

Study of the Déterminants of Stillbirths in the Reference Health Centers of Sélingué and Yorosso (Sikasso Region) From January 1, 2015, to December 31, 2017

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Abstract

Background: Stillbirths remain a major public health problem in sub-Saharan Africa and Mali. According to routine data collected from 2008 to 2016 in Sikasso, the health district of Sélingué had the highest stillbirth rate in the region (51.7 (‰) births) and that of Yorosso had the lowest (13.7 (‰) births). This led us to initiate this study to study the determinants of stillbirths in the Reference Health Centers of the two districts from January 1, 2015, to December 31, 2017.

Methods: It was a case-control study of 440 cases including 110 cases and 330 controls in each of the Health Centers. The statistical analysis was done on SPSS version 20 and the writing was done on Word. The value of $p < 0.05$ was found to be statistically significant.

Result: The prevalence's of stillbirths were 28, 6 ‰ in Sélingué and 140 ‰ in Yorosso. The Multivariate Analysis Yielded the Following Results:

1. Women who have not had an antenatal care have a 3 to 4 times higher risk of stillbirths than those who have had antenatal care (OR=3.87; CI: [1.86-8.04]; $p=0.000$); ambulance transport is a protective factor compared to other means of transport (OR: 0.27; CI: [0.09; 0.77]; $p=0.015$); The following reasons for evacuation were risk factors for stillbirths: painful uterine contractions (OR: 4.23; CI: [1.55-11.55]; $p=0.005$) and stationary dilatation (OR: 6.04; CI: [1.11; 32.85], $p=0.037$).
2. In Yorosso, the multivariate analysis selected antenatal care as the only statistically significant risk factor for stillbirths. Women who did not have antenatal care were 4 times more likely to give birth to stillbirths than those who did (OR=4.27; CI: [1.08-16.88]; $p=0.038$).

Conclusion: In light of these results, we believe that emphasis should be placed on the importance of prevention by strengthening antenatal care and improving evacuation conditions.

Keywords: OR, Stillbirths, Prevalence, Reference Health Center

Summary in English

Stillbirths remain a major public health problem in sub-Saharan Africa and Mali. Routine data collection from 2008 to 2016 has shown us the magnitude of the problem in the country and particularly in Sikasso where the rate is higher. We compared data from two Reference Health Centers (RHCs) from January 1, 2015, to December 31, 2017. It was a case-control study of 440 cases including 110 cases and 330 controls in each CSRef. The statistical analysis was done on SPSS version 20 and the writing on Word. The prevalences of stillbirths were 28, 6 ‰ in Sélingué and 140 ‰ in Yorosso. The multivariate analysis retained the following variables as risk or protective factors in the occurrence of stillbirths: prenatal consultation, mode of transport of parturients, reasons for evacuation (painful uterine contractions and stationary dilatation) in Sélingué. In Yorosso, the multivariate analysis retained as the only statistically significant risk factor in the occurrence of stillbirths the non-performance of prenatal consultation (ANC).

Because of these results, we believe that the importance of prevention should be emphasized by reinforcing ANC and improving evacuation conditions.

Introduction

A stillborn is defined by the World Health Organization (WHO) as a fetus born lifeless whose weight is $\geq 1000\text{g}$ and gestational age is ≥ 28 weeks of amenorrhea [1]. Stillbirth is a major public health problem in developing countries [2]. Indeed, the WHO in 2015 has estimated the number of stillborn children in the world at 2.6 million [1].

