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Out-of-Facility Deliveries in the Rural Health Zone of Kalenda, Democratic Republic of the Congo: Prevalence, Determinants, and Maternal and Neonatal Outcomes

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Abstract

Purpose: Childbirth outside a healthcare facility poses major risks for both mother and child. This study aimed to identify the determinants of out-of-facility delivery, estimate its prevalence, and assess maternal and neonatal outcomes in the rural health zone of Kalenda.

Methodology: We conducted a 15-month analytical case-control study from January 2024 to March 2025, including 328 cases and 656 controls. Cases were women who delivered outside healthcare facilities, whereas controls were women who delivered within healthcare facilities. Data were collected using a predesigned questionnaire administered in the community by community health workers, at health centers by area nurses, and at the general hospital and CSR by physicians. Data analysis was performed using Excel 2010, Epi Info 7.2.6.0, and SPSS 25.0. Chi-square tests, odds ratios, and the attributable fraction among the exposed were used. Multivariable logistic regression was performed to control for confounding factors.

Findings: After adjustment, the determinants associated with childbirth outside healthcare facilities include: a distance greater than 5 km between the maternity ward and the home (ORa= 57.61 CI [35.46 - 93.60] FER of 97.2%), lack of transportation (ORa=3.71 [1.628 - 8.46] FER of 73%), non-attendance of prenatal consultations (ORa is 14.41 [7.03 - 29.53] FER of 93%), and the onset of labor between 9 PM and 4 AM (ORa=2.75 [1.649 - 4.602] FER of 63.7%). The maternal mortality ratio is 3806 per 100,000 live births among the cases, compared to 467 among the controls (OR=7.55 CI [2.09-27.26]). Neonatal mortality stands at 119 deaths per 1000 births among cases, compared to 24 among controls (OR= 5.4 CI [3-10]).

Unique Contribution to Theory, Policy and Practice: Deliveries outside healthcare facilities are common in the rural area of Kalenda due to geographical factors, such as remoteness, nighttime onset of labor, and lack of transportation, as well as organizational factors, like the absence of prenatal consultation follow-ups. This leads to increased maternal and neonatal mortality and morbidity.

Keywords: *Determinants, Out-Of-Facility Delivery, Maternal, Outcome, Neonatal, Outcome, Healthcare Facilities, Kalenda, Democratic Republic of the Congo*

Introduction

Childbirth outside a healthcare facility refers to any delivery that occurs outside a health institution, whether at the mother's home or any other place such as a roadside or a field, regardless of whether it is assisted by a skilled health worker, an unskilled attendant, or not assisted at all. Such deliveries expose both the mother and the child to significant risks . [1-3]

In the Democratic Republic of the Congo, the prevalence of out-of-facility delivery is estimated at 16%, with 90% of these deliveries occurring in rural areas and 10% in urban areas. Important disparities are also observed across provinces, depending on local determinants. [4-8]

In Lomami Province, the prevalence of out-of-facility delivery has been reported at 24%. However, in the rural health zone of Kalenda, the prevalence, determinants, and maternal and neonatal outcomes of out-of-facility delivery remain poorly documented because of the lack of scientific studies on this topic.

The objective of this study was to identify the determinants of out-of-facility delivery, assess their contribution to the frequency of such deliveries, and describe the maternal and neonatal outcomes associated with out-of-facility delivery in the rural health zone of Kalenda.

Materials and methods

A case-control study was conducted over 15 months, from January 1, 2024, to March 31, 2025. Sample size was calculated using Epi Info StatCalc version 7.2.6.0, taking into account predefined values for the significance level, statistical power, and the relative risk to be detected. The confidence level was set at 95%.

The study included 328 cases and 656 controls, identified through exhaustive sampling. Women who delivered outside healthcare facilities were classified as cases, while those who delivered within healthcare facilities were considered controls. Each case was matched with two controls of the same age and residing in the same health area.

Data collection was carried out using a predesigned questionnaire administered in the community by community health workers, at the health center by the area nurses in charge, and at the general hospital and CSR by physicians.

A descriptive study was also conducted during the same period. A total of 2,038 deliveries were recorded, including 328 that occurred outside healthcare facilities.

Collected data were coded, entered, processed, and analyzed using Excel 2010, Epi Info 7.2.6.0, and SPSS version 27.0. Pearson's chi-square test was used to compare qualitative variables and determine whether associations between factors and out-of-facility delivery were statistically significant. The odds ratio was used as a measure of association, and the attributable fraction among the exposed was used as a measure of impact. Multivariable logistic regression was performed to control for confounding factors.

Results

Prevalence and sociodemographic characteristics

Our study population consisted of 984 women who delivered, including 328 who delivered outside healthcare facilities and 656 who delivered within healthcare facilities. The mean age was 31 years, with a standard deviation of 6.5. The youngest woman was 17 years old and the oldest was 45 years old. Out-of-facility deliveries accounted for 16.1% of the 2,038 deliveries recorded during the study period.

