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Research Article

Factors Associated With Hospital Outcomes for Cases of Anemia in Pregnancy at a Regional Level in Burkina Faso

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Background: Complications related to anemia in pregnancy are common in referral hospitals in Burkina Faso. This study aimed to identify the factors associated with hospital outcomes for anemia in pregnancy at a regional level in Burkina Faso.

Methods: A retrospective study was conducted on anemia cases identified from hospital records of pregnant women admitted between 2009 and 2011 in the maternity wards of public referral hospitals in the Cascades region of Burkina Faso. The hospital outcome was considered favorable if it was satisfactory for both the mother and the fetus, and unfavorable in other cases. The factors associated with unfavorable hospital outcomes were identified through multivariable logistic regression.

Results: A total of 1,815 cases of anemia in pregnancy were identified from hospital records and considered in the study. The outcome of hospitalization for the mother and fetus entity was unfavorable in 42.6% of cases. The factors associated with unfavorable hospital outcomes were rural residence (OR = 1.32; 95% CI: 1.00-1.74), evacuation cases (OR = 1.96; 95% CI: 1.48-2.60), 1st or 2nd trimester of pregnancy (OR = 2.74; 95% CI: 2.03-3.68), severe anemia (OR = 2.46; 95% CI: 1.75-3.46), moderate anemia (OR = 1.39; 95% CI: 1.05-1.85), and poor quality of anemia prevention (OR = 2.81; 95% CI: 1.62-4.88). The unfavorable hospital outcomes were less frequent in women in a union (OR = 0.46; 95% CI: 0.26-0.84), and in nulliparous and primiparous women (OR = 0.69; 95% CI: 0.54-0.88).

Conclusion: Unfavorable maternal-fetal hospital outcomes were common among cases of anemia in pregnancy in the Cascades region of Burkina Faso. They were more common in rural women, those admitted from an evacuation, those in early pregnancy, those with severe anemia, and those with poor quality anemia prevention.

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Background

Anemia in pregnancy is a public health problem, particularly in low-income countries. It is defined as a hemoglobin level < 11 g/dL [1]. According to the World

Health Organization's (WHO) latest updated data, 45.8% of pregnant women in Africa are anemic ^[2]. Burkina Faso, with 55.3% of pregnant women suffering from anemia in 2019, is ranked at a severe level of prevalence ^[2]. Anemia contributes to unfavorable hospital outcomes such as maternal or perinatal death, evacuation, or discharge against medical advice ^{[3][4]}. Some significant proportions of unfavorable hospital outcomes have been described in Burkina Faso, in a study where maternal and perinatal mortalities were close to 3% and 10%, respectively, among cases of severe anemia in pregnancy ^[5]. In other studies, occupational category, number of prenatal visits, duration of iron/folate supplementation, history of malaria or hemorrhage, and low brachial circumference were identified as the common factors associated with unfavorable hospital outcomes. In these studies, analyses were performed separately for pregnancy outcome and maternal health. Furthermore, these studies do not take into account discharge by evacuation or without medical advice; however, these types of discharges cause enormous suffering for patients and their families ^{[5][6]}. Identifying the factors associated with these unfavorable outcomes could contribute to the development of better prevention strategies for mothers and pregnancies. Ideally, the study of these factors should address both maternal health and fetal survival, not just one or the other. This would also allow a comprehensive overview of the hospital care system's response to anemia for the entity mother-fetus. Thus, our study aimed to analyze the hospital outcomes and their associated factors for the mother and fetus entity at a regional level in Burkina Faso.

Methods

Design: We performed a cross-sectional study with retrospective data collection. The data covered three years, from January 1, 2009, to December 31, 2011. This study is part of a research program that aims to understand the problem of anemia in pregnancy in Burkina Faso.

Setting: The study sites were the regional hospital of Cascades and the district hospital of Sindou in Burkina Faso. These two centers represented the hospital level in the Cascades region, one of the 13 regions of Burkina Faso. The Cascades region has three health districts that refer to the regional hospital.