The stillbirth rate varies considerably from country to country, with the lowest rates recorded in Finland and Singapore (2 ‰ births), and Denmark and Norway (2,2‰), and the highest in Pakistan (43,1‰), followed by Nigeria (42, 9 ‰), Bangladesh (36 ‰), and Djibouti and Senegal (34‰) [1]. Nearly 1.8 million, or 66%, occur in about ten countries: India, Pakistan, Nigeria, China, Bangladesh, the Democratic Republic of Congo, Ethiopia, Indonesia, Afghanistan, and the United Republic of Tanzania [3]. According to estimates by Blencowe H & al. in 2015 the stillbirth rate in Mali would be 35‰ [1]. Following the analysis of Local Health Information System (SLIS) data from 2008 to 2016 by Berthe & al. in 2018, the stillbirth rate in Mali would be 23 ‰ [4]. According to the same source, the Sikasso region has the highest stillbirth rate (28, 8‰) [4]. This is how we have chosen this region to elucidate the problem. Within the region, the health district of Sélingué has the highest rate (51, 7‰) and the health district of Yorosso has the lowest rate (13, 7‰), which is why they were chosen for this study. We wanted this comparison between the Centers de Santé de Références (CSRéf) to understand why Sélingué's rate is high and Yorosso's low.

The general objective was to study the determinants of stillbirths among parturients admitted to the two Reference Health Centers.

The Specific Objectives Were

- To determine the frequency of stillbirths among parturients at

the two referral health centers;

- To identify factors associated with fetal prognosis among parturients in the two referral health centers;
- Determine the variations in the frequency of stillbirths in parturients as a function of the 2nd and 3rd delay.

Materials and Methods

Study Framework

The study took place in the Sikasso region, in two health districts, more specifically at the level of Reference Health Centers.

Sélingué Reference Health Center

Located in the center of the commune of Kangaré, it comprises several blocks including the maternity ward. It is composed of a consultation office for midwives, an on-call room, an Antenatal Consultation (ANC) and Family Planning (FP) room, a manual intrauterine vacuum aspiration (MVA) room, an office for the doctor in charge of Reproductive Health, a delivery room with two tables, and hospitalization rooms with several beds. The staff of the Reference Health Center at the end of 2017 included four doctors, six senior health technicians, one medical assistant, four midwives, one laboratory technician, six public health technicians, one senior hygiene and sanitation technician, three managers, two matrons, three orderlies, two drivers, one secretary, three janitors. Rolling logistics includes two ambulances, nine motorcycles, one motor-cycle ambulance, and three liaison vehicles.

Yorosso Reference Health Center

The Yorosso Reference Health Center includes several units including the maternity ward. It is composed of a consultation office for midwives, an on-call room, an Antenatal Consultation (ANC) and Family Planning (FP) room, a room for manual intrauterine aspiration (MVA), an office for the doctor in charge of Reproductive Health, a delivery room with two tables, three hospitalization rooms with a capacity of eight beds. At the end of 2017, the staff of the CSRéf included four doctors, four higher health technicians (HHT), three midwives, three health technicians, four obstetric nurses, four health technicians, four midwives, one obstetric nurse, one laboratory technician, two Hygiene and Sanitation technicians, and two sales depot managers. In terms of rolling logistics, the CSRéf was equipped with an ambulance in good condition, two liaison vehicles, and seven motorcycles.

Period of Study

This retrospective study covered the period from January 1, 2015, to December 31, 2017. Data collection took place from December 1 to December 31, 2018.

Type of Study

This was a case-control analytical study that compared cases and controls from each of the two Referral Center of Health (CSRef). Cases were women who gave birth with a stillbirth outcome; controls were women who gave birth without a stillbirth outcome. In each CSRéf, we took 440 cases, including 110 cases and 330 controls.

Study Population

Target Population

All cases of expected deliveries during the period in the two health districts of Sélingué and Yorosso.

Source Population

All deliveries were performed at the level of the Reference Health Centers in the two health districts during the period.

Inclusion Criteria

Any case of childbirth performed between January 1, 2015, and December 31, 2017, at the level of the CSRef of the two health districts.

Any case of childbirth of women residing in the two health districts referred or evacuated to the CSRef for complications related to childbirth.

Criteria for Non-Inclusion

- Any case of childbirth that did not take place in the two districts from a health district other than that of Sélingué and Yorosso.
- Any delivery for which the obstetrical record and/or partograph are incomplete.