Table I. Sociodemographic characteristics of women who delivered outside ESS (n = 328)

Characteristic	Cases n 328	%
Age group		
≤20	20	6,1%
21-30 ans	132	40,2%
31-40 ans	148	45,1%
41 et plus	28	8,5%
Marital status		
Single	10	3,05
Divorced	4	1,2
Married	308	93,9
Widowed	6	1,8
Religion		
Catholic	102	31,1%
Kimbanguist	1	0,3%
Muslim	2	0,6%
Non-religious	69	21,0%
Neo-Apostolic	8	2,4%
Apostolic (Postolo)	19	5,7%
Protestant	37	11,2%
Revival Church	90	27,4%

The majority of women who delivered outside ESS were aged 31–40 years (45.1%), followed by those aged 21–30 years (40.2%). Overall, 93.9% of participants were married. Catholicism was the most frequently reported religion (31.1%), while 21.0% reported no religious affiliation.

Table II: Distribution of mothers (outside ESS) and their partners by occupation

Characteristics	Cases n 328	%
Mother's occupation		
Pupil / student	4	1,2%
Seamstress	6	1,8%
cultivator	250	76,2%
Teacher	5	1,5%
Nurse	0	0
Housewife	54	16,4%
Vendor / shopkeeper	9	2,7%
Partner's occupation		
Pupil / student	0	0
cultivator	300	91,4%
School principal / headmaster	0	0
Teacher	23	7%
Nurse	0	0
Prefect / local administrator	0	0
Vendor / shopkeeper	5	1,6%

This table shows that over 70% of women who delivered outside health facilities were cultivators, and that more than 90% of their husbands also worked as cultivators.

Table III: Reasons reported by women for delivering outside health facilities

Reason for delivering outside health facilities	Cases n= 328	%
Poor conduct of birth attendants	13	3,96%
Long distance to health facility	254	77,44%
Lack of money	42	12,80%
Lack of transportation	1	0,30%
Religious reasons	12	3,66%
Unexpected (precipitous) delivery	6	1,83%

This table clearly indicates that distance is the predominant factor, accounting for more than 70% of deliveries occurring outside health facilities.

This figure shows that most deliveries outside health facilities took place at home.

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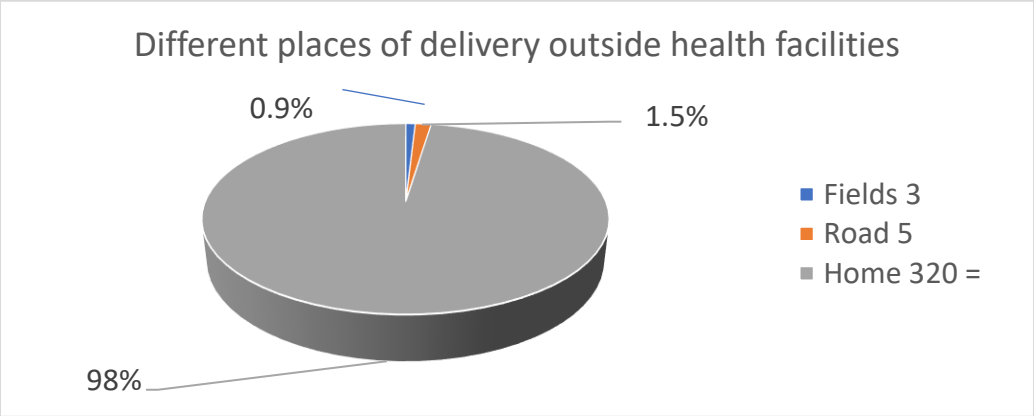

Figure 1: Places of delivery outside health facilities (ESS), n = 328

Table IV: Factors Associated with Delivery Outside Health Facilities

Sociodemographic factors	Cases	Controls	OR (95% CI)	P-value
Woman's educational level				
No education/primary education	285 (86.8%)	553 (84.3%)	1.2 (0.8–1.8)	0.2
Secondary/higher education	43 (13.1%)	103 (15.7%)	1	—
Partner's educational level				
No education/primary education	223 (67.9%)	310 (47.2%)	2.3 (1.7–3.1)	<0.001
Secondary/higher education	105 (32.0%)	346 (52.7%)	1	—

The table shows that women whose partners had no formal education or only primary-level education had more than twice the odds of delivering outside a health facility compared with those whose partners had secondary or higher education (OR = 2.3; 95% CI: 1.7–3.1; p < 0.001).

