International Journal of Healthcare Sciences ISSN 2348-5728 (Online)
Vol. 14, Issue 1, pp: (236-245), Month: April 2026 - September 2026, Available at: www.researchpublish.com

# Prevalence and Factors Associated with Neonatal Birth Asphyxia among Live Births from 2023–2025 in Kiziguro District Hospital in Gatsibo District, Rwanda

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**DOI: https://doi.org/10.5281/zenodo.20717106**

**Published Date: 16-June-2026**

***Abstract:*** **Newborn birth asphyxia remains a leading cause of newborn morbidity and mortality, particularly in low-income settings like Rwanda. This research targeted to assess the prevalence, trends, and factors associated with newborn birth asphyxia among live births at Kiziguro District Hospital from 2023 to 2025, providing evidence to improve neonatal outcomes and guide interventions. A retrospective design using secondary data from delivery and neonatal registers was employed, with data analyzed in version 26 of SPSS using descriptive statistics, trend analysis, and logistic regression ($p < 0.05$). Most mothers were aged 18–33 years, had primary/secondary education, attended 2–4 ANC visits, and had no complications; most deliveries were vaginal with normal birth weight. Births increased over time. The prevalence of neonatal birth asphyxia was 12.4% at 1 minute after birth. Multivariate logistic regression analysis identified several independent predictors. Newborn d with meconium-stained amniotic fluid at their birth were significantly more likely to develop asphyxia (AOR = 4.8; 95% CI: 3.9–5.9). Other significant factors included obstetric complications (AOR = 3.5; 95% CI: 2.8–4.3), low birth weight (AOR = 3.2; 95% CI: 2.6–3.9), and prolonged labor (>12 hours) (AOR = 2.9; 95% CI: 2.4–3.5). Additionally, cesarean and assisted deliveries, inadequate antenatal care visits (0–2) (AOR = 2.1; 95% CI: 1.7–2.6), and referral status (AOR = 1.5; 95% CI: 1.2–1.9) were significantly associated with increased odds of birth asphyxia. The prevalence of neonatal birth asphyxia at Kiziguro District Hospital is relatively high. Key predictors include meconium-stained amniotic fluid, obstetric complications, low birth weight, prolonged labor, inadequate antenatal care, and referral status. Strengthening antenatal care services, improving intrapartum monitoring, and ensuring timely obstetric interventions are critical to reducing the burden of neonatal birth asphyxia.**

***Keywords:*** **Prevalence, Neonatal Birth, Asphyxia, Live Births, Kiziguro District Hospital, Rwanda.**

## 1. INTRODUCTION

Neonatal birth asphyxia remains a significant global public health challenge and is one of the leading causes of neonatal mortality and long-term neurological disability. The World Health Organization (WHO, 2022) estimates that approximately two million newborns experience birth asphyxia annually worldwide, resulting in substantial numbers of neonatal deaths and severe lifelong complications. Despite considerable progress in improving child survival over the past decades, neonatal mortality continues to account for a large proportion of under-five deaths. Globally, nearly four million newborns die each year within the first week of life, with approximately 99% of these deaths occurring in low- and middle-income countries. Most neonatal deaths are attributed to preventable causes, including birth asphyxia, prematurity, and neonatal infections (Ayingeneye, 2023).

Birth asphyxia alone contributes to nearly 23% of neonatal deaths worldwide, largely due to inadequate intrapartum care, delayed obstetric interventions, and insufficient newborn resuscitation services (Jikamo et al., 2025). Although mortality associated with infectious diseases has declined substantially, progress in reducing deaths related to birth asphyxia has been comparatively slower. Furthermore, survivors often experience long-term complications such as cerebral palsy, cognitive impairment, developmental delays, epilepsy, and learning disabilities, creating significant social and economic burdens for families and healthcare systems (Su et al., 2024).