Participants: We analyzed all the hospital records of pregnant women admitted to the two centers between January 1, 2009, and December 31, 2011. An eligible hospital record was one that reported a biologic confirmation of anemia in pregnancy, i.e., a hemoglobin level below 11 g/dl ^[1], and whose hospitalization had ended.

Thus, a total of 5586 hospital records of pregnant women admitted between 2009 and 2011 were reviewed, including 5348 at the regional hospital and 238 at the district hospital. Of these, there were 1815 cases of anemia (32.5% of records). All cases of anemia for which the hospital outcomes were known (n =1635) were included in the analyses.

Variables: The dependent variable was “unfavorable hospital outcome” for the mother and fetus entity.

Whether or not the pregnancy was over, the possible outcomes for the mother at the time of hospital discharge were: improved health, evacuation or referral to another level, discharge without medical advice, and death.

For the fetus, the possible outcomes were: ongoing pregnancy, live birth, abortion, or stillbirth.

The hospital outcome for the mother was:

- favorable if her health had improved at the time of discharge,
- unfavorable in cases of evacuation or referral, in cases of discharge without medical advice, or in cases of death.

The hospital outcome for the fetus was:

- favorable in cases of live birth or ongoing pregnancy,
- unfavorable in cases of abortion or stillbirth.

The variable “hospital outcome” for the mother-fetus pairing combines the possible outcomes for the mother and fetus. So, the combined outcome of hospitalization for the mother-fetus entity was favorable if it was favorable for the mother and favorable for the fetus. In the other cases, the combined hospital outcome was considered unfavorable for the mother-fetus entity.

The independent variables were level of anemia (at admission time), type of hospital (regional or district hospital), patient age in years (categorized into adolescent girls 14–19 years, young adults 20–34 years, and adults 35 years and older), gestational age in trimesters, residence (urban or rural), marital status (single or in a union), income level (low for housewives and high for employed women), parity (nulliparous/primiparous and multiparous), mode of admission to the maternity ward (evacuation, referral, direct admission), time to referral/evacuation, reason for admission (anemia or other reason), and quality of anemia prevention before admission. Anemia in pregnancy was defined by WHO as a hemoglobin (Hb) < 11 g/dl [11]. It was classified into levels: mild anemia ($10 \leq \text{Hb} < 11$ g/dl), moderate anemia ($7 \leq \text{Hb} < 10$ g/dl), and severe anemia ($\text{Hb} < 7$ g/dl). Because gestational age was very poorly reported in the hospital records, it was estimated in trimesters using the symphysis-fundal height regarding the literature [7]. The time of referral/evacuation was categorized into acceptable (< 24 hours) and long (≥ 24 hours). In the absence of consensus on the limits of time of referral to the hospital, the categorization of the time frame took into account the risks related to pregnancy, the average distance to hospitals, the quality of the roads and means of transportation in the region, and the published experiences [8][9][10]. The quality of anemia prevention was considered “good” if the patient had received at least one antenatal visit with both iron/folate supplementation and malaria preventive treatment. It was acceptable if the patient received only one of the two preventive treatments at the antenatal visit. Otherwise, the quality of anemia prevention was considered “weak”. The choice of the independent variables was made regarding the literature related to anemia in pregnancy [6][11], assuming their possible association with the hospital outcomes.

Data collection: All data were extracted from the pregnant women's hospital records using a standardized questionnaire by four trained investigators. The standardized form had three sections devoted to sociodemographic characteristics, clinical data, and anthropometric measurements. This form, developed by the research team, has been approved by specialists in public health, epidemiology, and biostatistics from the *Université Libre de Bruxelles* in Belgium and the Nazi Boni University in Burkina Faso. The data gathering took three months.

Data quality management: To harmonize the understanding of the questionnaire, a pretest was conducted in a referral hospital in a neighboring region before the actual data collection. All questions were clarified with the investigators. At the end of the first day of data collection, a meeting was held to evaluate and correct the completion of the questionnaire; this evaluation was repeated once a week until the end of the data collection.

Statistical analysis: The data were entered in duplicate to reduce entry errors. The variables were summarized with descriptive statistics (frequencies and percentages). The chi-square test was used to analyze the associations between independent and dependent variables. The odds ratios (OR) and their 95% confidence intervals (95% CI) were calculated to estimate these association strengths.

