

# Intrauterine Fetal Death in the Third Trimester of Pregnancy in Kamina, DR Congo: Identification of High-Risk Mothers and Impact of the Periodicity of Antenatal Care

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**Abstract:** Purpose: Intrauterine fetal death (IUFD) is a problem frequently encountered in obstetrical practice in developing countries. The objectives of this study were to identify maternal risk factors for IUFD in the third trimester of pregnancy and to establish its relationship with the norms of periodicity of antenatal care in Kamina. Materiel and methods: This is a case-control study conducted in 6 health facilities in Kamina from January 2021 to May 2022. The effects of the socio-demographic characteristics and obstetrical history of mothers, number of prenatal attendances, age of pregnancy at the first prenatal attendance and number of consultations in third trimester of pregnancy on the occurrence of IUFD were studied. A total of 78 cases of IUFD were linked to 234 controls. Results: The adjustment allowed us to retain 5 parameters significantly associated with IUFD: residence in a rural environment (aOR=2.25; CI= [1.23-4.48]), absence of a history of abortion (aOR=2.97; CI=[1.21-7.26]), history of stillbirth (aOR=2.97; CI= [1.21-7.26]), non-follow up of prenatal care (aOR=3.69; CI=[1.78-7.68]) and insufficient number of prenatal attendances in the third trimester of pregnancy (aOR= 2.22; CI=[1.04 -4.73]). The values of the area under the ROC curve (AUC) found indicate a good capacity of the model (80.3%). Conclusion: The modifiable maternal determinants and those related to identified ANC should serve providers to reduce the occurrence of IUFD in Kamina and its surroundings.

**Keywords:** Intrauterine Fetal Death, Risk Factors, Antenatal Care

## 1. Introduction

The definition of the concept of intrauterine fetal death (IUFD) varies in the literature. The differences consist for the majority of authors in the consideration or not of intrapartum fetal deaths as well as with regard to the age limits of pregnancy. For some, IUFD means any fetal death before labor, occurring after the limit of fetal viability as set by the

World Health Organization (WHO), namely 22 weeks of amenorrhea or a birth weight of more than 500 grams [1]. However, the most consistent epidemiological data are linked to the Anglo-Saxon term stillbirth, grouping together antenatal and intrapartum fetal deaths [2-7].

Worldwide in 2019, around 2.0 million stillbirths at 28 weeks or older were registered, with an overall rate of 13.9 stillbirths per 1,000 births. The highest rate was found in West

and Central Africa with 22.8 stillbirths per 1000 births, followed by East and Southern Africa with 20.5 and South Asia at 18.2 [8].

Overall, the prevalence of IUFD is highly variable: 2% worldwide; 0.5% in high-income countries versus more than 1% in developing countries [5]. Our study conducted between 2014 and 2015 at the General Reference Hospital of Kamina in the Haut-Lomami province had found a prevalence of 13.98%; very high compared to the prevalence in the literature [9]. There are a large number of determinants identified in several studies. Some of them are common and several explanations are provided, but others vary from one environment to another depending on the life styles, the environment, certain habits of the general population and of pregnant women in particular [5, 7, 9–11].

The objectives of this study were to identify the maternal risk factors for IUFD in the health facilities of Kamina concerned by the study and to establish the relationship between the follow-up of antenatal care (ANC), the number of prenatal attendances, the age of the pregnancy at the first consultation, the number of prenatal attendance in the third trimester of pregnancy and the occurrence of IUFD.

## 2. Material and Methods

### 2.1. Study Setting

The study was conducted in 6 maternities of Kamina in Haut-Lomami province in the Democratic Republic of Congo (General Reference Hospital, University Clinics, the SNCC Clinic, Bumi Center, Shungu Center, and the Monseigneur Malunga Polyclinic).

### 2.2. Study Design and Period

This was a case-control study conducted in the health facilities concerned from January 2021 to May 2022.

### 2.3. Study Population and Sample

The study population was made up of women giving birth to IUFD on pregnancies  $\geq 28$  weeks recorded as well as their controls made up of live births, matched according to the age of pregnancy, the type of pregnancy and even known morbidity, meeting the selection criteria.

Were considered third trimester in utero fetal death:

- 1) For patients admitted before labor Any pregnant carrier of a pregnancy of at least 28 WA depending on the date of the last menstrual period or on the ultrasound in which the clinical examination and the ultrasound revealed the absence of heartbeats. The diagnosis in this case was clinical and ultrasound;
- 2) For patients admitted in parturition: any delivery in the third trimester of a newborn showing no signs of life and macerated.