The prevalence of neonatal birth asphyxia varies considerably across regions and countries, reflecting differences in healthcare infrastructure, maternal health services, and socioeconomic conditions. In high-income countries such as the United Kingdom, Canada, Germany, and Australia, the prevalence of birth asphyxia is relatively low, ranging between 1% and 2.5%. This low prevalence is largely attributable to well-established maternal and newborn healthcare systems characterized by universal access to antenatal care, skilled birth attendance, advanced fetal monitoring technologies, efficient referral mechanisms, and specialized neonatal intensive care units.

Although maternal risk factors such as obesity, diabetes, hypertension, and advanced maternal age remain common in these settings, they are generally identified and managed early through comprehensive antenatal surveillance, thereby minimizing the likelihood of intrapartum complications that may result in birth asphyxia (Murray, 2023). Conversely, in many low- and middle-income countries, the prevalence remains substantially higher. For example, studies from India report prevalence rates ranging from 4% to 15%, primarily due to disparities in healthcare access, delayed emergency obstetric care, shortages of skilled healthcare personnel, and persistent socioeconomic inequalities (Soni et al., 2025).

Sub-Saharan Africa bears the highest burden of neonatal mortality globally, accounting for approximately one-quarter of all neonatal deaths worldwide. The region records neonatal mortality rates averaging 26–27 deaths per 1,000 live births, significantly higher than the global average (Workineh et al., 2020).

Birth asphyxia remains one of the principal contributors to these deaths, driven by inadequate maternal and newborn healthcare services, poor intrapartum monitoring, shortages of skilled birth attendants, and limited neonatal resuscitation capacity (Nkundabaza et al., 2024). Considerable variation exists across African countries. South Africa reports relatively lower rates of approximately 15.2 cases per 1,000 live births, reflecting stronger healthcare infrastructure and more effective obstetric care systems (Stofberg et al., 2016).

In contrast, Nigeria records rates of approximately 26 cases per 1,000 live births, largely associated with delays in seeking, reaching, and receiving appropriate healthcare services (Ogba et al., 2024). Similarly, Zambia continues to experience high neonatal mortality linked to birth asphyxia due to persistent resource constraints, inadequate healthcare facilities, and shortages of trained healthcare providers, highlighting the need for comprehensive health system strengthening interventions (Rukwaru, 2024).

Within East Africa, neonatal mortality remains a major public health concern, with an average rate of approximately 26 deaths per 1,000 live births. Birth asphyxia is consistently identified among the leading causes of these deaths (Workineh et al., 2020). In Kenya, studies indicate a prevalence of approximately 28%, primarily associated with prolonged labor, obstructed labor, inadequate fetal monitoring, and delayed obstetric interventions (Lucy et al., 2025). Uganda reports neonatal mortality rates of about 27 deaths per 1,000 live births, with birth asphyxia contributing approximately 28.6% of neonatal deaths. Key determinants include maternal anemia, prolonged labor, limited access to emergency obstetric care, and inadequate neonatal resuscitation services, particularly in rural and underserved communities (Ayebare et al., 2022).

In Tanzania, birth asphyxia prevalence is estimated at approximately 24 cases per 1,000 live births and is commonly linked to delayed referrals, obstetric complications, and weaknesses in emergency newborn care systems (Tibenderana & Kessy, 2025). Across the East African region, common risk factors include inadequate antenatal care attendance, poor intrapartum monitoring, delayed referral systems, and insufficient emergency obstetric and neonatal care services, underscoring persistent challenges in maternal and newborn healthcare delivery.

In Rwanda, neonatal birth asphyxia remains a significant contributor to neonatal morbidity and mortality despite remarkable improvements in child health outcomes over the past two decades. Nationally, under-five mortality declined from 196 deaths per 1,000 live births in 2000 to 45 deaths per 1,000 live births in 2022.

However, reductions in neonatal mortality have been slower, with rates remaining between 17 and 18 deaths per 1,000 live births, which is above the Sustainable Development Goal target of 12 deaths per 1,000 live births (Ministry of Health, 2024). Evidence from healthcare facilities demonstrates the continuing burden of birth asphyxia. A study conducted at

Kibuye Referral Hospital reported a prevalence of 5% among 1,870 neonates delivered in 2021, indicating that birth asphyxia remains a persistent challenge despite improvements in maternal healthcare services (Ayingeneye, 2023). Conversely, research conducted at Rwamagana Level II Teaching Hospital involving 340 delivery records between May 2022 and May 2023 reported a much higher prevalence of 37.9%.

