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Prevalence and factors associated with birth asphyxia among neonates born in Mubende regional referral hospital, Mubende district, Central Uganda. A cross-sectional study.

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Abstract

Introduction

Birth asphyxia is a significant cause of neonatal mortality and lifelong morbidity worldwide. In Uganda, 28.6% of neonatal and 48% of perinatal deaths are due to birth asphyxia. Uganda recorded an average of 30 cases of asphyxia; the highest prevalence of 60 cases per 1000 live births being identified in Bundibugyo, Iganga and Mubende. There is scarcity of health facility-based data explaining this trend. This study aimed at determining the prevalence and factors associated with birth asphyxia among neonates born in Mubende regional referral hospital in Mubende district, central Uganda.

Methods

A quantitative cross sectional study design was used. Sample size of 97 was determined using Kish and Leslie formula (1965). 97 Mother-baby pairs were sampled consecutively. Paper based interviewer administered questionnaires were used to collect data. Data was entered into EpiData and exported to STATA 14 for analysis.

Results

96 mother-baby pairs were included in the final analysis. Prevalence of asphyxia was 4.17%. Of the 4 asphyxiated neonates, all (100%) were of male sex, born to mothers who were; of rural residence, referred to Mubende RRH in labour and had attained only primary level of education or less, while 3 (75%) had meconium-stained liquor. However, maternal education was the only factor association with birth asphyxia, higher education being protective against asphyxia (AOR 0.0606, P=0.0265, 95%CI 0.0008874 - 0.8189651)

Conclusion

The prevalence of birth asphyxia was high in our study indicating that 42 in every 1000 babies born in Mubende RRH are at a risk of birth asphyxia. Male neonates, rural residence, referral status, meconium staining, lower level of education contributed to birth asphyxia.

Recommendation

There is need to strengthen referral systems and prioritize mothers with male fetuses and lower education backgrounds to minimize asphyxia related mortality and morbidity.

***Keywords**: Birth asphyxia, Neonatal, Maternal, Risk factors*
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Introduction

Birth asphyxia, defined by the World Health Organization as the failure to initiate and sustain spontaneous breathing at birth, is a significant threat to the life and health of neonates(Su et al., 2024). It is defined by the American College of Obstetricians and Gynecologists, and the American Academy of Pediatrics as; umbilical cord arterial pH < 7; Apgar score of 0–3 for longer than 5 minutes; neonatal neurological manifestations (seizures, coma or hypotonia); and multisystem organ dysfunction (cardiovascular, gastrointestinal, hematological, pulmonary or renal system)(Workineh et al., 2020). In low resource settings, birth asphyxia is usually defined by a 5-minute Apgar score of less than 7 (<7)(Abebe et al., 2024; Ayebare et al., 2022).

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Birth asphyxia is associated with brain damage among new born children with up to 80% of survivors suffering from lifelong health problems such as developmental delays, cerebral palsy, intellectual disabilities, and behavioral problems(Komakech et al., 2023). Of the affected neonates, 15% to 20% die in the neonatal period, and up to 25% of survivors are left with permanent neurologic deficits(Gillam-Krakauer et al., 2025). Su et al. (2024) also noted that surviving neonates with birth asphyxia also often have many complications, including impairments to the lungs, kidneys, gastrointestinal system, and cardiovascular functions.

Birth asphyxia remains a significant cause of neonatal mortality worldwide accounting for approximately one million neonatal deaths every year (Moshiro et al., 2019). The incidence of birth asphyxia in most developed countries is marginal accounting for less than 0.1% of newborn sdeaths compared to developing countries where it ranges from 4.6 to 26 per 1000 live births (Workineh et al., 2020).

Studies across East, Central and Southern Africa by Workineh et al., (2020) found the prevalence of birth asphyxia to be at 15% while another study conducted in Ethiopia by Woday et al., (2019) found a higher prevalence of birth asphyxia of 22.6%.

One of the Sustainable Development Goals (SDGs) recommends countries to achieve the target of neonatal mortality of 12 deaths per 1,000 live births by 2030 (Zewude et al., 2021) and yet Uganda is still far from achieving this target with an estimated 18 neonatal deaths per 1000 live births(WHO, 2025) despite having adopted interventions such as promotion of maternal birth preparedness, skilled attendance at birth, essential newborn care, basic and comprehensive obstetric care, and neonatal resuscitation, more still remains to be done(Ayebare et al., 2022).