Estimation of Sample Size

To calculate the sample size, we used the October 2012 version of the Episheet Excel file by Rothman KJ et al. We used Sélingué's stillbirth rate of 5.17% for the nine consecutive years as a reference. This frequency was considered as the incidence among the exposed and applied to the calculation of the sample size in both Sélingué and Yorosso. Thus from the Episheet tool, we have the following elements: the case-to-control ratio is 1 out of 3; the odds ratio is equal to 3; the confidence interval (CI) is equal to 95%; the power of the study is equal to 83%. These integrated data yielded 110 cases, to which we applied the 1 in 3 ratios, which yielded 110 cases and 330 controls. Thus we obtained a sample of 440 parturients.

Survey Frame

The sampling frame consisted of all partograms of the study period. The statistical unit was the partogram.

Polling Technique

Systematic random sampling was used to select study subjects. For this purpose, we calculated the sampling step k according to the sample size in each group (cases and controls). The choice of referral structures is explained by the fact that they receive obstetrical complications from CSComs and other first-level structures but also themselves. Therefore, the CSRefs scientifically represent the frameworks for conducting this study.

Tools for Data Collection

The data collection was based on partograms. Missing data were completed from the delivery registers, Emergency Obstetric and Neonatal Care (EmONC) registers, reference/evacuation notebooks, reference/evacuation cards, operating room registers, ambulance registers, and Administrative Communication Network (ACN) call registers.

Deontological and Ethical Considerations

The objectives of the study and the data collection procedures were explained in detail to the administrative and health authorities. Participation in the study did not involve signing informed consent because the study subjects were partographers and not individuals. However, patient anonymity and confidentiality were strictly respected. The inclusion of patients in the study did not involve any physical or psychological risk. The study offered no financial incentives to patients whose records were selected. Data were entered and kept on the computer of the principal investigator, who had the ultimate responsibility for maintaining the confidentiality of the data.

Results

Descriptive Results

Our study showed that out of 11,454 deliveries in Sélingué during the period, 328 were stillbirths, or 28.6%, while in Yorosso out of 1407 deliveries, 197 newborns were stillbirths or 140%.

Compared to the state of stillbirths, there were 61 fresh stillbirths out of 110 or 63% in Sélingué and 58 fresh stillbirths out of 110 or 53% in Yorosso.

Analytical Results

Multiple Logistic Regression Sélingué

Multiple logistic regression retained the following risks in the final model at CSRef de Sélingué:

- Women who did not have an ANC were 3-4 times more likely to deliver stillbirths than those who did (OR=3.87; CI: [1.86-8.27]; $p<0.000$);
- Ambulance transportation is a protective factor compared with other means of transportation (OR: 0.27; CI: [0.09; 0.77]; $p=0.015$).
- The following reasons for evacuation were risk factors for stillbirths: painful uterine contractions (OR: 4.23; CI: [1.55-11.55]; $p=0.005$) and stationary dilatation (OR: 6.04; CI: [1.11; 32.85], $p=0.037$).

Yorosso

The multivariate analysis retained Antenatal Consultation (ANC) as the only statistically significant risk factor for stillbirths. Women who did not have an ANC had a 4-fold higher risk of stillbirths (OR=4.27; CI: [1.08-16.88]; $p=0.038$).

Comments and Discussions

Stillbirth Rates

Regarding the frequencies of stillbirths in the two CSRefs, we found a stillbirth rate of 28.6 ‰ in Sélingué versus 140 ‰ in Yorosso. These results are contrary to those of Berthé & al. in 2018 who found 51.7 ‰ in Sélingué and 13.6 ‰ in Yorosso [4]. Thus, this finding points to the recurring problem of data reliability in our healthcare institutions. Although in our study the comparison is made between the two CSRefs, the fact remains that the data is inaccurate. This fact is attested to by the evaluation of the routine Health Information System conducted by the National Directorate of Health, which found an average accuracy of 64% at the level of the health districts surveyed [5]. Prevalence in Sélingué is lower than that found in the CSRef of commune VI according to Traoré

M & al. in 2006 who found 50,1‰ [6]. On the other hand, the prevalence in Yorosso is higher than the result of Doumbia M & al. in 2014 in three Complete Emergency Obstetric and Natal Care (EmONUC) facilities in Segou (Macina, San, and Markala), which was 49 ‰ [7]. The frequency at the CSRéf in Sélingué is lower than that found by Bjerregaard-A M & al. in 2018 in a study conducted in an urban hospital in Guinea-Bissau, which was 81‰. In contrast, the prevalence found in Yorosso is higher [8]. Matthews RJ & al. in 2017 found a frequency of 3.8 ‰ in a study of stillbirth data collection from January 2015 to February 2017 in England [9].