Multivariable logistic regression was used to construct two models. In the first model (model 1), involving all subjects, only independent variables that were associated with the dependent variable in univariate analysis at a significance level of 0.20 were considered for inclusion. Variables in the final model were selected by a top-down stepwise procedure to retain only those with a p-value < 0.05. The adjusted OR and their 95% CI were estimated from this model. The model was tested for fit and good specification using the Hosmer-Lemeshow test and the link test, respectively. Gestational age was missing for 317 women (18%), but because the proportion of unfavorable hospital outcomes was significantly higher in this group, these women with missing gestational age were considered in the analyses. Due to missing data for some variables, the first multivariable model included only 1363 subjects (82% of the total sample); the proportions of unfavorable hospital outcomes did not differ between the subjects included in the analysis and those not included (43% vs. 40%, respectively; $p = 0.29$). A second logistic regression model was constructed for the subgroup of evacuated or referred cases (model 2) to account for the effect of referral/evacuation time, following the same method as for model 1. The data were analyzed using SPSS Statistics version 24.

Results

1) Characteristics of the study population

The majority of cases were women in union, of low income, under 35 years of age, and in their 1st or 2nd trimester of pregnancy. Twenty-seven percent (27%) had severe anemia, 42% had moderate anemia, and 32% had mild anemia. Anemia accounted for more than one-tenth of the reasons for hospitalization. The common modes of hospital admission were evacuation and direct admission. The referral/evacuation time did not exceed 24 hours in the majority of cases. Prevention of anemia in the peripheral health facilities was good in most cases (Table 1). Indeed, the number of antenatal visits per woman before hospitalization ranged from 0 to 6, with a median of 2 visits; the majority of women had benefited from iron/folate supplementation and malaria preventive treatment.

2) Hospital outcomes for pregnant women admitted with anemia

An unfavorable hospital outcome for both the mother and fetus was reported in 42.6% of cases (Table 2). In 71.6% of cases, the hospital outcome was favorable for the mother. In the remaining cases, the outcome was unfavorable, ending in

evacuation or referral in 24.8% of cases, discharge without medical advice in 1.9% of cases, and death in 1.8% of cases.

For cases received from the peripheral care system, 32.4% were again evacuated or referred to a higher level. Severe anemia was associated with referral/evacuation ($p < 0.001$) and maternal death ($p = 0.003$), but not with discharge without medical advice ($p = 0.09$). More than half (54.2%) of referred/evacuated cases had severe anemia on admission. The proportion of referred/evacuated cases was higher ($p < 0.001$) in the 2nd trimester (41.1%) than in the 1st trimester (18.2%) and the 3rd trimester of pregnancy (20.2%). Sixty-one percent (61.0%) of cases admitted with severe anemia in the 2nd trimester were referred or evacuated again. There were more rural (78.0%) than urban (22.0%) cases whose hospitalization ended in referral/evacuation ($p < 0.001$). The majority of patients who died (23/30 deaths) were from rural areas. Referral/evacuation times of less than one day corresponded to obstetrical emergencies and anemia, and the hospital outcome of these cases was unfavorable in 83.2%. The longest delays were observed in free referral cases without medical transport.

The overall maternal mortality ratio among the studied cases was 30 per 804 live births (i.e., 3,732/100,000 live births). This ratio was 3,517/100,000 for severe anemia, 1,446/100,000 for moderate anemia, and 745/100,000 for mild anemia.

Regarding anemia prevention, 72.6% of patients without iron/folate supplementation, 64.5% of patients without preventive treatment for malaria, and 78.6% of women without prenatal care had an unfavorable hospital outcome. The frequency of unfavorable hospital outcomes decreased as the number of prenatal visits increased. Among patients who had at least four antenatal visits (15.7% of cases), an unfavorable hospital outcome was observed in 18.9% of cases.

For the fetus, the hospital outcome was favorable in 77.7% of cases (with ongoing pregnancy in 46.1% and live birth in 31.6%) and unfavorable in 22.3% of cases (including abortion: 12.7% of cases; stillbirth: 8.7%; ectopic pregnancy: 0.9%). There were more abortions in moderate and mild anemia cases than in severe cases ($p = 0.03$). The level of anemia was not associated with stillbirth ($p = 0.19$) and ectopic pregnancy ($p = 0.29$).