About a decade ago, Helping Babies Breath (HBB), a high impact intervention used globally to reduce neonatal mortality due to birth asphyxia was introduced in Uganda through Clinton Health Access Initiative (CHAI) working with the Ministry of health (MoH) and other stake holders. Milic, (2020) noted that before the HBB mentorship program was conducted by CHAI, MoH, and Association of Obstetricians and Gynaecologists of Uganda (AOGU) in Mubende regional referral hospital in 2020, many of the fresh stillbirths were due to birth asphyxia. With the introduction of the interventions, an estimated 35 babies were able to survive in one month alone(Milic, 2020). Despite these interventions, Mubende continues to grapple with a burden of neonatal mortality attributed to prematurity (12.2%) and other neonatal conditions (9.7%) birth asphyxia inclusive(Mubende District, 2025).

In Uganda, Birth Asphyxia accounts for 28.6% of all neonatal deaths and 48% of perinatal deaths(Ayebare et al., 2022). A cross-sectional study done by Ayebare et al., (2022) in two regional referral hospitals in Northern Uganda found a prevalence of birth asphyxia of 5.3% and a nationwide retrospective study conducted in Uganda by Komakech et al., (2023) using health management information systems(HMIS) data revealed a high prevalence of birth asphyxia with an average of 29 cases per 1000 live births (2.9%). However, the highest incidence of birth asphyxia was recorded in the three districts of Bundibugyo, Iganga and Mubende, each recording greater than 60 cases of birth asphyxia per 1000 live births (6%), more than twice the national average(Komakech et al., 2023). These are nearly 60 cases of cerebral palsy, mentally retarded or early neonatal deaths per 1000 live births in the above districts. In Mubende district, it is reported that prematurity and other neonatal conditions including birth asphyxia contribute to 12.2% and 9.7% mortality respectively. The scarcity of data to account for this persistently high prevalence of birth asphyxia in Mubende District prompted a need for investigation. Upon this background, the study was set to assess the prevalence and factors associated with birth asphyxia in Mubende regional referral hospital in Mubende district, Central Uganda.

Methods

Study design

A hospital based quantitative cross sectional study design was used which enabled the assessment of birth asphyxia prevalence as well as the factors associated with it. This design also favored both the economic and time feasibility of the study while allowing for exploration of multiple factors.

Study setting

The study was conducted in Mubende Regional Referral Hospital, a public hospital located in Mubende Municipality in central Uganda at latitude 00º34'03"N and longitude 31º23'35"E approximately 148 kilometers East of Fort portal Regional Referral Hospital and 151 kilometers to the West

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of Mulago National Referral Hospital in Kampala. It is a referral hospital for the districts of Mubende, Mityana, Kiboga and Kyankwanzi with a 175 bed capacity and six delivery beds and one main operating theatre serving a catchment area of about 610,600 people as of July 2020. MRRH conducted approximately 2969 deliveries annually out of the total 3,110 in all the health facilities of Mubende District in 2019/2020(Mubende District, 2025).

Study population

The study population constituted neonates born in Mubende regional referral hospital within the research period 4th to 21st July 2025.

Sample size determination

The sample size was determined using the Kish and Leslie formula as follows;

$$n = \frac{z^2 pq}{e^2}$$

Where;

n is the required sample size; *z* is the z-score of 1.96 at 95% confidence interval; *p* is the prevalence of the condition (6% for Mubende District based on previous national study); *q* is 1-p and *e* is the margin of error which is 5% at 95% level of confidence.

Thus

$$n = \frac{(1.96)^2(0.06(1-0.06))}{(0.05)^2}$$

$$n = 86.666496$$

This gives us a sample size of 87 mothers. Adjusting for a non-response rate of 10% as seen in similar previous studies;

$$\text{Final Sample size} = \frac{n}{1-non\ response\ rate(10\%)}$$

$$= \frac{87}{1-0.1}$$

$$= 97$$

A final sample size of 97 mothers was contacted for the study. 98 mothers were screened for eligibility; 96 mothers consented to the study and one mother declined to participate and one did not complete the interview thus 96 mothers were ultimately included in the study.