Table V: Socioeconomic Factors Associated with Delivery Outside Health Facilities

Socioeconomic characteristic	Cases	Controls	OR(95% CI)	P-value
Monthly household income				
Less than 50,000 FC/month	310 (94.51%)	584 (89.02%)	2.1(1.2–3.6)	0.004
50,000 FC or more/month*	18 (5.49%)	72 (10.98%)	1	—
Means of transportation to the health facility				
No	313 (95.43%)	565 (86.13%)	3.3(1.9–5.9)	<0.001
Yes	15 (4.57%)	91 (13.87%)	1	—
Household size				
7 or more members	200 (60.98%)	440 (67.07%)	0.7(0.5–1.0)	0.6
Fewer than 7 members	128 (39.02%)	216 (32.93%)	1	—
Payment for delivery care				
No	17 (5.18%)	7 (1.07%)	5.0(2.0–12.0)	<0.001
Yes	311 (94.82%)	649 (98.93%)	1	—

This table shows that women from households with a monthly income below 50,000 FC (approximately US$2) had twice the odds of delivering outside a health facility compared with those living in households with a monthly income above 50,000 FC (approximately US$2). In addition, women who did not have access to a means of transportation had three times the odds of delivering outside a health facility compared with those who had access to transportation. However, 94% of deliveries outside health facilities were paid for, compared with 98% among the controls. Women in the case group had five times the odds of having an unpaid delivery compared with women in the control group.

Table VI: Geographic Exposure Factors Associated with Delivery Outside Health Facilities

Geographic exposure factor	Cases	Controls	OR (95% CI)	P-value
Distance between the maternity unit and the woman's home				
>5 km	271 (82.62%)	45 (6.86%)	64.5 (42.0–97.0)	<0.001
≤5 km	57 (17.38%)	611 (93.14%)	1	—

This table shows that participants living more than 5 km from a health facility had 64 times higher odds of delivering outside a health facility than those living within 5 km (OR = 64.5; 95% CI: 42.0–97.0; P < 0.001).

Table VII: Obstetric and Gynecological Factors Associated with Delivery Outside Health Facilities

Obstetric and gynecological factor	Cases	Controls	OR (95% CI)	P-value
Gravidity				
Primigravida/paucigravida	53 (16.1%)	100 (15.2%)	1.1 (0.7–1.5)	0.7
Multigravida/great multigravida	275 (83.8%)	556 (84.7%)	1	—
Parity				
Primipara/low parity	56 (17.07%)	113 (17.2%)	0.9 (0.7–1.4)	0.9
Multipara/great multipara	272 (82.9%)	543 (82.7%)	1	—
Attendance at antenatal care (ANC)				
No ANC attendance	133 (40.5%)	14 (2.1%)	31.3 (17.6–55.5)	<0.001
ANC attendance	195 (59.4%)	642 (97.8%)	1	—

This table indicates that women who did not attend antenatal care (ANC) had 31 times higher odds of delivering outside a health facility than women in the control group. However, the cases and controls had similar odds ratios for parity and gravidity.

Table VIII: Obstetric and Gynecological Factors Associated with Delivery Outside Health Facilities

Obstetric and gynecological exposure factor	Cases	Controls	OR(95% CI)	P-value
Onset of labor				
9:00 p.m. to 4:00 a.m.	253 (77.1%)	371 (56.5%)	2.6 (1.9–3.5)	<0.001
5:00 a.m. to 8:00 p.m.	75 (22.8%)	285 (43.4%)	1	—
Time of delivery				
9:00 p.m. to 4:00 a.m.	216 (65.8%)	448 (68.2%)	0.8 (0.7–1.2)	0.4
5:00 a.m. to 8:00 p.m.	112 (34.1%)	208 (31.7%)	1	—
Gestational age at delivery				
Preterm	39 (11.8%)	24 (3.6%)	3.5 (2.1–6.0)	<0.001
Term	289 (88.1%)	632 (96.3%)	1	—

This table shows that women whose labor began between 9:00 p.m. and 4:00 a.m. had approximately twice the odds of delivering outside a health facility compared with those whose labor began between 5:00 a.m. and 8:00 p.m. In addition, preterm deliveries had approximately three times the odds of occurring outside a health facility compared with term deliveries.

Table IX: Maternal Mortality Ratio

Maternal death	Cases	Controls	OR (95% CI)	P-value
Yes	11 (3,806 per 100,000 live births)	3 (467 per 100,000 live births)	7.5 (2.0–27.2)	<0.001
No	317	653	1	—

According to this table, the maternal mortality ratio for deliveries occurring outside health facilities was approximately seven times higher—3,806 maternal deaths per 100,000 live births—than that for deliveries occurring in health facilities, which was 467 maternal deaths per 100,000 live births.

Table X: Characteristics of Newborns of Women Who Delivered

Newborn characteristics	Cases (n = 328)	Controls (n = 656)	OR(95% CI)
Newborn sex			
Female	145 (44.2%)	315 (48.0%)	0.85(0.6–1.1)
Male	183 (55.7%)	341 (51.9%)	1
Interpregnancy interval between the two most recent children			
<2 years	175 (58.5%)	74 (12.2%)	10.0(7.2–14.1)
≥2 years	124 (41.4%)	530 (87.7%)	1

This table shows that women whose two most recent children were born less than two years apart had five times higher odds of delivering outside a health facility compared with women in the control group.