The Proportions of Fresh and Macerated Stillbirths Are Different from One CSRéf to Another

The Sélingué CSRéf recorded 63% fresh stillbirths while Yorosso recorded 53%. In both cases, this proportion is over 50% and this highlights the problem of the quality of care in our health institutions. A skin that appears « fresh » or free of signs of maceration is used as a surrogate measure for a stillbirth per partum, while a sign of « maceration » will be considered to evoke an antepartum stillbirth [10].

The difference between the two groups would be explained by the existence of the many rural maternity hospitals, private facilities, and cases from other health districts in Sélingué. Most rural maternity hospitals are run by matrons. These fresh stillbirth rates are lower than the one published by Doumbia M & al. in 2014 who found in three EmONUC facilities in Ségou (Macina, Markala, and San) a fresh stillbirth rate of 72% [7]. In the study conducted by Bjerregaard-Andersen M & al. in 2018, the fresh stillbirth rate was 70.3% (8).

Multiple Logistic Regression

Multiple logistic regression retained the following risks in the final model at CSRéf de Sélingué:

- Age: further analysis showed that there were no statistically significant differences between the 3 comparison groups (<18 years, $p=0.076$; 19-35 years, $p=0.0232$; >35 years is the reference modality). The multiple logistic regression shows that the statistical differences observed in the bi-variate analysis are due to selection bias. Indeed, we did not match the cases and controls at the time of selection. This was difficult for us because the study was retrospective. Our result is similar to the study of Nkemtendong PT & al. in 2017 in Douala (Cameroon), who showed that maternal age did not appear as a risk factor in the final model (13). Adam B & al. in 2016 in northern Ghana, found that maternal age was the only demographic determinant significantly associated with stillbirths in the multivariate model. Indeed, mothers aged 24 years had a high risk of stillbirth compared with mothers aged 25-34 years (OR = 3.0, 95% CI [1.08-8.39]) (11). Sutapa B N & al. in 2015 found that age was a risk factor in the final model (OR: 4.3

95% CI [1.7-10.7]) (12).

- Women who did not have ANC had a 3 to 4 times higher risk of stillbirth than those who did (OR=3.87; CI: [1.86-8.27]; $p<0.000$); This result is consistent with Christou A & al. in 2019 in Afghanistan, whose final model found that women who did not receive antenatal care had a three-fold higher risk of stillbirths (OR: 3.03, 95% CI [1.73; 5.30]) [14].
- Ambulance evacuation is a protective factor compared with other means of transport (OR: 0.27; CI: [0.09; 0.77]; $p=0.015$). The means of transport was reported by Sutapa BN & al. in 2018 in India as a risk factor for stillbirths $p=0.001$ [12].
- In most of the studies we have read, the concept of distance did not emerge particularly strongly, but rather the travel time and the time to care. According to Nkemtendong PT in Cameroon, long distances, poor transport conditions, and poor communication were found to be 14 times more likely to result in stillbirths in the case of referral than those coming directly from home for maternity care [13]. It should also be noted that referral from one facility to another was a risk factor in the study by Nkemtendong PT & al. in 2017 in Cameroon (OR 14.86 95% CI [3.35-66.01]; $p=0.0004$) [13].

The following reasons for evacuation were risk factors for stillbirths: painful uterine contractions (OR: 4.23; CI: [1.55-11.55]; $p=0.005$) and stationary dilatation (OR: 6.04; CI: [1.11; 32.85], $p=0.037$). Cord abnormalities have been reported as a risk factor for stillbirths in Nigeria according to Olusanya BO & al. in 2009 (OR 29.63; 95% CI: [14.23-61.71]) [15]. Aguinaga M & al. in 2019 found that the main causes of antepartum fetal death were congenital anomalies without maternal condition and antepartum hypoxia and maternal medical-surgical factors [16]. To intrapartum causes, the most common were acute intrapartum causes, complications of the placenta, cord, and membranes, and maternal complications of pregnancy [16].