The study identified several significant risk factors, including low maternal educational attainment, maternal weight below 50 kilograms, low birth weight, maternal hypertension, maternal anemia, and intrapartum complications (Mukobwa, 2025). These variations across health facilities suggest that the burden and determinants of neonatal birth asphyxia may differ considerably according to local healthcare contexts and population characteristics. Consequently, further district-level investigations are essential to generate context-specific evidence that can inform targeted interventions aimed at reducing neonatal morbidity and mortality associated with birth asphyxia in Rwanda.

## 2. METHODOLOGY

### 2.1 Study Design

This study employed a cross-sectional design using secondary data from hospital records to determine the prevalence and associated factors of neonatal birth asphyxia among live births at Kiziguro District Hospital in Rwanda from 2023–2025.

### 2.2 Study Setting

This study was conducted at Kiziguro District Hospital, located in Kiziguro Sector, Agakomeye Cell, Bwiza Village, Gatsibo District, Eastern Province of Rwanda.


**Photo: Kiziguro District Hospital**

### 2.3 Study Population

In this study population comprises all live births recorded in Kiziguro district hospital of Gatsibo District during the years 2023–2025 that met inclusion criteria.

### 2.4 Data Collection Instruments

Data have been collected using a structured data extraction checklist applied to delivery and neonatal registers.

### 2.5 Data Analysis

Data has been passed in SPSS version 2026 for analysis, descriptive statistics, including frequencies, percentages and means, have been used to summarize maternal, intrapartum, and neonatal characteristics.

## 3. RESULTS AND DISCUSSIONS

### 3.1 Socio-demographic and obstetric Characteristics of Respondents

Table. 1 presents the socio-demographic and obstetric features of the participants. Geatest number of mothers were aged 18–25 years (3,571; 38.9%) and 26–33 years (3,177; 34.6%), with 385 (4.2%) under 18 and 209 (2.3%) above 41 years. Regarding education, 4,858 (52.9%) had primary, 3,620 (39.4%) secondary, 513 (5.6%) university, and 187 (2%) had no formal education. Most had 0–2 births (6,023; 65.6%), attended 2–4 ANC visits (7,354; 80.1%), and reported no obstetric complications (8,651; 94.3%). Vaginal delivery was most common (5,273; 57.5%), followed by cesarean section (3,898; 42.5%) and assisted delivery (7; 0.1%). Labor lasted <12 hours in 5,863 (63.9%) cases. Me conium-stained amniotic fluid occurred in 769 (8.4%) births. Weight at birth was normal (2.5-4.5 kg) in 8,473 (92.3%) babies, low (<2.5 kg) in 705 (7.7%), and high/overweight (>4.5 kg) in 2 (0.02%). Most births were singletons (9,043; 98.5%), with twins accounting for 135 (1.5%). Regarding admission status, 987 (10.8%) babies were directly admitted, while 8,191 (89.2%) were referred from other health facilities.

**Table 1: Socio-demographic and obstetric Characteristics of Respondents**

| Demographic variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Age** | | |
| <18 | 385 | 4.2 |
| 18-25 | 3571 | 38.9 |
| 26-33 | 3177 | 34.6 |
| 41 Above | 209 | 2.3 |
| **Educational** | | |
| No formal education | 187 | 2 |
| Primary | 4858 | 52.9 |
| Secondary | 3620 | 39.4 |
| University | 513 | 5.6 |
| **Number of births** | | |
| 0-2 | 6023 | 65.6 |
| 3-4 | 2345 | 25.6 |
| ≥5 | 808 | 8.8 |
| | | |
| **ANC Number** | | |
| 0-2 | 1358 | 14.8 |
| 2-4 | 7354 | 80.1 |
| 4-6 | 466 | 5.1 |
| **Obstetric complication** | | |
| Yes | 527 | 5.7 |
| No | 8651 | 94.3 |
| **Mode of delivery** | | |
| Assisted (Vacuum/ Forceps) | 7 | 0.1 |
| Cesarean Section | 3898 | 42.5 |
| Vaginal | 5273 | 57.5 |
| **Labor period** | | |
| <12 hours | 5863 | 63.9 |
| > 12 hours | 3315 | 36.1 |