Table XI: Postpartum Neonatal Outcome Associated with Delivery Outside Health Facilities

Neonatal outcome at birth	Cases (n = 328)	Controls (n = 656)	OR(95% CI)	P-value
Stillbirth	39 (119 per 1,000 live births)	16 (24 per 1,000 live births)	5.4 (3.0–10.0)	<0.001
Live birth	289 (88.1%)	640 (97.5%)	1	—

This table shows that the stillbirth rate was approximately five times higher among infants born to women who delivered outside health facilities (cases), reaching 119 per 1,000 births, compared with infants born to women who delivered in health facilities (controls).

Table XII: Multivariable Analysis of Factors Associated with Delivery Outside Health Facilities

Exposure factor	Adjusted OR (aOR)	95% CI	P-value	Population-attributable fraction (%)
Partner's educational level				
Secondary or higher education	1	—	—	—
No education or primary education	1.4	0.8–2.3	0.17	—
Distance between the maternity unit and the home				
≤5 km	1	—	—	—
>5 km	36.1	21.6–60.2	<0.001	97.2
Monthly household income				
≥50,000 FC/month	1	—	—	—
<50,000 FC/month	0.8	0.3–2.2	0.736	—
Payment for delivery care				
Yes	1	—	—	—
No	5.9	1.3–26.5	0.018	80.0
Means of transportation to the health facility				
Yes	1	—	—	—
No	5.4	2.3–13.0	<0.001	80.0
Antenatal care attendance				
Yes	1	—	—	—
No	11.2	5.5–22.9	<0.001	90.0
Time of labor onset				
5:00 a.m.–8:00 p.m.	1	—	—	—
9:00 p.m.–4:00 a.m.	3.1	1.9–5.3	<0.001	66.6
Gestational age at delivery				
Term	1	—	—	—
Preterm	3.0	1.0–9.3	0.05	—
Interpregnancy interval between the two most recent children				
≥2 years	1	—	—	—
<2 years	2.2	1.2–3.8	0.0049	50.0

After adjustment for all potential confounding variables, six factors remained statistically significantly associated with delivery outside a health facility (ESS): living more than 5 km from the health facility (aOR = 36.1; 95% CI: 21.63–60.29); lack of access to transportation (aOR = 5.47; 95% CI: 2.30–13.00); failure to attend antenatal care (aOR = 11.25; 95% CI: 5.52–22.95); onset of labor between 9:00 p.m. and 4:00 a.m. (aOR = 3.19; 95% CI: 1.92–5.31); unpaid delivery care (aOR = 5.98; 95% CI: 1.35–26.56); and an interpregnancy interval of less than two years between the two most recent children (aOR = 2.22; 95% CI: 1.28–3.88).

A distance of more than 5 km from the health facility accounted for 97.2% of deliveries occurring outside health facilities, whereas non-attendance at antenatal care accounted for 90%. The latter factor was also associated with living more than 5 km from the health facility.

By eliminating the geographic barrier posed by distance, an estimated 97% of women who delivered outside health facilities could potentially be redirected to these facilities. Conversely, non-payment of delivery fees accounted for 80% of deliveries occurring outside health facilities. Providing free delivery services in health facilities could potentially encourage 80% of women who delivered outside these facilities to seek care there.

Discussion

1. Frequency of Home Deliveries

The prevalence of deliveries occurring outside health facilities (ESS) in our study setting was 16.1%. This finding is similar to that reported by Sangho O. et al., who found a prevalence of 16.18% (Oumar Sangho et al., 2020), and to the findings of the 2024 third Demographic and Health Survey of the Democratic Republic of the Congo, which reported a prevalence of 16% (Ministry of Health, 2024).

Our findings were lower than those reported by Bolekaleka Singa V. et al., who found a prevalence of 43% in Yahisuli, Democratic Republic of the Congo (Bolekaleka Singa et al., 2019), and by Kaboko M. et al., who reported a prevalence of 39.3% in Nyuzu (Zihindula et al., 2022).

Conversely, our findings were higher than those reported by Kane C. S. et al. in 2011, who found a prevalence of 5.1%; by Sidibé A. et al. (2020), who reported 7.86% in Mali; by Bonane et al., who reported 1.28% at Yalgado Ouédraogo University Hospital in Burkina Faso; and by Malam H. (1995), who reported 11% in Niger.

These differences in prevalence may be explained by the specific characteristics of our study population, including its low socioeconomic status, the considerable distance between women's homes and health facilities, low educational attainment, and limited knowledge of the risks associated with delivery outside a health facility.