Intrapartum fetal deaths were excluded.

The minimum sample size was calculated with StatCalc of Epi-Info software version 7.2.4.0. considering a prevalence of 14% of IUFD among exposed [9], a prevalence of 4% of

IUFD in unexposed [12], a power of 80%, a CI of 95% and a ratio of one case to three controls. The minimum sample size was estimated at 256 subjects due to 64 cases and 192 controls. A total of 78 IUFD cases and 234 controls were studied.

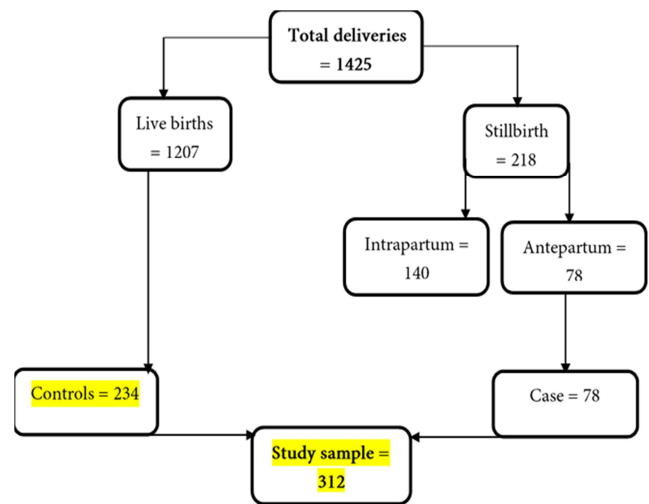


Figure 1. Diagram of study population and sample.

### 2.4. Data Collection

Data collection was done prospectively by teams of investigators, briefed beforehand, using pre-established collection sheets. These teams were supervised by ourselves. They were composed in each health unit of a doctor representing us and at least 3 other members to avoid the loss of information.

### 2.5. Data Analysis

Our data was encoded in Excel 2016 software and exported to SPSS version 23 for analysis. Analytical statistical analyzes were carried out successively. In the bivariate analysis, the Odds Ratio (OR) with their 95% confidence intervals (95% CI) were used to measure the strength of the association between the dependent variable (IUFD) and the independent variables. Measures of association were considered statistically significant when the p-value was less than or equal to 0.05 and or when the lower bound of the 95% CI was  $\geq 1$ . Variables with a  $p \leq 0.20$  in bivariate analysis had been subject to an ascending logistic regression in a step-by-step Wald approach to adjust the associations between the occurrence of IUFD and the maternal parameters as well as those of the quality of the antenatal consultation in terms of frequency to control the confounding factors.

### 2.6. Ethical Considerations

The mothers had received sufficient information on the objectives of the study and on the interest of their participation. Mothers Participation in this Study was free, voluntary without constraint. All information collected from participants was confidential. Only the restricted research team had access to it. A free and informed consent form was presented and read for each respondent. To ensure confidentiality, data were collected anonymously. This study caused no morbidity

respondents and a favorable opinion from the Ethics Committee of the University of Lubumbashi was required and

obtained at the start of the study (approval letter N° UNILU/CEM/021/2020).