| | | |
|---|---|---|
| **Meconium stained** | | |
| Yes | 769 | 8.4 |
| No | 8409 | 91.6 |
| **Referral status** | | |
| Direct admission | 987 | 10.8 |
| Referral From other health facility | 8191 | 89.2 |
| **Birth weight** | | |
| Low birth weight (< 2.5kg) | 705 | 7.7 |
| Normal (2.5-4.5 kg) | 8473 | 92.3 |
| Overweight > 4.5kg | 0 | 0 |
| **Number of births** | | |
| Single | 9043 | 98.5 |
| Twin | 135 | 1.5 |

### 3.2 Table 1 Distribution of births by year and months

Table 2 presents the time-based distribution of births by year and month. Over the study period, births increased steadily from 2,749 (30%) in 2023 to 2,946 (32.1%) in 2024 and 3,483 (37.9%) in 2025. Monthly distribution was relatively even, with slightly higher numbers in November (841; 9.2%) and October (831; 9.1%), while lower counts were observed in February (680; 7.4%) and May (726; 7.9%). Other months ranged between 7.9% and 9%, reflecting a consistent pattern of births throughout the year.

| Births chronology | Frequency | Percent |
|---|---|---|
| Year | | |
| 2023 | 2749 | 30 |
| 2024 | 2946 | 32.1 |
| 2025 | 3483 | 37.9 |
| **Month** | | |
| January | 749 | 8.2 |
| February | 680 | 7.4 |
| March | 769 | 8.4 |
| April | 827 | 9 |
| May | 726 | 7.9 |
| June | 735 | 8 |
| July | 749 | 8.2 |
| August | 739 | 8.1 |
| September | 747 | 8.1 |
| October | 831 | 9.1 |
| November | 841 | 9.2 |
| December | 785 | 8.6 |

### 3.3 Presentation of Findings

#### 3.3.1 Table 2 Prevalence of neonatal birth asphyxia

Neonatal birth asphyxia was defined based on the Apgar score at 1 minute, 5 minutes and 10 minutes after birth. A newborn was classified as having birth asphyxia if the Apgar score was less than 6 at 5 minutes, which includes both severe asphyxia (Apgar score <4) and mild to moderate asphyxia (Apgar score 4–5). Newborns with an Apgar score of 6 or above were classified as not having birth asphyxia (normal outcome). For the purpose of statistical analysis, particularly logistic regression, the outcome variable was dichotomized as follows:

1 = presence of high probability to get neonatal birth asphyxia (Apgar score <6 at 1 minute)

0 = Absence of neonatal birth asphyxia (Apgar score ≥6 at 1 minute)

This binary classification enabled the estimation of associations between independent variables and the probability of newborn asphyxia. Table 3 illustrates the distribution of birth asphyxia (combined mild and severe cases) and normal neonatal outcomes at 1, 5, and 10 minutes after birth. The proportion of newborns experiencing asphyxia decreased progressively over time, from 12.4% at 1 minute to 10.4% at 5 minutes and 9.5% at 10 minutes. In contrast, the proportion of newborns with normal status increased correspondingly from 87.6% at 1 minute to 89.6% at 5 minutes and 90.5% at 10 minutes. The probability for getting birth asphyxia at 1 minute were 12.4%, then due to healthcare interventions the prevalence of neonatal birth asphyxia became 10.4% at 5 minutes and improved to 9.5% at 10 minutes. This progressive decline indicates the effectiveness of immediate neonatal resuscitation interventions. However, the relatively high prevalence at 1 minute suggests gaps in intrapartum care and early neonatal management.

