:* The analysis focused on a total of 1128 women (564 cases and 564 controls). Place of residence ($P=0.011$), the referral for care ($P<0.001$), maternal age ($P<0.001$), state of consciousness of the mother ($P<0.001$), and the presence of a fever ($P<0.001$) were significantly associated with the occurrence of maternal death. In multivariate analysis, maternal age (OR 1.45; 95% CI, 0.95–2.20; $P<0.001$), coma (OR 1.44; 95% CI, 0.16–0.2; $P=0.010$), and presence of fever (OR 1.67; 95% CI, 1.21–2.28; $P<0.001$) were risk factors related to maternal death. *Conclusion:* The determined factors demonstrate that the survival of women is closely linked to their health.


## 1. Introduction

Neonatal and maternal deaths are important public health problems. Approximately 303 000 women die each year worldwide due to pregnancy and childbirth or in the postpartum period [1]. Among all maternal deaths in 2015, approximately 99% (302 000) occurred in low-resource regions; Sub-Saharan Africa alone represents 66% of deaths [1], while the maternal mortality ratio (MMR) is estimated to be 546 deaths per 100 000 living births [1].

Although most countries have undertaken initiatives to eradicate or reduce the financial barriers to accessing health care, the Millennium Development Goals (MDGs)—specifically goal 5—have not been achieved [2]. Several studies conducted in low-resource countries, specifically in Sub-Saharan Africa, reported that in addition to obstetric complications, factors such as the child's gender, maternal age, maternal level of education, maternal socioeconomic status, and the lack of access to quality health care are risk factors for maternal mortality [3–6].

The inaccessibility of health care is linked either to financial insecurity or to the remoteness of health facilities from the homes of pregnant women [3,7–11]. To attack the problem of financial access to the healthcare system, some countries undertook a national policy of subsidization or exemption from fees for obstetric and neonatal care [12–14]. Most of the studies were conducted prior to the implementation of national policies for subsidized or free healthcare services for pregnant women [4,5,15–19].

The aim of the present study was to determine the factors associated with maternal mortality in hospitals in Burkina Faso in the context of exemption and fee subsidies for obstetric and newborn care.

## 2. Materials and methods

### 2.1. Study setting

The study was conducted in the 13 regions of Burkina Faso. The population of Burkina Faso was estimated in 2014 to be more than 17 300 000 inhabitants according to the general census of the population in 2006. The population was composed of 48.3% men and 51.7% women. According to the demographic and health survey from 2010, the maternal mortality rate was estimated as 341 per 100 000 live births [20]. There are 1859 healthcare facilities in the country (1553 public and 306 private).

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### 2.2. Study type and population

The study was a case–control survey nested to the needs assessment of emergency obstetric and neonatal care (EmONC) study. The study population consisted of women who had complications related to pregnancy or childbirth during pregnancy, during birth, or within 42 days following childbirth and who died (for cases) or survived (for controls) between May 2013 and April 2014 in public and private health facilities in Burkina Faso.

### 2.3. Sampling

The needs assessment for EmONC was conducted on a sample of health facilities in the public sector (3 University Hospitals/National Hospitals [CHU/HN]; 9 regional health centers [CHR]; 48 medical centers with surgical antenna [CMA]; and 700 primary health care centers [CSPS]) and private sector (11 polyclinics; 41 clinics) [21]. A total of 812 health facilities were included. All deaths that occurred in the sample health facilities were included in the study.

### 2.4. Selection of cases and controls

Cases were women who were identified in the records to have died from obstetric causes during the study period. Obstetric complications included direct (e.g. hemorrhage, antepartum and postpartum complications, sepsis, complications of abortion, eclampsia and severe pre-eclampsia, ectopic pregnancy, and rupture of the uterus) and indirect obstetric complications (e.g. malaria, HIV infection, and hepatitis) [22,23].

Controls were women who had survived the same obstetric complication as the cases they were paired with during the same period. The controls were chosen from the same health facility as the case. However, if there was no case that matched the criteria in the same facility, the control was selected from the nearest health facility of the same category. All maternal deaths that were recorded at arrival to the health facility or those that occurred at home were excluded.