### 3. Results

**Table 1.** Association between socio-demographic characteristics and maternal obstetrical history and IUFD.

| parameters                    | IUFD       |             | OR [95% CI]       | p      |
|-------------------------------|------------|-------------|-------------------|--------|
|                               | Yes (n=78) | No (n=234)  |                   |        |
| Mother's age                  |            |             |                   |        |
| <20                           | 18 (23.1%) | 25 (10.7%)  | 2.83 [1.43-5.62]  | <0.001 |
| 20-35                         | 48 (61.5%) | 189 (80.8%) | 1                 |        |
| >35                           | 12 (15.4%) | 20 (8.5%)   | 2.36 [1.08-5.17]  | 0.03   |
| Educational level             |            |             |                   |        |
| None or primary               | 41 (52.6%) | 64 (27.3%)  | 2.94 [1.73-4.99]  | <0.001 |
| Secondary or higher           | 37 (47.4%) | 170 (72.7%) |                   |        |
| Residence                     |            |             |                   |        |
| Surrounding villages          | 35 (44.9%) | 32 (13.7%)  | 5.14 [2.87-9.19]  | <0.001 |
| City of Kamina                | 43 (55.1%) | 202 (86.3%) |                   |        |
| Occupation                    |            |             |                   |        |
| Non remunerative              | 68 (87.2%) | 181 (77.4%) | 1.99 [0.96-4.14]  | 0.61   |
| Remunerative                  | 10 (12.8%) | 53 (22.6%)  |                   |        |
| Marital status                |            |             |                   |        |
| Single                        | 12 (15.4%) | 25 (10.7%)  | 1.52 [0.72-3.19]  | 0.27   |
| Married                       | 66 (84.6%) | 209 (89.3%) |                   |        |
| Gravidity                     |            |             |                   |        |
| 1                             | 25 (32.1%) | 55 (23.5%)  | 2.14 [1.06-4.33]  | 0.03   |
| 2-3                           | 17 (21.8%) | 80 (34.2%)  | 1                 |        |
| ≥4                            | 36 (46.1%) | 99 (42.3%)  | 1.71 [0.89-0.27]  | 0.10   |
| Parity                        |            |             |                   |        |
| 1                             | 33 (42.3%) | 92 (39.3%)  | 1.50 [0.80-3.08]  | 0.19   |
| 2-3                           | 16 (20.5%) | 70 (29.9%)  | 1                 |        |
| ≥4                            | 29 (37.2%) | 72 (30.8%)  | 1.76 [0.88-3.52]  | 0.11   |
| History of abortion           |            |             |                   |        |
| Yes                           | 6 (7.7%)   | 41 (17.5%)  | 0.39 [0.16-0.63]  | 0.04   |
| Nope                          | 72 (92.3%) | 193 (82.5%) |                   |        |
| History of premature delivery |            |             |                   |        |
| Yes                           | 4 (5.1%)   | 11 (4.7%)   | 1.1 [0.34-3.55]   | 0.88   |
| No                            | 74 (94.9%) | 223 (95.3%) |                   |        |
| Stillbirth history            |            |             |                   |        |
| Yes                           | 14 (17.9%) | 9 (3.8%)    | 5.47 [2.26-13.21] | <0.001 |
| No                            | 64 (8.2%)  | 225 (96.2%) |                   |        |

The maternal socio-demographic parameters associated with the occurrence of IUFD were age below 20 years (OR=2.83; 95% CI= [1.43-5.62]), age above 35 (OR=2.36; 95% CI = [1.08-5.17]), low level of education (OR=2.94; 95% CI = [1.73-4.99]) and residence in the village (OR=5.14; 95% CI =[2.87-9.19]), primigestity (OR=2.14; 95% CI = [1.06-4.33]) and stillbirth history (OR=5.47; 95% CI = [2.26-13.21])(Table 1).

**Table 2.** Association between pregnancy monitoring and IUFD.

| Parameters  | IUFD       |             | OR [95% CI]       | p      |
|---|------------|-------------|-------------------|--------|
|   | Yes (n=78) | No (n=234)  |                   |        |
| ANC follow-up   |            |             |                   |        |
| No  | 42 (53.8%) | 32 (13.7%)  | 7.37 [4.12-13.16] | <0.001 |
| Yes   | 36 (46.2%) | 202 (86.3%) |                   |        |
| Number of prenatal attendance                                 |            |             |                   |        |
| <4  | 69 (88.5%) | 162 (69.2%) | 3.41 [1.61-7.20]  | 0.01   |
| ≥4  | 9 (11.5%)  | 72 (30.8%)  |                   |        |
| Pregnancy age at the first prenatal attendance                |            |             |                   |        |
| ≤16 weeks   | 7 (9.0%)   | 42 (17.9%)  | 0.92 [0.38-2.24]  | 0.85   |
| >16 weeks   | 29 (31.2%) | 160 (68.4%) | 1                 |        |
| ANC not followed  | 42 (53.8%) | 32 (13.7%)  | 7.24 [3.95-13.28] | <0.001 |
| Number of prenatal attendance at third trimester of pregnancy |            |             |                   |        |
| <2  | 62 (79.5%) | 103 (44.0%) | 4.9 [2.68-9.04]   | 0.001  |
| ≥2  | 16 (20.5%) | 131 (56.0%) |                   |        |

Mothers who had not attended the antenatal consultation service were highly exposed to IUFD (OR=7.37; 95% CI = [4.12-13.16]). In relation to the norms of periodicity studied in this table, it follows that the number of ANC <4 (OR=3.41; IC95= [1.61-7.20]) and the insufficient number of antenatal visits to the third trimester (OR=4.9; IC95= [2.68-9.04]) were associated with the occurrence of IUFD (Table 2).