| Time | Asphyxia (Mild + Severe) N (%) | No Asphyxia (Normal) N (%) |
|---|---|---|
| **1 min** | **1140 (12.4%)** | 8038 (87.6%) |
| **5 min** | **959 (10.4%)** | 8219 (89.6%) |
| **10 min** | **868 (9.5%)** | 8310 (90.5%) |
| | | |
| | | |

**3.3.2 Table 3 Maternal, Obstetric, and Neonatal Factors Associated with Neonatal Birth Asphyxia at Kiziguro District Hospital (2023–2025)**

Table 4 showed that there were significant links between several factors and neonatal birth asphyxia. These factors included maternal age ($p = 0.006$), education level ($p < 0.001$), number of antenatal care visits ($p < 0.001$), parity ($p = 0.02$), presence of obstetric complications ($p < 0.001$), Type of delivery ($p < 0.001$), duration of labor ($p < 0.001$), meconium-stained amniotic fluid ($p < 0.001$), referral status ($p < 0.001$), birth weight ($p < 0.001$), and multiplicity ($p < 0.001$). These results suggest that maternal socio-demographic traits, healthcare use, and obstetric and neonatal conditions are linked to the occurrence of neonatal birth asphyxia in this study group. Bivariate analysis demonstrated statistically significant associations between neonatal birth asphyxia and several variables including maternal age, education level, ANC attendance, parity, obstetric complications, Type of delivery, labor period, meconium-stained amniotic fluid, referral status, birth weight, and

| Variable | Category | Asphyxia N (%) | No Asphyxia N (%) | p-value |
|---|---|---|---|---|
| **Maternal Age** | | | | |
| | <18 | 60 (15.6) | 325 (84.4) | 0.006 |
| | 18–25 | 320 (9.0) | 3,251 (91.0) | |
| | 26–33 | 270 (8.5) | 2,907 (91.5) | |
| | 34–41 | 210 (11.4) | 1,626 (88.6) | |
| | >41 | 35 (16.7) | 174 (83.3) | |
| **Education Level** | | | | |
| | No formal | 45 (24.1) | 142 (75.9) | <0.001 |
| | Primary | 520 (10.7) | 4,338 (89.3) | |
| | Secondary | 290 (8.0) | 3,330 (92.0) | |
| | University | 40 (7.8) | 473 (92.2) | |
| **ANC Visits** | | | | |
| | 0–2 | 250 (18.4) | 1,108 (81.6) | <0.001 |
| | 2–4 | 600 (8.2) | 6,754 (91.8) | |
| | 4–6 | 45 (9.7) | 421 (90.3) | |
| **Parity** | 0–2 | 500 (8.3) | 5,523 (91.7) | 0.02 |
| | 3–4 | 250 (10.7) | 2,095 (89.3) | |
| | ≥5 | 145 (17.9) | 663 (82.1) | |
| **Obstetric Complications** | | | | |
| | Yes | 180 (34.2) | 347 (65.8) | <0.001 |
| | No | 715 (8.3) | 7,936 (91.7) | |
| **Mode of Delivery** | | | | |
| | Vaginal | 350 (6.6) | 4,923 (93.4) | <0.001 |
| | Cesarean | 530 (13.6) | 3,368 (86.4) | |

| | | | | |
|---|---|---|---|---|
| | Assisted (Vacuum/Forceps) | 15 (21.4) | 55 (78.6) | |
| **Labor Duration** | | | | |
| | <12 hrs | 300 (5.1) | 5,563 (94.9) | <0.001 |
| | >12 hrs | 595 (17.9) | 2,720 (82.1) | |
| **Meconium-Stained Fluid** | | | | |
| | Yes | 300 (39.0) | 469 (61.0) | <0.001 |
| | No | 595 (7.1) | 7,814 (92.9) | |
| **Referral Status** | | | | |
| | Referred | 820 (10.0) | 7,371 (90.0) | <0.001 |
| | Direct Admission | 75 (7.6) | 912 (92.4) | |
| **Birth Weigh** | | | | |
| | Low (<2.5 kg) | 220 (31.2) | 485 (68.8) | <0.001 |
| | Normal (2.5–4.5 kg) | 670 (7.9) | 7,801 (92.1) | |
| | High (>4.5 kg) | 5 (100) | — | |
| **Multiplicity** | | | | |
| | Referred | 820 (10.0) | 7,371 (90.0) | <0.001 |
| | Direct Admission | 75 (7.6) | 912 (92.4) | |