Sampling technique and sampling procedure

Consecutive sampling was used whereby every mother who met the inclusion criteria was contacted consecutively to consent for the study until the required number of mothers was reached. This variant of convenient sampling was chosen due to its flexibility in the complex setting of the maternity environment where it is difficult to obtain a complete sampling frame as well as giving all potential participants a chance to be contacted.

Data collection tools

A structured interviewer administered questionnaire was used to obtain maternal socio-demographics, prenatal and perinatal events after which the fetal and obstetric data were abstracted from the non-electronic delivery notes and from the electronic hospital health records.

Data collection procedure

APGAR scores were obtained by the qualified health workers who were present at the time of delivery of the baby. Socio-demographic data was obtained directly from the mother or care taker and obstetric data was abstracted from the maternal antenatal card, labor progress charts, delivery notes and the integrated maternal register.

Study variables

The outcome variable or dependent variable was birth asphyxia which was measured as a 5 minute Apgar score of <7 of a neonate born in Mubende regional referral hospital and met the selection criteria for the study. The independent variables were grouped into maternal and neonatal factors based on the analysis of previous literature. Maternal variables were age, tribe, religion, level of education, marital status, employment status, residence, stature, blood group, gravidity and parity; medical conditions during pregnancy, number of antenatal care visits attended, consumption of alcohol, smoking, drug abuse, and referral status, preterm vaginal bleeding, pre-labour rupture of membranes, prolonged labour, obstructed labour,staining of

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amniotic fluid, borderline/ inadequate pelvis and placenta praevia, presentation, time of membrane rupture and duration of labour. Neonatal variables were sex, gestational age at birth, birth weight, moulding, birth trauma and congenital anomalies.

Data management

Data was entered into EpiData version 4.6.0.6 and exported to STATA version 14 for analysis. Univariate analysis was performed to generate descriptive statistics, and association of factors was tested using bivariate and multivariate analysis. Chi test was performed on maternal and neonatal factors. Factors with p values <0.2 at this level were included in the multivariate models for further analysis. Standard logistic regression and fishers exact tests were performed to determine which factors were associated with birth asphyxia.

Ethical considerations

Ethical approval was obtained from the MIHS research committee, and introductory letter was obtained from Mildmay Institute of Health Sciences on 25th June 2025, permission to collect data was obtained from the hospital director of Mubende Regional Referral Hospital and the unit in-charge on 4th July 2025. The study was fully voluntary whereby informed Consent was obtained from mothers before recruitment to the study. Study information has been kept secure under lock and key and personal identifiers of respondents will continue to be kept confidential until deemed due for complete termination of study materials.

Quality assurance

The research questionnaire was pretested in a similar environment to the research site before data collection to check for acceptability, comprehension by respondents and validity. Research questionnaires were checked regularly for completeness and respondents contacted in case of missing information and ample time was given for data collection.

Inclusion criteria

All neonates whose mothers came to the facility at full term and in active first stage of were included in the study.

Exclusion criteria

All neonates who were not at full term, whose mothers were severely sick, elective Cesarean section mothers and mothers who came to hospital in second stage of labour were excluded from the study.

Bias

The use of convenience sampling predisposed the study to sampling bias however, efforts were made to ensure that all mothers who came to the facility were screened and given chance to participate on a rolling basis until the required number of respondents were reached.

Results

Socio-demographic characteristics of the respondents

98 mothers were screened for eligibility; one declined to participate while one did not complete the study. 96 mother-baby pairs were included in the final analysis. Majority of mothers were married (83%). Majority of the respondents (66%) were either Catholics (33%) or Pentecostals (33%). Nearly half of the mothers had only primary education (45.8%), while 35.4% had O' Level, and only 13.5% had A' Level or higher. The most dominant tribes were Baganda (21.88%) and Banyankole (19.79%) (total of 41.67%) while the rest of the tribes across western Uganda such as the Bakiga, Banyarwanda, Bafumbira, Banyooro and Batooro shared nearly half of the respondents (49.99%). Majority were peasants (37.5%). Only a small number were formally employed (10.42%). Majority resided in the rural setting (60.42%).