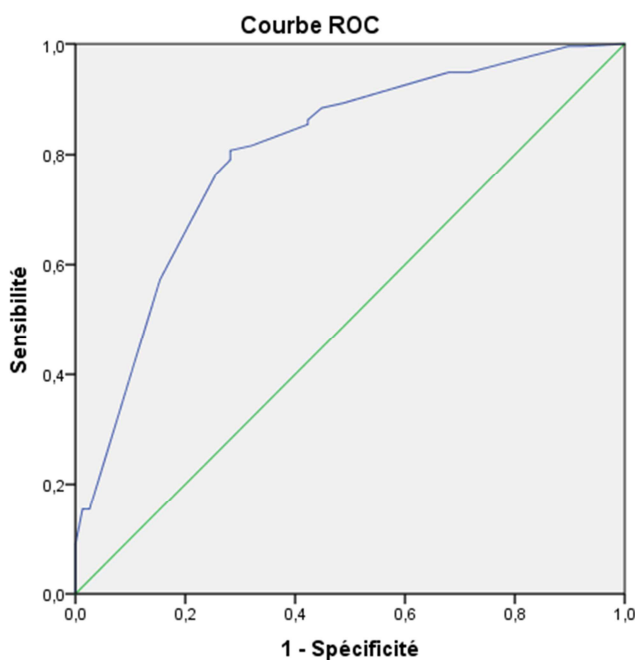
**Table 3.** Multivariate analysis of the various maternal variables and the periodicity of ANC with respect to the occurrence of IUFD.

| Parameters                                  | aOR [IC95]        | p      |
|---|-------------------|--------|
| Rural residence/residence in Kamina         | 2.25 [1.23-4.48]  | 0.021  |
| Unmonitored pregnancy/monitored pregnancy   | 3.69 [1.78-7.68]  | <0.001 |
| Number of ANC at the third trimester <2/ ≥2 | 2.22 [1.04-4.73]  | 0.039  |
| Abortion history: no/yes                    | 2.97 [1.21-7.26]  | 0.017  |
| Stillborn history: yes/no                   | 7.56 [2.50-22.87] | <0.001 |

Of all the variables studied, only residence in the village (aOR=2.25; 95% CI = [1.23-4.48]), non-monitoring of pregnancy (aOR=3.69; 95% CI = [1.78]-7.68]), the number of ANC <2 in the third trimester of pregnancy (aOR=2.22; 95% CI=[1.04-4.73]), the absence of a history of abortion (aOR=2.97; 95% CI = [1.21-7.26]) and history of stillbirth (aOR=7.56; 95% CI = [2.50-22.87]) remained significantly associated with occurrence of IUFD (Table 3).

#### *Discriminant analysis of the in utero fetal death prediction model*

The area under the ROC curve (AUC) values in the figure below indicate a good model performance of 80.3% (74.5-86.1) (Figure 1).



**Figure 2.** ROC curve of the prediction of IUFD from the sociodemographic characteristics of the mother, her obstetrical history and the follow-up of ANC, the number of ANC, the age of pregnancy at ANC1 and the number of ANC in the third trimester of the pregnancy.

## 4. Discussion

### *4.1. Association Between Sociodemographic Characteristics of the Mother and IUFD in Kamina*

Among the socio-demographic parameters studied, the age of the mother <20 years and >35 years, the level of education (none or primary) and residence in the village were significantly associated with the occurrence of fetal death in utero compared to mothers aged 20 to 35, educated and residing in Kamina. The extreme ages of the mother have been incriminated in several studies as risk factors for fetal death in utero [9, 10, 13, 14]. Indeed, maternal age is associated with several morbidities including arterial hypertension, diabetes mellitus, obesity, the risk of placenta previa, retroplacental hematoma and fetal malformations explain the predisposition

of elderly women to IUFD. The exposure of mothers living in the village to having a fetal death in utero is mainly explained by the difficult access to quality health care during their pregnancy as well as their generally precarious living conditions. Indeed, there are inequalities of equipment in terms of health infrastructure between the urban environment where the concentration of socio-economic and health infrastructure is located as well as a large proportion of the educated population and the rural environment, predominantly illiterate and disadvantaged and health behavior inequalities. Indeed, an urban woman, regardless of her level of education, will be influenced by the behavior of the women around her, by the proximity of a health structure and by the circulation of information.