### 3.3.3 Multivariate Logistic Regression of Factors Associated with Neonatal Birth Asphyxia

After controlling for potential confounding variables, several factors stayed statistically significant independent predictors of neonatal birth asphyxia. Among these, meconium-stained amniotic fluid emerged as the strongest predictor (AOR = 4.8), indicating that neonates exposed to meconium during delivery were approximately nearly five times strongly linked with development of asphyxia matched with those having clear amniotic fluid. These results underscore the critical role of timely detection and management of fetal distress during labor. Similarly, the appearance of gynoec-obstetric complications were strongly linked with neonatal birth asphyxia (AOR = 3.5). Mothers who experienced complications during pregnancy or delivery were significantly more likely to have newborns affected by asphyxia, highlighting the importance of early identification and appropriate management of high-risk pregnancies. In addition, low birth weight was found to be a significant predictor (AOR = 3.2), suggesting that neonates with lower physiological reserves are more vulnerable to hypoxic conditions during delivery.

Intrapartum factors also played a substantial role. Prolonged labor exceeding 12 hours was associated with nearly a threefold increase in the likelihood of birth asphyxia (AOR = 2.9), indicating possible deficiencies in labor monitoring and timely intervention. Furthermore, the mode of delivery, particularly assisted vaginal delivery and cesarean section, was linked to higher odds of asphyxia. This association likely reflects underlying complications that necessitated such interventions rather than the procedures themselves. Maternal healthcare utilization also influenced outcomes. Mothers who attended fewer antenatal care (ANC) visits (0–2) had twice the risk of delivering neonates with birth asphyxia (AOR = 2.1), emphasizing the protective effect of adequate ANC attendance in identifying and managing pregnancy-related risks. Lastly, referral status was independently associated with neonatal birth asphyxia (AOR = 1.5), suggesting that delays in accessing comprehensive emergency obstetric care among referred cases may contribute to adverse neonatal outcomes. Overall, these findings highlight that neonatal birth asphyxia is influenced by a combination of maternal, intrapartum, and neonatal factors, many of which are preventable through improved antenatal care, effective labor monitoring, and timely obstetric interventions.

**Table 4: Multivariate Logistic Regression of Factors Associated with Neonatal Birth Asphyxia**

| Variable | Category | AOR | 95% CI | p-value |
|---|---|---|---|---|
| **ANC Visits** | 0–2 vs 2–4 | **2.1** | 1.7–2.6 | <0.001 |
| | 4–6 vs 2–4 | 1.2 | 0.9–1.6 | 0.210 |
| **Obstetric Complications** | Yes vs No | **3.5** | 2.8–4.3 | <0.001 |
| **Mode of Delivery** | Cesarean vs Vaginal | **1.8** | 1.5–2.2 | <0.001 |
| | Assisted vs Vaginal | **2.6** | 1.4–4.9 | 0.003 |
| **Labor Duration** | >12 hrs vs <12 hrs | **2.9** | 2.4–3.5 | <0.001 |
| **Meconium-Stained Fluid** | Yes vs No | **4.8** | 3.9–5.9 | <0.001 |
| **Birth Weight** | Low vs Normal | **3.2** | 2.6–3.9 | <0.001 |
| **Referral Status** | Referred vs Direct | **1.5** | 1.2–1.9 | 0.001 |
| **Parity** | ≥5 vs 0–2 | **1.6** | 1.2–2.1 | 0.002 |
| **Maternal Education** | No formal vs Secondary+ | **1.9** | 1.3–2.8 | 0.001 |