2. Sociodemographic Characteristics of Women Who Delivered Outside Health Facilities

Age

According to our data on maternal age, the mean age of women who delivered outside health facilities (ESS) was 31 years, with a standard deviation of 6.5 years. The youngest woman was 17 years old, whereas the oldest was 45 years old. The most affected age group was 31–40 years.

Similarly, Mukadi et al. reported that, in the Abedju Health Zone in the Democratic Republic of the Congo, 82.8% of women were aged 18–35 years (4). Likewise, Diabaté M. reported in Mali in 2023 that women aged 18–34 years accounted for 80.6% of the study population (21).

In contrast, Oumar Sangho et al. reported a mean age of 28 years in Mali, ranging from 15 to 42 years, with a predominance of women aged over 35 years (5). De Jong et al. in the Netherlands, and Hutton et al. in Canada in 2013, found that women aged over 35 years were more likely to deliver outside health facilities, with prevalences of 16.9% (9) and 22.5% (10), respectively.

In our study, the predominance of deliveries outside health facilities among women aged 31–40 years may be attributed to their perception of having substantial childbirth experience, which may encourage them to choose delivery outside formal health facilities.

Occupation

According to our findings, more than 70% of women who delivered outside health facilities (ESS) were farmers, and more than 90% of their husbands were also farmers. Our findings are consistent with those of Kaboko et al., who likewise observed that female farmers were more likely to deliver outside health facilities (19).

However, several studies conducted in Mali, including those by Diabaté et al., Kane C. S. et al. (21, 12), and Sidibé A. et al. (13), reported that housewives were more highly represented in their study populations, accounting for 65% to 98.8% of participants.

In our study, the predominance of female farmers among women who delivered outside the formal healthcare system may be attributed to the fact that subsistence farming is the main livelihood in the study area.

Marital Status

Regarding marital status, more than 90% of the women in our study were married. This finding is consistent with the results reported by Mukadi J. W. et al. and Keita, who found that 70.7% and 92.6%, respectively, of women who delivered outside health facilities (ESS) were married (8). Similarly, Diabaté et al. reported that married women constituted the majority of their

study population, accounting for 94% (21). In contrast, Sangho O. found that unmarried women were more predominant, accounting for 65% of participants (5).

Our findings may be explained by the substantially higher number of married women compared with unmarried women in the study population. In addition, the rural setting of the study may account for the high proportion of married women, possibly reflecting the prevalence of early marriage.

Educational Level

Regarding educational attainment, our findings indicated that women with primary-level education were more likely to deliver outside health facilities (ESS), accounting for 64.2% of cases. However, Mukadi J. W. et al. in the Democratic Republic of the Congo (4), Diabaté et al. in Mali (21), and Faye A. in Senegal reported that women with no formal education were more frequently affected by delivery outside health facilities, with corresponding proportions of 37.9%, 91.9%, and 65%, respectively. In contrast, Bolekaleka and Bulaya observed a predominance of women with secondary-level education (22).

In our study, the predominance of women with primary-level education may be attributed to the failure of local health authorities to organize educational sessions and health talks adapted to different levels of schooling, thereby limiting women's opportunities to acquire accurate knowledge and overcome misinformation.

3. Obstetric Characteristics of Women Who Delivered Outside Health Facilities

Parity

In our study, 83.84% of women in the case group who delivered outside health facilities (ESS) were multiparous, compared with 84.76% of women in the control group. A similar finding was reported by Diabaté, who observed a prevalence of 75.6% (21), whereas Kouakou K. P. et al. reported a prevalence of 83.23% (7).

Conversely, Mukadi J. W. et al. and Kane C. S. et al. reported a predominance of primiparous women, accounting for 44.83% and 52.1%, respectively (4, 12).

Multiparous women may be more likely to deliver outside health facilities because their previous childbirth experiences may give them a greater sense of confidence in managing labor and delivery without skilled birth attendance.

Complications Associated with Home Delivery

We found that 26.52% of women who delivered outside health facilities (cases) experienced postpartum complications, compared with 2.90% of women in the control group. The most frequently reported complication was postpartum genital tract hemorrhage, which occurred in 15.8% of cases.

Mukadi J. W. et al. reported that 34.2% of cases experienced postpartum hemorrhage (4). In contrast, Bolekaleka and Bulaya, as well as BIVROH et al. and Keita, reported perineal tears as the most common complication, with a prevalence of 36.1% (22).

Maternal Mortality Ratio

Our study found a maternal mortality ratio of 3,806 deaths per 100,000 live births among women who delivered outside health facilities (ESS), compared with 467 deaths per 100,000 live births among women who delivered in health facilities (controls). The odds of maternal death were approximately 7.5 times higher among women who delivered outside health facilities (OR = 7.55; 95% CI: 2.09–27.26; P = 0.0004).

Sangho O. et al. reported three maternal deaths among women who delivered outside health facilities, whereas Coulibaly Salimata K. reported no maternal deaths in a study conducted in Mali (5).