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Table 1: Socio-Demographic Characteristics of the respondents (n=96)

Characteristic	Category	f (%)
Marital status	Married	80 (83.3%)
	Single	16 (16.7%)
Religion	Catholic	32 (33.3%)
	Pentecostal	32 (33.3%)
	Protestant	16 (16.7%)
	Muslim	9 (9.4%)
	SDA	7 (7.3%)
Education	No/pre-primary	5 (5.2%)
	Primary	44 (45.8%)
	O' Level	34 (35.4%)
	A' Level & above	13 (13.5%)
Tribe	Baganda	21 (21.8%)
	Banyankole	19 (19.79%)
	Banyoro	13 (13.54%)
	Others	43 (44.79%)
Employment status	Formal employment	10 (10.42%)
	Self-employed/business	27 (28.13%)
	Unemployed/housewife	23 (23.96%)
	Peasant	36 (37.5%)
Residence	Rural	58 (60.42%)
	Urban	38 (39.58%)

Prevalence of Birth asphyxia

Table 2: Prevalence of asphyxia among neonates born in Mubende Regionl referral hospital (n=96)

Birth asphyxia	Freq.	Percent	Cum.
0	92	95.83	95.83
Asphyxia	4	4.17	100.00
Total	96	100.00	

Of the 96 neonates considered in this study, 4 neonates met the study definition for birth asphyxia (5-minute Apgar score < 7), giving a prevalence of birth asphyxia of 4.17% which approximates to 42 cases of asphyxia per 1000 Live births.

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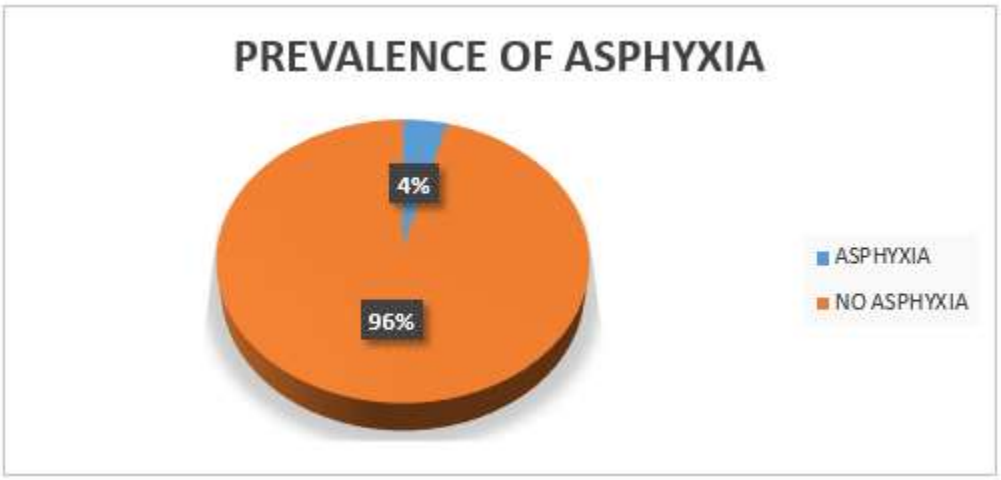
Figure 1: Prevalence of birth asphyxia in Mubende regional referral hospital



Maternal factors associated with birth asphyxia

Table 3: Maternal Factors associated with birth asphyxia

Characteristic	Category	Frequency (%)
Gravidity	1–2	45 (46.9%)
	3–4	34 (35.4%)
	≥5	17 (17.7%)
Parity	0–1	48 (50.0%)
	2–3	31 (32.3%)
	≥4	17 (17.7%)
Antenatal care visits	<4	30 (31.3%)
	≥4	66 (68.7%)

The mean age of the mothers was 25.76 with a standard deviation of 6.17 (Minimum=17, maximum=44). About half of the mothers were primiparous (50%). Majority of the mothers were between 1.4 to 1.6 meters (91). Majority of the mothers did not know their blood groups (56.25%) of those who knew their blood groups, majority were blood group O-rhesus positive (20.83%), while the other blood groups (A+, B+, AB+) were equally distributed, each with 7 mothers (7.29%) and only one was blood group A-(1.04%) (n=96).