The rural woman, on one hand is perpetually subject to the decisions of the husband and his family which can often be favorable to less costly traditional interventions and on the other hand confronted with the problem of inaccessibility of health facilities (long distance to travel, insufficient means of transport, roads in poor conditions, etc.) [15]. Of all these factors studied, only residence in the village remained statistically associated with the occurrence of fetal death in utero after adjustment (OR=2.25; 95% CI=[1.23-4.48]).

### *4.2. Association Between Obstetrical History and the Occurrence of IUFD*

We noted that the history of delivery of a stillborn child (OR=5.47; 95% CI = [2.26-13.21] and primigestia (OR=2.14; 95% CI = [1.06-4.33]) were related to the occurrence of IUFD and a history of abortion was a protective factor (OR=0.39; 95% CI=[0.16-0.63]. in multivariate analysis, only the history of IUFD (aOR=7.56; 95% CI=[2.50-22.87]) and the absence of a history of abortion (OR=2.97; 95% CI = [1.21-7.26]) were included in the mother's obstetric history. On future pregnancies, some research has shown that the delivery of a fetal death does not remain without consequences. Studies comparing pregnancies after IUFD with pregnancies following live birth find association with obstetric complications [5, 7, 16, 17]. This observation was confirmed by two meta-analyses by Flenady including five studies and finding for subsequent pregnancy a risk of fetal death multiplied by 2.6 (95% CI = [1.5-4.5]) [5]. Our study dealing with risk factors for the occurrence of fetal death in utero at the General Reference Hospital of Kamina found that in 28.3% of cases, at least one history of fetal death in utero was noted among the patients. The occurrence of fetal death in utero was

linked to the previous delivery of a fetal death (OR=3.1; 95% CI = [1.32-7.22]) [9]. This situation found in our study could be due to the existence of stable, unknown and poorly controlled maternal and/or environmental factors during subsequent pregnancies that produce the same effects.

#### 4.3. Number of Prenatal Attendance, Age of Pregnancy at the First Attendance, Number of Attendances in Third Trimester and Occurrence of IUFD

Mothers who did not attend the prenatal consultation service were highly exposed to fetal death in utero compared to those who attended this service (OR=7.37; 95% CI= [4.12-13.16]). In relation to the standards of the periodicity of prenatal consultations, it follows from our results that the number of ANC <4 (OR=3.41; IC95= [1.61-7.20]) and the insufficient number of prenatal visits in the third trimester (OR=4.9; IC95= [2.68-9.04]) exposed pregnant women to IUFD contrary to the age of pregnancy at the start of ANC ≤16 WA (0.92 [0, 38-2.24]; p=0.85). Among these factors studied, only unmonitored pregnancy (aOR=3.69; IC95= [1.78-7.68]) and the number of ANC < 2 in the third trimester (aOR=; IC95=2.22 [1.04-4.73]) remained associated with the occurrence of IUFD after adjustment. Several studies have shown the relationship between prenatal follow-up and the occurrence of fetal death in utero [12, 18–20]. A study of the frequency of antenatal visits conducted in rural Uganda found that attending at least 4 antenatal visits was associated with a reduced risk of stillbirth and obstetric complications at birth. When antenatal visits are more frequent, more comprehensive screening, prophylaxis and beneficial management services are offered; thus reducing maternal and fetal morbidity and mortality, including IUFD. Indeed, the non-monitoring of pregnancy does not make it possible to identify the modifiable risk factors of IUFD and to take charge of them.

The study showed that the high number of prenatal visits in the third trimester protected the pregnant woman against IUFD before labour. These results agree with those of the WHO according to which the complications of pregnancy including fetal deaths occur more in the third trimester [21]. This is why, in the 2016 model that it encourages, the pregnant woman must increase the number of contacts in the third trimester of pregnancy with a frequency of one contact every two weeks.

## 5. Conclusion and Recommendations

The occurrence of IUFD at the third trimester of pregnancy is associated with 5 parameters including 3 maternal and 2 related to the frequency of antenatal consultations: rural residence, absence of a history of abortion and history of IUFD, follow-up of antenatal consultations and the insufficient number of ANC in the third trimester of pregnancy. The promotion of antenatal consultations should be encouraged and providers should identify high-risk mothers at prenatal consultations in order to implement a specific monitoring and care policy.

It is therefore recommended that pregnant women start

prenatal consultations early and keep to appointments to benefit from all the interventions indicated (screening and prophylaxis) and the management of pathologies that can complicate pregnancy if necessary.

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