Neonatal Outcome Associated with Delivery Outside Health Facilities

The stillbirth rate in our study was 119 per 1,000 births among women who delivered outside health facilities, compared with 24 per 1,000 births among women who delivered in health facilities. Stillbirth was approximately five times more likely among deliveries occurring outside health facilities (OR = 5.4; 95% CI: 3.0–10.0; P < 0.001).

In addition, Coulibaly Salimata K. and Kalilou O. reported a stillbirth rate of 8.8% in their study (22).

Discussion: Bivariate Analysis

Geographic Distance: A Dominant Factor in a Context of Rural Isolation

The strongest determinant identified in our model was a distance of more than 5 km between the woman's home and the maternity facility (aOR = 36.1; 95% CI: 21.63–60.29; P < 0.001; AF_e = 97.2%). This association was substantially stronger than those reported in both the national and international literature.

Our findings are consistent with evidence from the Democratic Republic of the Congo, where several authors have established that geographic distance is a major barrier to skilled birth attendance. Kaboko Mbilika and Wembonyama (2022), in their study conducted in the rural Nyunzu Health Zone in Tanganyika Province, reported similar findings. Likewise, Mukadi wa Mpoy and Dhani Sazu (2022), in the Abedju health area of the Ariwara Health Zone, identified distance and lack of transportation as the two main factors contributing to home delivery.

In the Lemera Health Zone, in South Kivu, the distance to health facilities was also among the factors significantly associated with home delivery (P < 0.05). More recently, MEMISA (2025) reported that, in the Democratic Republic of the Congo, women walk an average of 2.5 hours on

unpaved roads to reach a maternity facility, while emergency transportation is unavailable in most rural areas.

At the subregional level, Bassoum et al. (2024), in Senegal's Podor Health District, demonstrated that the mode of transportation used to reach a health facility was an independent determinant of home delivery (aOR = 3.33; 95% CI: 2.06–5.38). In Benin, a study conducted in Parakou between 2010 and 2020 confirmed that distance from health facilities (P = 0.000) and the lack of an adequate means of transportation (P = 0.04) were significantly associated with home delivery. In Gabon, data from the *African Journal of Social Sciences and Public Health* indicated that lack of transportation accounted for 34.5% of the reasons for home delivery, followed by lack of financial resources (32.8%) and the lack of nearby health facilities (23.4%).

However, our findings differ in terms of the magnitude of the association observed. The adjusted odds ratio for distance in our study (aOR = 36.1) was substantially higher than that generally reported in the African literature, where odds ratios for distance typically range from 2 to 8.

Lack of Antenatal Care: A Structural Determinant of Failure to Use Health Services

Lack of antenatal care (ANC) attendance emerged as the second independent determinant in our model (aOR = 11.251; 95% CI: 5.516–22.946; P < 0.001; AF_e = 90%).

Our findings are consistent with evidence from the Democratic Republic of the Congo. Mucail-a-Mucail et al. (2021), in the Lubumbashi Health Zone, showed that factors associated with late initiation of ANC were multiple and closely interrelated with socioeconomic determinants. At the national level, ANC utilization remains low: only 35.93% of Congolese women completed at least the four antenatal visits recommended in 2022 (DHS2), while within the Salvation Army health network, the proportion completing four ANC visits ranged from only 14% to 22%.

At the international level, Bassoum et al. (2024), in Senegal, reported that women who did not receive ANC had 2.17 times higher odds of delivering at home (aOR = 2.17; 95% CI: 1.27–3.72). In Bamako, Mali, recent studies showed that lack of ANC tripled the risk of not delivering in a maternity facility (P = 0.0002). More specifically, a Malian study found that lack of ANC increased the odds of delivering outside a maternity facility by 4.82 times (P < 0.001; OR = 4.82; 95% CI: 2.06–8.87). In sub-Saharan Africa, a meta-analysis of more than 42 articles covering over 30 countries confirmed that individual knowledge, attitudes, and skills—largely shaped by ANC attendance—are statistically significant predictors of delivery outside a health facility.

Our adjusted odds ratio of 11.251 was higher than those reported for this factor in most African studies.

This difference may reflect the synergistic effect of non-attendance at antenatal care (ANC) with other determinants in our study setting. In an isolated rural area such as Kalenda, a woman

who does not attend ANC may simultaneously experience limited awareness of pregnancy-related risks, no institutional link with the maternity facility, and inadequate logistical preparation for delivery, thereby amplifying the effect of this individual factor.

Financial Barriers

Unpaid delivery care (aOR = 5.982; 95% CI: 1.347–26.557; P = 0.018) and lack of access to transportation (aOR = 5.470; 95% CI: 2.302–13.001; P < 0.001) represent two distinct but converging determinants, both reflecting financial and logistical barriers to accessing obstetric care.