Of the 35 unfavorable hospital outcomes of pregnant noncouple women, 32 cases (91.4%) were abortions. The marital status was not associated with maternal hospital outcome and level of anemia.

The majority of maternal deaths and stillbirths (18 of 28 maternal deaths or 64.3% and 91 of 141 stillbirths or 64.5%) occurred in multiparous women; however, the frequency of severe anemia was higher in nulliparous women (30.7%).

Variable	n	%
Age (year)		
14-19 (adolescent)	355	21.9
20-34 (young adult)	1059	65.2
≥ 35 (adult)	209	12.9
Residence		
Urban	588	37.7
Rural	971	62.3
Marital status		
In union	1490	95.0
Not in union	79	5.0
Income level		
Low	1486	93.2
High	108	6.8
Gestational age		
1 st and 2 nd trimester	451	26.8
3 rd trimester	912	54.3
Unknown	317	18.9
Parity		
Nulliparous or primiparous	782	49.2
Multiparous	809	50.8
Hospital		
Regional	1473	90.1
District	162	9.9
Mode of admission		
Evacuation	650	43.2
Referral	236	15.7
Direct admission	618	41.1
Time of referral/evacuation		
< 24 hours	541	82.2
≥ 24 hours	117	17.8
Reason of admission		
Anemia	222	13.6
Other	1413	86.4
Anemia		
Severe	439	26.9

Variable	n	%
Moderate	667	40.8
Mild	529	32.4
Quality of anemia prevention		
Weak	90	5.5
Acceptable	38	2.3
Good	1507	92.2

Table 1. Sociodemographic characteristics of cases of anemia in pregnant women admitted to public referral maternity wards of the Cascades region (Burkina Faso) between 2009 and 2011

Hospital outcome	Mother		Fetus		Global outcome	
	n	%	n	%	n	%
Favorable	1205	71,6	1354	77,7	938	57,4
Unfavorable	479	28,4	389	22,3	697	42,6
Total	1684	100,0	1743	100,0	1635	100,0

Table 2. Hospital outcome of cases of anemia in pregnant women admitted to public referral maternity wards of the Cascades region (Burkina Faso) between 2009 and 2011

3) Factors associated with hospital outcome for cases of anemia in pregnancy

Tables 3 and 4 present the results of univariate and multivariate analyses. In univariate analysis, the factors associated with unfavorable hospital outcomes for the mother and fetus entity were rural residence, noncoupled status, referral or evacuation cases, anemia as the reason for admission, the first two trimesters of pregnancy, multiparity, severe or moderate anemia, and low quality of anemia prevention.

In model 1 (Table 3), which did not include the time of referral/evacuation, unfavorable hospital outcomes were more common among rural women, those admitted from an evacuation, patients in the 1st or 2nd trimesters of pregnancy, those with moderate or severe anemia, and those with poor quality of anemia prevention. The hospital outcomes were less unfavorable in women in union, and in nulliparous and primiparous women.

In the analysis of the subgroup of referred or evacuated cases (model 2, Table 4), factors associated with unfavorable hospital outcomes were rural residence, evacuation with less than 24 hours' delay, first two trimesters of pregnancy, severe or moderate anemia, and poor quality of anemia prevention. Marital

status and parity were not associated with unfavorable hospital outcomes in this model.

The patient's age, type of hospital, income level, and reason for admission were not associated with unfavorable hospital outcomes for cases of anemia in pregnancy.