In Yorosso, multivariate analysis found that women who had not had ANC were four times more likely to deliver stillbirths than those who had (OR=4.27; CI: [1.08-16.88]; $p=0.038$). The fact that the other variables are not retained in the final model does not mean that they are not associated. Insufficient data collection could explain this result. Indeed, we had enough difficulty collecting data that was retrospective.

Conclusion

This study, although limited to two CSRéfs, allowed us to identify the important risk factors attributable to the occurrence of stillbirths: age, transport by means other than an ambulance, the distance between the CSRéf and the structures of origin, and the reason “cord protrusion” (Sélingué). Non-achievement of ANC was a factor in the occurrence of stillbirths in both CSRéfs. It would be important to conduct a socio-anthropological study to understand why the non-performance of ANC is frequent in our services.

Table I: Results of multivariate analysis in the study of determinants of stillbirths in the CSRéfs of Sélingué and Yorosso from January 1, 2015 to December 31, 2017.

| Variables | cases | controls | OR | CI à 95% for OR | | p |
|---|-------|----------|-------|-----------------|--------|-------|
| < 18 ans | 19 | 27 | 0,357 | 0,115 | 1,111 | 0,076 |
| 18-35 ans | 71 | 216 | 0,560 | 0,216 | 1,449 | 0,232 |
| >35 ans | 20 | 87 | . | . | . | . |
| Interpregnancy interval < 2 ans | 35 | 126 | 0,746 | 0,380 | 1,464 | 0,394 |
| Interpregnancy interval > 2 ans | 24 | 94 | . | . | . | . |
| < 30 km | 74 | 154 | 0,66 | 0,31 | 1,44 | 0,30 |
| > 30 km | 32 | 164 | . | . | . | . |
| No ANC performed | 39 | 55 | 3,60 | 1,78 | 7,30 | 0,000 |
| ANC performed | 71 | 275 | . | . | . | . |
| referred | 24 | 19 | 2,612 | 0,799 | 8,541 | 0,112 |
| evacuated | 47 | 130 | 2,441 | 0,147 | 40,491 | 0,533 |
| Self-referred | 39 | 181 | . | . | . | . |
| Moto | 63 | 200 | 1,447 | ,091 | 22,941 | 0,793 |
| Ambulances | 21 | 104 | 0,271 | ,094 | ,779 | 0,015 |
| Autre moyen de transport | 26 | 26 | | | | |
| Painful Uterine Contractions | 22 | 169 | 4,87 | 1,82 | 13,02 | 0,002 |
| No Painful Uterine Contractions | 88 | 161 | | | | |
| Hypertension | 9 | 26 | 0,650 | 0,175 | 2,414 | 0,520 |
| No Hypertension | 101 | 304 | . | . | . | . |
| Stationary dilatation | 4 | 31 | 6,038 | 1,110 | 32,847 | 0,037 |
| No Stationary dilatation | 100 | 229 | . | . | . | . |
| Cord incidence | 8 | 2 | 0,587 | 0,082 | 4,196 | 0,596 |
| No Cord incidence | 102 | 328 | . | . | . | . |
| Parity <7 | 70 | 192 | 1,99 | 0,78 | 5,08 | 0,15 |
| Parity ≥7 | 12 | 40 | . | . | . | . |
| presentation of the summit | 88 | 314 | 0,44 | 0,168 | 1,16 | 0,127 |
| Other types of presentation | 22 | 16 | . | . | . | . |
| Low track | 72 | 268 | 0,639 | 0,285 | 1,436 | 0,278 |
| Instrumented Delivery | 9 | 20 | 1,192 | 0,231 | 6,164 | 0,834 |
| Caesareans and Versions by Internal Maneuvers | 29 | 42 | . | . | . | . |