As shown by our findings from the Democratic Republic of the Congo, the cost of delivery ranges from US$10 to US$20 for an uncomplicated vaginal delivery and may reach US$150 for a cesarean section. These costs are prohibitive for the poorest households. The World Bank's *State of Health and Poverty Report* for the Democratic Republic of the Congo highlights multidimensional poverty as a major barrier to healthcare access in the country.

In the Abedju Health Zone, Mukadi wa Mpoy and Dhani Sazu (2022) reported that 32.8% of women identified poverty as the primary factor contributing to home delivery. Bolekaleka Singa and Bulaya Lungela (2017), in the Yahisuli Health Zone of Yangambi, Democratic Republic of the Congo, likewise confirmed that the financial inaccessibility of health facilities is among the major factors explaining home delivery.

Internationally, Bassoum et al. (2024), in Senegal, showed that women belonging to the poorest wealth quintiles had 3.44 times higher odds of delivering at home (aOR = 3.44; 95% CI: 2.17–5.46). In Francophone West Africa, specifically Libreville, Gabon, lack of financial resources accounted for 32.8% of the reasons for home delivery. In Bamako, Mali, financial hardship was a significant determinant of delivery outside a maternity facility (OR = 3.03; P = 0.0003).

These findings are consistent with the Congolese national initiative providing free childbirth services, launched in September 2023 by President Tshisekedi, which officially recognizes the importance of financial barriers in the underutilization of obstetric care.

Time of Labor Onset: An Understudied Situational Determinant

Labor onset between 9:00 p.m. and 4:00 a.m. was an important and independently significant risk factor for delivery outside a health facility (aOR = 3.188; 95% CI: 1.916–5.306; P < 0.001; AF_e = 66.6%).

Studies have shown that women who give birth at night in Colorado have a 21.3% higher risk of complications, partly because of reduced staff availability. In Bamako, studies have reported that nocturnal labor is associated with delivery outside a maternity facility, although statistical significance has not always been established.

By contrast, the international literature has focused mainly on the quality of hospital-based care at night and has paid limited attention to rural settings, where transportation difficulties and insecurity impede access to health facilities—an aspect that remains understudied. This study therefore highlights relatively novel factors in the African context.

Preterm Birth and Short Interpregnancy Interval: Biological and Reproductive Determinants

Preterm birth (aOR = 3.096; 95% CI: 1.027–9.335; P = 0.050) and an interpregnancy interval of less than two years (aOR = 2.223; 95% CI: 1.275–3.878; P = 0.0049; AF_e = 50%) were significant biological and reproductive determinants in our model.

According to the WHO (2023), preterm birth occurs predominantly in South Asia and sub-Saharan Africa. In Lubumbashi, a study by Tamubango Kitoko et al. (2023) reported a preterm birth rate of 4.19%, a neonatal mortality rate of 14.84%, and a prevalence of urogenital infections of 26.99% among women who delivered preterm. These findings suggest that preterm birth, which is often unpredictable, increases the likelihood of delivery outside health facilities, particularly in areas without emergency transportation.

Regarding short interpregnancy intervals, a study conducted by Lamika Ngonde et al. in Bandundu demonstrated a significant association between failure to maintain an adequate interval between pregnancies and factors such as women's low educational attainment, religion, and the partner's low income (P < 0.001). Bafola Motohiangene et al. (2019) reported that 85% of women in Basoko were unaware of the risks associated with an interpregnancy interval of less than two years, including low birth weight and impaired child growth.

At the African level, Munezero Désiré (Rwanda) cited the work of Hobcraft et al. (1987), which indicated that an interval of less than 12 months between births increased the risk of death of the preceding child by 70%–80% during the first five years of life. These studies highlight that closely spaced pregnancies compromise the mother's nutritional and physical condition, increase the risk of unforeseen obstetric complications, and hinder adequate logistical preparation for delivery.

Non-significant Factors: Partner's Educational Level and Monthly Income

Partner's educational level (aOR = 1.412; 95% CI: 0.856–2.331; P = 0.176) and a monthly household income below 50,000 FC (aOR = 0.842; 95% CI: 0.311–2.283; P = 0.736) were not independently significant determinants in our multivariable model.

The lack of access to transportation and the cost of delivery care may explain why household income was not statistically significant. Similar studies conducted in Senegal and Bamako support these findings. Although partner's educational level was statistically significant in bivariate analyses in several African studies, its effect was no longer significant in the multivariable analysis after adjustment for structural variables such as distance and cost. This

finding reinforces the view that structural barriers strongly influence decisions regarding the place of delivery.

Conclusion

This study of deliveries occurring outside health facilities in the rural Kalenda Health Zone, Lomami Province, identified multidimensional determinants and assessed the associated maternal and neonatal risks.

Our findings indicate that these deliveries are primarily associated with geographic factors, including long distance to health facilities, lack of access to transportation, and nocturnal onset of labor, as well as organizational factors, particularly non-attendance at antenatal care. From a clinical perspective, maternal and neonatal outcomes indicate excess morbidity and mortality associated with delivery outside health facilities.