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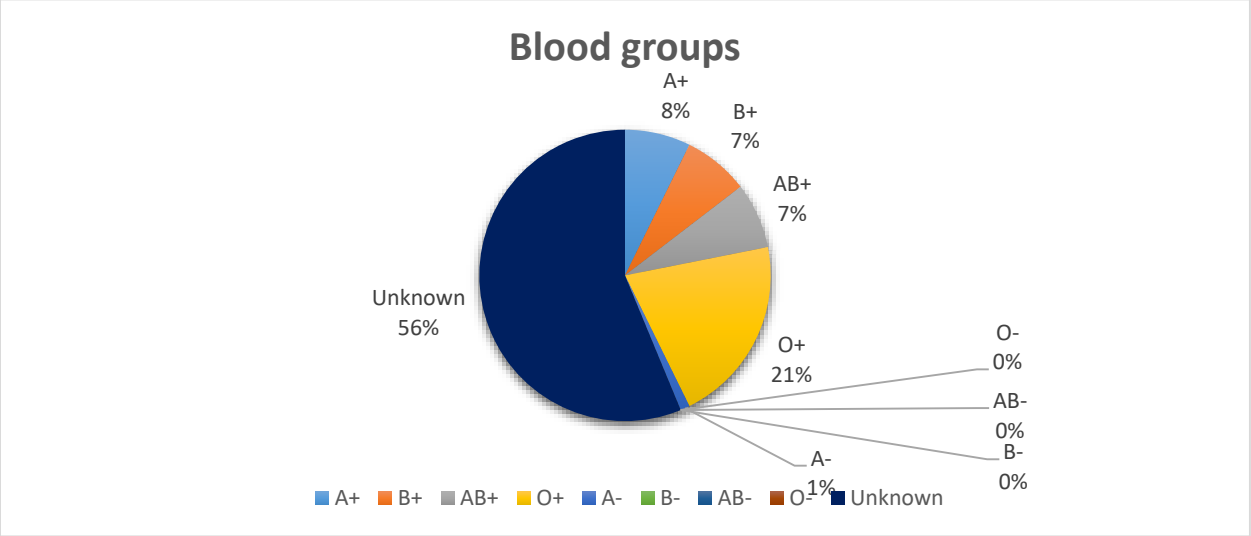
Figure 2 Blood groups of respondents



All the respondents went for ANC during pregnancy (100%). Majority went for the first visit during the second trimester (58%), 36% went for their first visit during the first trimester, and 6% during the third trimester. A majority (68.7%) attended at least four antenatal visits. The mean number of ANC visits was 4.3 with a standard deviation of 1.6 (minimum=2, maximum=8).

Figure 3: Trimester of pregnancy during first ANC Visit

Majority of the mothers denied consumption of any drug or alcohol during pregnancy (68.75%) while 31.25% (30) reported to have consumed alcohol only. Over half had adequate type of pelvis (55.21%). Over half of the mothers reported to have suffered malaria in pregnancy (52.08%). Majority did not get hospitalized during pregnancy

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(68.75%). The mean number of hospitalizations was 3.4 times with a standard deviation of 7.22 (min =1, max = 40). Nearly half of the mothers(40) were referred to Mubende regional referral hospital in labour (41.67%). Only a small number of mothers of the respondents reported bleeding before labour (21.88%). There was a small number of cases of breech presentation (12.5%) compared to cephalic presentation (87.5%). Majority of the mothers had ruptured membranes in the first stage of labour (63%). Majority of the mothers gave birth by Caesarean section (78.13%).

The trend shows that most (75%) of the asphyxiated neonates were born to mothers with borderline type of pelvis, most (75%) of the asphyxia cases were born to mothers who reported to have suffered malaria during pregnancy. All (100%) cases of birth asphyxia were born to mothers who did not know their blood group, were referrals from other facilities, and were in cephalic presentation.

Neonatal factors associated with birth asphyxia

Table 4: Neonatal factors associated with birth asphyxia

Characteristic	Category	Frequency (%)
Sex	Male	55 (57.29%)
	Female	41 (42.71%)
Birth weight	<2.5 kg	14 (11.46%)
	2.5-3.4 kg	62 (64.58%)
	≥3.5 kg	22 (22.98%)
Congenital anomalies	Yes	3 (3.1%)
	No	93 (96.9%)

Slightly more than half of the neonates were male (57.29%). Over half of the neonates were born between 37 and 39 weeks of gestation (52%), while 46.88% were born between 40 and 42 weeks and 1.04% above 40 weeks. Most neonates had normal birth weight (64.58%), while 14.6% were low birth weight and 22.92% were above 3.5 kg. Majority did not have any degree of moulding (79.17%), 19.79% had +1 moulding (19), and 1.04 had moulding +2. Majority of the neonates did not have any birth trauma (95.83%) while only 3.13% presented with caput succedaneum. Congenital anomalies were observed in 3.1% of neonates. All (100%) of the asphyxiated neonates were of male sex, majority (75%) were born at 40 weeks or more.