## 4. DISCUSSIONS

### 4.1 Socio-Demographic and Obstetric Characteristics of Respondents

The findings of this study indicate that although the majority of mothers were aged between 18 and 33 years, the prevalence of neonatal birth asphyxia was higher among mothers younger than 18 years (15.6%) and those older than 41 years (16.7%). Additionally, low maternal educational attainment, inadequate antenatal care (ANC) attendance, and grand multiparity were significantly associated with increased rates of neonatal birth asphyxia. Mothers with no formal education recorded the highest prevalence of asphyxia (24.1%), while infants born to mothers who attended fewer than three ANC visits experienced a higher prevalence of asphyxia (18.4%). Similarly, mothers with five or more previous births had a higher prevalence of neonatal birth asphyxia (17.9%) compared to those with lower parity levels.

These findings are consistent with evidence from Sub-Saharan Africa, which identifies teenage pregnancy, advanced maternal age, low educational attainment, inadequate ANC utilization, and high parity as important maternal risk factors for neonatal birth asphyxia (Usman et al., 2022). Maternal education plays a crucial role in promoting positive health-seeking behavior, timely utilization of maternal health services, and adherence to recommended pregnancy care practices. Likewise, adequate ANC attendance facilitates early identification and management of pregnancy-related complications, thereby reducing the risk of adverse neonatal outcomes.

The study further revealed that intrapartum complications, particularly prolonged labor and meconium-stained amniotic fluid, were strongly associated with neonatal birth asphyxia. Infants exposed to meconium-stained amniotic fluid had a notably higher prevalence of asphyxia (39.0%), while prolonged labor was also a significant contributing factor. Furthermore, low birth weight infants experienced substantially higher rates of birth asphyxia (31.2%) compared to normal-weight newborns. These findings corroborate studies conducted in South Africa, where intrapartum complications and compromised fetal oxygenation were identified as major contributors to perinatal asphyxia and neonatal mortality (Stofberg et al., 2016). Collectively, these results underscore the importance of effective antenatal, intrapartum, and immediate postnatal care in reducing the burden of neonatal birth asphyxia.

### 4.2 Prevalence of Neonatal Birth Asphyxia

The prevalence of neonatal birth asphyxia in this study was 10.4% based on the Apgar score assessed at five minutes after birth. This finding confirms that birth asphyxia remains a significant public health concern despite ongoing improvements in maternal and newborn healthcare services. The prevalence observed is within the range reported in several studies conducted across Sub-Saharan Africa, where prevalence estimates vary from approximately 12% to 40%, depending on the study setting, population characteristics, and diagnostic criteria used (Enyew et al., 2025).

However, the prevalence recorded in the present study is lower than findings reported in other regional studies. For example, a study conducted at Rwamagana Level II Teaching Hospital in Rwanda reported a prevalence of 37.9%, while a hospital-based study in Khartoum, Sudan, reported a prevalence of 22.5% (Alfaifi et al., 2025; Mukobwa, 2025). The lower prevalence observed in the current study may reflect differences in healthcare infrastructure, availability of skilled birth attendants, quality of obstetric care, referral mechanisms, and implementation of neonatal resuscitation services. Nevertheless, the persistence of birth asphyxia among more than one in ten newborns highlights the need for continued efforts to strengthen maternal and newborn healthcare services, particularly during labor, delivery, and the immediate postnatal period.

### 4.3 Factors Associated with Neonatal Birth Asphyxia

The study identified several maternal, obstetric, and neonatal factors significantly associated with neonatal birth asphyxia. Maternal age emerged as an important determinant, with higher proportions of asphyxia observed among mothers younger than 18 years and those older than 41 years compared to mothers aged 18–33 years. This finding is consistent with studies conducted in Uganda and Ethiopia, which reported that teenage and advanced-age mothers are more likely to experience pregnancy and delivery complications that increase the risk of neonatal asphyxia (Apio et al., 2025; Enyew et al., 2025).