Recommendations

Based on the findings of this study, conducted in the rural Kalenda Health Zone (Lomami Province), the following recommendations are proposed. They address the geographic, organisational and financial determinants of delivery outside health facilities (DOHF), which was associated with excess maternal and neonatal mortality.

To the Ministry of Health and provincial health authorities

- Reduce geographic inaccessibility, the strongest determinant identified (distance >5 km: aOR = 36.1), by building and equipping maternity units in remote villages and hamlets.
- Establish a functional emergency transport system, available at night and in the rainy season, with a simple call number (for example, ambulance motorbikes or community shuttles), since lack of transportation (aOR = 5.47) and night-time labour onset between 9:00 p.m. and 4:00 a.m. (aOR = 3.19) were independent risk factors.
- Implement free maternity care effectively in Kalenda, where it was not yet applied, and ensure it covers delivery and the related costs. Unpaid delivery care was independently associated with DOHF (aOR = 5.98).
- Pair free care with timely reimbursement of facilities and payment of staff, so that removing fees does not compromise service availability.
- Strengthen the referral and counter-referral system, notably for preterm labour and obstetric emergencies (preterm birth: aOR = 3.10).

To the Kalenda Health Zone management team and health facilities

- Promote early and regular antenatal care attendance, the second strongest determinant (no ANC: aOR = 11.25), through outreach activities, community health workers and reminders for pregnant women.

- Use ANC visits to prepare each birth: identify a place of delivery, plan transport and funds, and recognise danger signs, including for the preterm births that cannot be predicted.
- Ensure a functional 24-hour delivery service, with staff and lighting available at night.
- Reinforce the training of providers in postpartum haemorrhage prevention and management, and in respectful maternity care, since haemorrhage was the most frequent complication (15.8%) and postpartum complications were far more common after DOHF (26.52% versus 2.90%).
- Systematically track and audit maternal deaths and stillbirths related to DOHF.

To communities, community health workers and leaders

- Organise health education sessions adapted to women with primary-level or no education, since primary-level women accounted for 64.2% of DOHF cases, and address the false belief that experience from earlier deliveries is protective, notably among multiparous women (83.84%) and women aged 31–40 years.
- Raise awareness of the risks of DOHF, of the benefits of free maternity care and of the dangers of closely spaced pregnancies (interval <2 years: aOR = 2.22).
- Strengthen family planning and birth spacing counselling, including at postpartum and postnatal contacts.
- Involve husbands and community leaders in birth preparedness, particularly for transport and emergency funds, since most women were married and most husbands were farmers.

To researchers

- Conduct larger and, ideally, multi-site studies to confirm the very strong association with distance (aOR = 36.1), much higher than the 2 to 8 range typically reported in African literature, and to assess whether it reflects isolation specific to Kalenda or estimation imprecision.
- Study night-time labour and rural transport difficulties, which remain understudied.
- Evaluate the effect of free maternity care once implemented, with a post-implementation assessment comparing DOHF rates before and after.

Conflict of Interest

The authors declare no competing interests.

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What Is Already Known

- Sociodemographic and cultural factors are associated with deliveries occurring outside health facilities (ESS).
- The frequency of deliveries outside health facilities is influenced by various contextual factors.
- Delivering outside a health facility poses significant risks to both the mother and the newborn.

What This Study Adds

- To our knowledge, this is the first study to describe the frequency of deliveries occurring outside health facilities before the implementation of free maternity services in the rural Kalenda Health Zone, Democratic Republic of the Congo.
- This study identifies the determinants of deliveries occurring outside health facilities in the same setting.
- This study quantifies the attributable fraction associated with each determinant of delivery outside health facilities in this setting, an aspect that has rarely been documented in the international literature.
- The findings suggest that eliminating the geographic barrier of a distance greater than 5 km could potentially enable 97% of women who delivered outside health facilities to deliver in these facilities.
- The study shows that stillbirth and maternal mortality were substantially higher among women who delivered outside health facilities, an often-overlooked reality.

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Authors' Contributions

All authors read and approved the final version of the manuscript.

All authors made substantial contributions to the various stages of the study. Luboya Kabila Joseph, Mwembo Tambwe Albert, and Chenge Mukaleng Faustin contributed to the conceptualization and design of the study. Luboya Kabila Joseph obtained authorization from the Provincial Health Division of Lomami to conduct the study and supervised data collection together with Mukelaka Kabeya Marie-Thérèse. He also transcribed and analyzed the data. Mukalay Abdon, Mwarabu M. B., Makang M. P., Mwembo Tambwe Albert, and Chenge Mukaleng Faustin verified the accuracy and completeness of the data and contributed to the initial drafting of the manuscript.

Luboya K. J., Mwembo T. A., and Chenge M. F. prepared the final manuscript. All authors read and approved the final version of the manuscript.

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