Bivariate and Multivariate analysis of factors associated with birth asphyxia

Chi square test was performed at bivariate level to screen for factors that had statistically significant associated with birth asphyxia. Factors with p values <0.2 were included in the multivariable Fisher's exact logistic regression analysis to assess for statistical significance of their associations with birth asphyxia.

Maternal level of education (p=0.006), residence of respondent (p=0.098), type of pelvis (p=0.114), medical conditions (p=0.192), hospitalization (p=0.168), referral status (0.016), amniotic fluid staining (0.023) and colour of amniotic fluid (0.013) were screened as likely to be associated with birth asphyxia at bivariate level but multivariate level found maternal level of education as the only factor with statistically significant association with birth asphyxia(AOR 0.0606, P=0.0265, 95%CI 0.0008874 - 0.8189651). Other maternal and neonatal variables did not show statistically significant associations.

Table 5: P-Values of factors associated with birth asphyxia at bivariate level

Variable	p-value
Maternal education	0.006
Residence of respondent	0.098
Type of pelvis	0.114

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Medical conditions	0.192
Hospitalizations	0.168
Referral status	0.016
Amniotic fluid staining	0.023
Colour of amniotic fluid	0.013

Table 6: Fisher's exact logistic regression of factors associated with birth asphyxia

Variable	Adjusted Odds Ratio	95% CI	p-value
Maternal education	0.0606436	0.0008874 - 0.8189651	0.0265
Residence of respondent	1.751437	0.0000 - 24.52083	1.0000
Type of pelvis	2.123615	0.2893077 – 21.87928	0.6083
Medical conditions	0.790647	0.3046485 – 1.45373	0.5987
Hospitalizations	4.036001	0.3947185 – inf.	0.2521
Referral status	5.306059	0.6378609 – inf.	0.1306
Colour of Amniotic fluid	2.49516	0.7083562 – 11.13596	0.1722

Table 7: Fisher's exact logistic regression of birth asphyxia and education level of respondents (EDU), residence of respondents (RES) and type of pelvis (PELV)

```
Exact logistic regression                       Number of obs =         96
                                                Model score   =   5.205807
                                                Pr >= score   =     0.1418

------------------------------------------------------------------------------
    ASPHYXIA | Odds Ratio       Suff.   2*Pr(Suff.)     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         EDU |   .0606436           6       0.0265      .0008874    .8189651
         RES |   1.751437*          4       1.0000             0    24.52083
        PELV |   2.123615           7       0.6083      .2893077    21.87928
------------------------------------------------------------------------------
(*) median unbiased estimates (MUE)
```

Table 8: Exact logistic regression of birth asphyxia (ASPHYXIA) against Hospitalization (HOSP) referral status (Ref), and medical conditions diagnosed in pregnancy (DIAG)

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Exact logistic regression — Number of obs = 96; Model score = 8.529025; Pr >= score = 0.0549

ASPHYXIA	Odds Ratio	Suff.	2*Pr(Suff.)	[95% Conf.	Interval]
HOSP	4.036001*	8	0.2521	.3947185	+Inf
Ref	5.306059*	4	0.1306	.6378609	+Inf
DIAG	.790647	31	0.5987	.3046485	1.45373

(*) median unbiased estimates (MUE)

Maternal education was the only factor with significant association with birth asphyxia. Higher education was protective against asphyxia (AOR = 0.060643695%CI 0.0008874 - 0.8189651 p = 0.0265).

Discussion

Prevalence of Birth Asphyxia

The prevalence of birth asphyxia in this study was 4.17%. This figure is lower than the previous estimate for Mubende district (6%) in a national study. However, it is still higher than the estimated national prevalence of birth asphyxia which stands at 2.9%(Komakech et al., 2023). The difference could be attributed to the fact that the national figure took into account all the health facilities in Mubende district while our study only focused in regional referral hospital with robust and well-equipped facilities for emergency obstetric care which reduces risks of birth complications significantly. The prevalence is comparable to other hospital-based studies in similar settings in Uganda, which also reported rates below 10%(Ayebare et al., 2022; Komakech et al., 2023). In-as-much as this figure is lower than what has been found in most African studies, it is very high compared to the developed countries(Alfaifi et al., 2025; Bayih et al., 2020; Gizachew et al., 2024; Jimma et al., 2022; Kibai, 2017; Olofsson, 2023, 2023; Opitasari & Andayasari, 2016; Wayessa et al., 2018). This suggests that while birth asphyxia remains a public health concern, the burden may vary considerably depending on context and facility-level factors.