Variable	Unfavorable hospital outcomes (%)	OR (95%CI)	P	Adjusted OR (95%CI)	P
Hospital			0.25	NC	
Regional	42.2	0.82 (0.60–1.14)			
District	46.9	1			
Age (year)			0.76	NC	
14–19	44.8	1.01 (0.72–1.43)			
20–34	41.6	0.89 (0.66–1.20)			
≥ 35	44.5	1			
Residence			< 0.001		0.047
Rural	48.5	1.87 (1.51–2.31)		1.32 (1.00–1.74)	
Urban	33.5	1		1	
Marital status			0.036		0.012
In union	42.4	0.62 (0.39–0.97)		0.46 (0.26–0.84)	
Not in union	54.4	1		1	
Income level			0.20	NC	
Low	43.3	1.30 (0.87–1.95)			
High	37.0	1			
Mode of admission			< 0.001		<0.001
Evacuation	50.8	2.05 (1.63–2.56)		1.96 (1.48–2.60)	
Referral	45.8	1.46 (1.01–2.11)		1.21 (0.85–1.72)	
Direct	33.5	1		1	
Reason of admission			< 0.001	NS	
Anemia	62.2	2.51 (1.86–3.36)			
Other	39.6	1			
Gestational age (trimester)			< 0.001		<0.001
1 st or 2 nd	57.2	3.37 (2.66–4.27)		2.74 (2.03–3.68)	
3 rd	28.4	1		1	

Variable	Unfavorable hospital outcomes (%)	OR (95%CI)	p	Adjusted OR (95%CI)	p
Unknown	65.5	4.78 (3.59–6.36)		4.79 (3.40–6.76)	
Parity			0.016		0.003
Nulliparous or primiparous	39.5	0.78 (0.64–0.96)		0.69 (0.54–0.88)	
Multiparous	45.5	1		1	
Anemia			< 0.001		< 0.001
Severe	62.4	3.76 (2.88–4.92)		2.46 (1.75–3.46)	
Moderate	39.1	1.46 (1.14–1.85)		1.39 (1.05–1.85)	
Mild	30.6	1		1	
Quality of anemia prevention			< 0.001		0.001
Weak	73.3	4.00 (2.48–6.45)		2.81 (1.62–4.88)	
Acceptable	44.7	1.18 (0.62–2.25)		0.84 (0.40–1.74)	
Good	40.7	1		1	

Table 3. Factors associated with unfavorable hospital outcomes for cases of anemia in pregnancy (Model 1)

Model 1 (n = 1363, including 589 unfavorable outcomes): Hosmer-Lemeshow test: p = 0.06; NC: not considered; NS: not included because not significant

Variable	n	Unfavorable hospital outcomes (%)	OR (95%CI)	p	Adjusted OR (95%CI)	p
Hospital				0.97	NC	
Regional	767	49.4	0.99 (0.68-1.46)			
District	119	49.6	1			
Age (year)				0.73	NC	
14-19	193	50.3	0.91 (0.58-1.44)			
20-34	567	48.7	0.86 (0.58-1.27)			
≥ 35	120	52.5	1			
Residence				< 0.001		0.027
Rural	654	53.1	1.86 (1.34-2.57)		1.66 (1.06-2.59)	
Urban	201	37.8	1		1	
Marital status				1.00	NC	
In union	839	49.9	1.00 (0.43-2.33)			
Not in union	22	50.0	1			
Income level				0.07	NS	
Low	829	50.5	1.89 (0.97-3.76)			
High	37	35.1	1			
Mode of admission				0.19	NS	
Evacuation	650	50.8	1.22 (0.91-1.65)			
Referral	236	45.8	1			
Time of referral/evacuation				0.011		0.002
< 24 hours	496	50.6	1.72 (1.13-2.64)		2.08 (1.29-3.33)	
≥ 24 hours	110	37.3	1		1	
Reason of admission				< 0.001	NS	
Anemia	184	63.0	2.01 (1.44-			

Variable	n	Unfavorable hospital outcomes (%)	OR (95%CI)	p	Adjusted OR (95%CI)	p
			2.81)			
Other	702	45.9	1			
Gestational age (trimester)				< 0.001		<0.001
1 st or 2 nd	245	64.1	2.95 (2.15–4.04)		1.78 (1.13–2.80)	
3 rd	509	37.7	1		1	
Unknown	132	67.4	3.42 (2.28–5.13)		3.48 (2.04–5.92)	
Parity				0.12	NS	
Nulliparous or primiparous	402	46.3	0.81 (0.62–1.06)			
Multiparous	464	51.5	1			
Anemia				< 0.001		<0.001
Severe	294	65.0	3.33 (2.34–4.74)		2.77 (1.67–4.60)	
Moderate	343	46.1	1.54 (1.10–2.15)		1.44 (0.92–2.23)	
Mild	249	35.7	1		1	
Quality of anemia prevention				< 0.001		<0.001
Weak	53	79.3	4.21 (2.14–8.30)		5.51 (2.16–14.09)	
Acceptable or good	833	50.0	1		1	