Maternal educational level was also significantly associated with birth asphyxia. The prevalence of asphyxia decreased progressively with increasing levels of maternal education, suggesting that education enhances awareness of maternal health services, promotes timely healthcare-seeking behavior, and improves compliance with recommended pregnancy care practices. Similar findings have been reported in Uganda, where lower maternal education was associated with delayed access to healthcare and poorer maternal and neonatal outcomes (Apio et al., 2025).

Antenatal care attendance demonstrated a significant protective effect against neonatal birth asphyxia. Infants born to mothers who attended fewer than three ANC visits experienced substantially higher rates of asphyxia than those whose mothers attended the recommended number of visits. This finding supports previous evidence indicating that adequate ANC provides opportunities for early detection and management of maternal and fetal complications, thereby reducing adverse birth outcomes (Enyew et al., 2025).

Maternal parity was another significant factor. Grand multiparous mothers experienced higher rates of neonatal birth asphyxia compared to mothers with fewer previous births. Similar observations have been reported in Rwanda and other low- and middle-income countries, where high parity has been associated with increased risks of obstetric complications and adverse neonatal outcomes (Ayingeneye, 2023).

Among neonatal factors, low birth weight was one of the strongest predictors of neonatal birth asphyxia. Infants weighing less than 2.5 kilograms had significantly higher rates of asphyxia compared to those with normal birth weight. This finding is consistent with evidence from India and other developing countries, which demonstrates that low birth weight infants are particularly vulnerable to respiratory distress, impaired adaptation to extrauterine life, and birth asphyxia (Soni et al., 2025). Additionally, multiple births were associated with an increased risk of asphyxia, corroborating findings from Ghana that highlighted the elevated vulnerability of twins and other multiple births to delivery complications and adverse neonatal outcomes (Abubakari et al., 2019).

The findings demonstrate that neonatal birth asphyxia is a multifactorial condition influenced by maternal socio-demographic characteristics, obstetric complications, and neonatal factors. These results emphasize the importance of strengthening maternal education, improving ANC utilization, enhancing intrapartum monitoring, and ensuring timely neonatal resuscitation to reduce the burden of birth asphyxia and improve neonatal survival outcomes.

## 5. CONCLUSIONS

Based on the study findings, it is concluded that neonatal birth asphyxia remains a significant public health concern and an important contributor to neonatal morbidity and mortality. The occurrence of birth asphyxia is influenced by a combination of maternal, intrapartum, and neonatal factors that collectively increase the risk of adverse birth outcomes.

First, maternal socio-demographic characteristics, including teenage pregnancy or advanced maternal age, low levels of education, inadequate utilization of antenatal care (ANC) services, and high parity, were found to be significantly associated with an increased prevalence of neonatal birth asphyxia. These factors may limit access to essential maternal healthcare services and reduce opportunities for early detection and management of pregnancy-related complications. Second, intrapartum factors, particularly prolonged labor and meconium-stained amniotic fluid, emerged as major predictors of neonatal birth asphyxia. These complications compromise fetal oxygenation during labor and delivery, thereby increasing the likelihood of neonatal distress and adverse outcomes at birth.

Third, neonatal characteristics such as low birth weight and multiple births were identified as important risk factors for birth asphyxia. Newborns with these characteristics are more vulnerable to respiratory difficulties and other complications during the immediate postnatal period. Finally, the study established that timely and effective neonatal resuscitation within the first ten minutes after birth plays a critical role in reducing the severity and consequences of birth asphyxia. This finding underscores the importance of ensuring the availability of skilled birth attendants, adequately trained healthcare providers, and essential neonatal resuscitation equipment in delivery settings.

The study highlights the need for comprehensive interventions aimed at improving maternal health education, promoting early and regular ANC attendance, strengthening intrapartum monitoring and management, and enhancing the quality of neonatal resuscitation services. Addressing these factors will contribute significantly to the prevention of neonatal birth asphyxia and the improvement of neonatal survival and health outcomes.

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