### 2.5. Variables of analysis

The dependent variable was the occurrence of maternal death independent of the obstetric complications.

The independent variables included sociodemographic data (age, profession, residence, marital status, and level of education), obstetric history (gestation and parity), etiological data (cause of death), place of death, term of pregnancy, number of prenatal consultations, referral, type of health facility, and place of delivery/intervention.

### 2.6. Data collection

A generic questionnaire (module 9) developed by the Averting Maternal Death and Disability (AMDD) program [24] in collaboration with UN agencies was used. We included variables related to the nested case–control study. The data collection was conducted from July 7 to August 20, 2014.

Information was extracted from the hospitalization records for women, records of deceased patients, medical records, partograph charts, records of birth, child health records, records of prenatal consultation, records of the operating block, admission records, resuscitation records, hospital registers, and audit reports on maternal deaths. The collection was carried out by midwives, state qualified nurses, and trainee medical students, all of whom received prior training.

### 2.7. Data entry and analysis

After the data were entered twice they were processed. Statistical analysis of the data was conducted using SPSS version 18 (SPSS Inc, Chicago, IL, USA). McNemar $\chi^2$ tests were used to compare the matched sample. Univariate analysis was conducted for the determinants associated with the occurrence of the death. The factors that were associated with maternal death under the threshold of $P<0.20$ were selected for the multivariate analysis. The significant variables in the univariate analysis were modelled in a logistic regression conditional model by selecting variables with the manual backward step-to-step method under a 5% threshold of significance.

### 2.8. Ethical considerations

The national assessment was led by a team from the Research Institute of Health Sciences who obtained approval from the Ethics Committee of Health in Burkina Faso.

## 3. Results

Overall, 622 death records were identified by a census of all cases of maternal deaths in health facilities surveyed during the 12-month study period. There was no information on the record for 58 cases. The analysis focused on the files of 1128 women divided into 564 cases and 564 controls. The cases and controls were not significantly different regarding the type of complication and health facilities, which were the matching criteria.

### 3.1. Descriptive analysis of the characteristics of the women

The average age of the women was 27 ± 7 years among cases and 26 ± 6 years among the controls. The majority lived in rural areas (65.7% of cases and 58.3% of controls). Almost all of the mothers lived as a couple (94.7% of cases and 94.5% of controls) and did not attend school (90.7% of cases and 82.6% of controls). The average number of pregnancies for the women was three and two for the cases and controls, respectively (Table 1).

More than three-quarters of the cases (86.0%) were referred for care from a facility to another facility where the death occurred. They were referred for care mostly from public health facilities: CSPS and CMA (61.7% of cases). Additionally, deliveries or interventions among cases occurred more often in CMAs (30.2%).

### 3.2. Factors associated with maternal mortality

The univariate analysis showed that place of residence ($P=0.011$), the referral location of the women ($P<0.001$), maternal age ($P<0.001$), the state of consciousness during the admission examination ($P<0.001$), and the presence of a fever ($P<0.001$) were significantly associated with the occurrence of maternal death (Table 2). However, marital status, level of education, occupation, type of health facility where the women had been referred for care, gravidity, parity, term of pregnancy, number of prenatal care visits, and place of delivery/intervention were not associated (Table 2).

In the multivariate analysis, young age (<20 years) (OR 1.45; 95% CI, 0.95–2.20), state of consciousness (OR 1.44; 95% CI, 0.16–0.21), and the presence of a fever (OR 1.67; 95% CI, 1.21–2.28) were factors related to maternal mortality (Table 2).

## 4. Discussion

The main findings of the study were that three factors (age, state of consciousness, and fever) were significantly associated with maternal mortality.

Women had a mortality risk that was higher according to their age, especially for those under 20 years old and for those more than 40 years old. Many authors have reported age as a risk factor in low-income countries [3–6,15,16,25,26]. The high risk for teenagers is due to biologic immaturity [27,28].