Table 4. Factors associated with unfavorable hospital outcomes for cases of anemia in pregnancy (Model 2)

Model 2 (n = 589 including 283 unfavorable outcomes): Hosmer-Lemeshow test: p = 0.54; NC: not considered; NS: not included because not significant

Discussion

Our results show that, when considering the mother and fetus entity, there is a higher proportion of unfavorable outcomes from hospitalization of cases of anemia in pregnancy in the Cascades region of Burkina Faso. However, the proportions of unfavorable hospital outcomes were lower for both mother and

fetus considered separately. This proportion increases by more than half when the entity is considered and reflects the result perceived at the time of hospital discharge.

The aggregation of outcomes had the particularity of including referral/evacuation and discharge without medical advice. This provides a more comprehensive overview of the performance of hospitals in the management of anemia in pregnant women.

Thus, referrals and evacuations accounted for the largest part of unfavorable outcomes. More than one in five patients were referred or evacuated to a higher level of the care system.

In the first logistic model, evacuation and referral were associated with unfavorable hospital outcomes. When analyzing the subgroup considering the delay in referral or evacuation, it was rather the short delay, i.e., the urgency of the situation, that was associated with the unfavorable outcome. The causes of these emergencies should then be better understood to inform studies and interventions aimed at reducing unfavorable hospital outcomes for the mother-fetus entity.

Worse, one-third of the cases received from referral/evacuation were evacuated to a higher level, whereas regional hospitals were supposed to take care of the majority of the cases received and refer only a small proportion.

Another variable of interest in the study was discharge against or without medical advice. Their proportion was high, but the study design did not allow for an exploration of their motivations. This high proportion reflects the level of dissatisfaction with care among a particular group of patients. Investigating the underlying reasons could help inform interventions aimed at reducing the frequency of such discharges.

The maternal mortality rate in our sample was very high. This rate showed a downward trend over the three years: 3.5 percent in 2009, then 0.9 percent in 2010, and 1.8 percent in 2011.

Unfavorable hospital outcomes for the fetus were also characterized by high rates of abortion and stillbirth. This shows the extent of the unmet need for anemia management in hospitals in Burkina Faso. These high rates are extreme and require further investigation, even though the sample consisted of urgent or complicated cases.

Several factors explained these unfavorable outcomes. The most important were severe anemia, admission from evacuation, poor quality of anemia prevention, and the 1st or 2nd trimester of pregnancy.

Severe anemia was the most common reason for evacuation to the next level of care and was associated with maternal death. Hospitalization for severe anemia in the second trimester of pregnancy resulted in referral/evacuation in almost two-thirds of cases, with anemia as the reason in more than half of the cases. The care system was therefore sufficiently vigilant to detect, but not to treat, severe anemia, especially in the second trimester of pregnancy. This excess of "repeated" referral/evacuation of severe anemia cases was explained by the low availability of blood for transfusion and the non-use of injectable iron in Burkina Faso hospitals.

Unfavorable hospital outcomes were also associated with marital status, and the determining parameter was the high frequency of abortion (91.4%) among

women who were not in a union. This situation is linked to the difficulties faced by pregnant women, often young, unemployed, and left to themselves.

Multiparity was associated with a higher incidence of unfavorable hospital outcomes, with higher proportions of stillbirth (64.5%) and maternal death (64.3%) in multiparous women. This is facilitated by the context of a low-income country. Iron deficiency is common in pregnant women who cannot replenish their stores between several pregnancies in close succession [12].

Living in a rural area was also associated with unfavorable hospital outcomes of anemia in pregnancy. This association was consistent across all logistic models. The majority of referrals/evacuations, cases of severe anemia, and maternal deaths were from rural areas. This is because malnutrition and inadequate health care are prevalent in the rural areas of the country [13].