Maternal and Obstetric Factors Associated with Birth Asphyxia

Maternal education was significantly protective against birth asphyxia, with higher levels of education associated with reduced odds (AOR = 0.0606436, 95% CI [0.0008874 - 0.818965], p = 0.0265). This aligns with studies from sub-Saharan Africa, where maternal education has been linked to improved health-seeking behavior, greater utilization of antenatal services, and better birth preparedness (Bayih et al., 2021). Education likely enhances awareness and timely decision-making in the intra-partum period.

The trend indicates that referral status was linked with birth asphyxia risk but was statistically not found to be significant. This is however consistent with other studies that had larger sample size(Ayebare et al., 2022). Referred mothers often arrive late, sometimes after complications have already developed, which may contribute to poorer neonatal outcomes. Other maternal trends that appear to be associated with birth asphyxia include having a borderline pelvis, having suffered malaria during pregnancy and not knowing the blood group. The trend towards obstetric factors like staining of amniotic fluid and colour of fluid was also identified. This reflects a similar pattern with other studies(Desalew et al., 2020; Fitriana et al., 2021; Gizachew et al., 2024; Handing et al., 2024; Ikang, 2018).

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Intra-partum and Neonatal Factors Associated with Birth Asphyxia

Meconium-stained liquor was found in most of the asphyxiated neonates although it was not a statistically significant factor for birth asphyxia. This is biologically plausible since meconium aspiration can lead to airway obstruction, respiratory compromise, and poor neonatal outcomes. Studies in similar contexts have consistently reported this association(Su et al., 2024).

Although all the cases of birth asphyxia were male, this association was not statistically significant. However, the trend is consistent with evidence that male infants may be more vulnerable to adverse perinatal outcomes(Abate et al., 2025; Ayebare et al., 2022; Bayih et al., 2021). The lack of statistical significance is likely due to the small sample size and limited number of outcome events.

Study limitations

The difficulty in obtaining a complete sampling frame for the study hindered the use of probability sampling hence predisposing the study to sampling bias. The small sample size was powered mainly for estimation of prevalence but was not adequate for determining the associated factors using standard logistic regression. Therefore, exact logistic regression was used to complement the findings.

Generalizability

The study was hospital-based and used consecutive sampling, which may limit generalizability to the wider community of Mubende. The study did not account for all possible confounders, such as intra-partum monitoring practices and staffing levels, which could influence outcomes. These limitations mean that the findings should be interpreted as exploratory rather than definitive.

Conclusion

The prevalence of birth asphyxia was high in our study indicating that 42 in every 1000 babies born in Mubende RRH are at a risk of birth asphyxia. Maternal education was the only factor found to be statistically associated with birth asphyxia with higher education being protective. However, referral status of mothers, rural residence, male sex, and amniotic fluid staining also appeared to contribute to asphyxia

Recommendation

The findings therefore highlight key areas for intervention, including promoting maternal education, strengthening referral systems, and improving intrapartum monitoring and timely obstetric care. Larger studies and studies putting into consideration other confounding factors such as staffing levels and intrapartum monitoring are also required to complement these findings.

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List of abbreviations

APGAR : Appearance, Pulse, Grimace, Activity, Respiration
WHO: World Health Organization
MOH: Ministry of Health
MRRH: Mubende Regional Referral Hospital
HIV: Human Immunodeficiency Virus
CP; Cerebral Palsy
IUFD: Intrauterine Fetal Death
CHAI: Clinton Health Access Initiative
AOGU: Association of Obstetricians and Gynecologists of Uganda
UPA: Uganda Pediatricians Association
UHPAB: Uganda Health Professionals' Assessment Board
MHIS: Mildmay Institute of Health Sciences
AOR: Adjusted odds ratios

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All project data is available on Reasonable request to the corresponding author.

Author contributions:

Ecaat Isaac Newton Olupot: conceptualization, protocol development, project implementation, data analysis, writing &editing.

Okwany Jimmy: Supervision, review Ainebyona Hilda: Visualization, Editing, reviewing.

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