Table II: Results of the multivariate analysis in Yorosso in the study of stillbirths from January 1, 2015 to December 31, 2017 at the level of the Sélingué and Yorosso CSRefs.

| variables | cas | témoins | OR | CI 95% for OR | | p |
|--------------------------------------|-----|---------|--------|---------------|---------|-------|
| < 18 years | 11 | 68 | 3,519 | 0,126 | 98,439 | 0,459 |
| 18-35 years | 84 | 227 | 12,151 | 0,499 | 295,721 | 0,125 |
| >35 years | 15 | 35 | . | . | . | . |
| Number of pregnancies < 7 | 18 | 87 | 1,786 | 0,257 | 12,412 | 0,557 |
| Number of pregnancies ≥7 | 92 | 242 | . | . | . | . |
| Parity < 7 | 42 | 145 | 0,173 | 0,017 | 1,783 | 0,140 |
| Parity ≥7 | 68 | 184 | . | . | . | . |
| Not achieved ANC | 47 | 103 | 4,270 | 1,080 | 16,8820 | 0,038 |
| Achieved ANC | 63 | 227 | . | . | . | . |
| < 30 Km | 32 | 164 | 0,725 | 0,179 | 2,937 | 0,652 |
| > 30 Km | 74 | 154 | . | . | . | . |
| Presentation of the summit | 79 | 297 | 4,978 | 0,880 | 28,150 | 0,069 |
| Presentation of the seat and face | 22 | 23 | 2,617 | 0,326 | 21,002 | 0,365 |
| Presentation Transverse and others | 9 | 10 | . | . | . | . |
| Reasons for admission 1* | 17 | 98 | 0,898 | 0,140 | 5,745 | 0,909 |
| Reasons for admission 2** | 25 | 39 | 1,276 | 0,217 | 7,489 | 0,787 |
| Reasons for admission 3*** | 58 | 91 | . | . | . | . |
| Interval between pregnancies < 2 ans | 90 | 219 | 2,131 | 0,193 | 23,535 | 0,537 |
| Interval between pregnancies > 2 ans | 1 | 16 | . | . | . | . |

*: Painful uterine contractions, HTA, absent BDCF, Stationary dilation and Pre-eclampsia/eclampsia;

** : Scarred uterus, Premature rupture of membranes, Placenta Praevia, HRP and prolonged dystociic labor;

***: Expulsive phase > 45 min, Anemia, Height<150 cm, Prolonged dystocic labour; Prolonged dystocic labour.

Acronyms and Abbreviations

ACN: Administrative Communication Network

ANC: Antenatal consultation

MVA: Manual intrauterine suction

CSCoM: Community Health Center

CSRef: Reference Health Centers

CI: Confidence Interval

EmONUC: Complete Emergency Obstetrical and Neonatal Care

FP: Family Planning

HHT: Higher Health Technicians

SLIS: Local Health Information System

SPSS: Social Package Statistical Software

OR: Odds Ratios

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Participation in the study did not involve signing informed consent because the study subjects were partographers and not individuals. However, patient anonymity and confidentiality were strictly respected. The inclusion of patients in the study did not involve any physical or psychological risk.

Availability of Data and Materials

The datasets during and/or analyzed during the current study available from the corresponding author on reasonable request.

Financing

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Contribution of the Authors

Mamadou SIMA participated in the design of the study and its writing. Fatou DIAWARA participated in the study design and writing. Diakaridia KONE participated in the writing of the manuscript. Alou SAMAKE participated in the writing of the manuscript. Kounandy DOUMBIA participated in the writing of the manuscript. Cheickna DIALLO participated in the writing of the manuscript. TERERA Ibrahim participated in the analysis of the data. TEGUETE Ibrahima participated in the writing of the manuscript. TRAORE Yousouf participated in the writing of the manuscript. SANGHO Hamadoun participated in the writing of the manuscript. Mariam SYLLA participated in its conception and

coordination and the writing of the manuscript. Seydou DOUMBIA contributed to the coordination and writing of the article. All authors read and approved the final manuscript.

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