The low quality of anemia prevention was due to inadequate iron/folate supplementation, malaria preventive treatment, and coverage of obstetric care.

Published literature allows us to discuss the nuances of our results compared to others.

The maternal mortality ratio was 26 times higher than the in-hospital maternal mortality rate of 144 per 100,000 live births that was routinely reported in Burkina Faso in 2012 [14]. But it was fairly close to the 2,800 per 100,000 live births reported among cases of anemia in pregnancy in the same regional hospital in 2014 by Savadogo et al [5]. According to Bailey et al., the case fatality of anemia in pregnancy reaches 2,300 per 100,000 live births in low-income countries [4].

The 127‰ rate of abortion in our study is higher than the rate reported by health facilities in Burkina Faso as a whole in 2012 [14]. The abortion rate in sub-Saharan Africa is between 40 and 60 per 1,000, according to a recent estimate. However, these estimates did not target only cases of anemia and took into account nonhospital data [15].

The proportion of stillbirths in our study was similar to that observed in routine data from hospitals (6.5%) in Burkina Faso in 2012 [14]. It was also close to that of Savadogo et al., who reported a stillbirth rate of 9.4% in 2014 among cases of severe anemia in pregnancy at the regional hospital of Cascades [5]. We did not find an association between stillbirth and the level of anemia. Although Kasa et al [16] in a meta-analysis published in 2023, found that stillbirth was associated with maternal anemia (aOR: 2.62, 95% CI: 1.93, 3.31), this association remains controversial in the literature [17].

In 2012, a proportion of 5.12% of patients were discharged without or against medical advice in Burkina Faso hospitals [14]. Most authors found high rates of discharge without or against medical advice in studies conducted in African hospitals. Lack of improvement in health, financial difficulties, poor hospital conditions, and disagreements with carers were the main reasons for discharge [18][19].

As in our study, Dickson et al. found an association between women's non-union status and high abortion frequency in a multisite study in Ghana and Mozambique [20]. Klutsey and Ankomah also showed that women who were not in a union were at the greatest risk of induced abortion [21].

The association between multiparity and stillbirth or maternal death has also been observed by several authors, particularly in sub-Saharan Africa and South Asia, but also elsewhere^{[17][22][23]}.

The quality of anemia prevention was insufficient in our study. In a previous study carried out in the Cascades region in 2012, we found a lack of knowledge of the prevention measures. This was the case for 75% of care providers and 66% of community health workers in the sample ^[24].

In summary, the determinants of unfavorable hospital outcomes for pregnant women with anemia in the Cascades region between 2009 and 2011 were rural residence, unmarried status, admission due to evacuation, first two trimesters of pregnancy, multiparity, moderate or severe anemia, and low quality of anemia prevention. These results could be used as a baseline for the planning and evaluation of strategies to improve the prevention and treatment of anemia in pregnancy.

Our study limitations were inherent in the retrospective collection of data from hospital records, which were completed summarily and sometimes poorly archived. However, the extension of the data collection period allowed a representative number of subjects to be included in the analyses despite the extent of the missing data.

Including only records with a positive diagnosis of anemia may have introduced a selection bias. This shortcoming was mitigated by the verification of the similarity of the results with the national references and those in the literature.

Conclusion

Unfavorable hospital outcomes for the maternal-fetal entity were common among cases of anemia in pregnancy in the Cascades region of Burkina Faso. They were more common in rural women, those admitted from an evacuation, those in early pregnancy, those with severe anemia, and those with poor quality anemia prevention. By aggregating unfavorable hospital outcomes, this study gives us an overall view of the high incidence of suffering throughout the mother-fetus entity.

Statements and Declarations

Ethics

The study protocol conforms to the Declaration of Helsinki and has been approved by the Ethics Committee of the Centre MURAZ (Ref. 022-2014/CE-CM, 22 October 2014) in Burkina Faso. The study has also been approved by the local health authorities. The data gathered were anonymous. The hospital records were kept under lock and key at the hospital.

Data Availability

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

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Author Contributions

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