

## Factors Contributing to Birth Asphyxia as the Major Complication among Newborns Delivered at Gitwe District Hospital, Southern Province, Rwanda.

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### ABSTRACT

**Background:** Birth asphyxia is the failure to initiate and sustain breathing at birth leads to decrease oxygen perfusion to various organs. According to WHO, 4 million neonatal deaths occurred each year due to birth asphyxia. This study was aimed at evaluating antepartum, intrapartum, and fetal risk factors of birth asphyxia as the main complication among neonates delivered at Gitwe District Hospital

**Materials and Methods:** This was a case-control study, conducted from September 2016 to January 2017 at Gitwe District Hospital. Neonates diagnosed with birth asphyxia were considered as "cases" while neonates born either with normal vaginal delivery or by a cesarian section having no abnormality were considered as "control". All data were entered and analysed through STATA 12 and the significant association was at 5% level.

**Results:** Out of total 248 neonates, 54 were "cases" and 194 were "control". Significant antepartum risk factors were maternal age of 35+ (aOR= 2.2, 95% CI: 1.20-2.80), incomplete ANC (aOR= 1.30, 95% CI: 1.10-2.17), HIV (aOR= 5.8, 95%CI: 1.84-52.0). Significant Intrapartum risk factors were breech presentation (aOR= 2.8, 95% CI: 1.40-18.51), home delivery (aOR= 3.31, 95%CI: 2.2-6.7), long labor duration (aOR=2.0 95% CI: 2.41 – 12.3), and eclampsia(aOR=2.2, 95%CI:3.1 – 15.6) . Significant fetal risk factors were lower birth weight (aOR = 4.2, 95% CI: 2.2 – 8.5).

**Conclusion:** Considering the findings of the study, there is an urgent need to develop strategies for their early identification and management by involving women, health professionals and policy makers. In addition to what they do, community health workers should be trained for emergency obstetric care, basic newborn care including preliminary resuscitation measures to provide skilled birth attendance and encourage early recognition and referral to avoid a home delivery.

**Keywords:** Birth asphyxia, case-control study, Gitwe District Hospital, Rwanda

## 1.0 Introduction

The under 5 mortality has been substantially decreased in a good number of developing countries have (United Nations, 2013) while in contrast, deaths of neonates have remained endemic with an estimated 4 million annual neonatal deaths occurring globally (Lawn, 2014). It was recently showed that annual reduction rate in neonatal mortality between 1990 and 2012 (2%) was much lower than that for child mortality rate (3.4%) (United Nations, 2013; Lawn, 2012).

World Health Organization defined birth asphyxia as “the failure to initiate and sustain breathing at birth” (World Health Organization, 1997), and it is one of the leading causes of newborn mortality (Lopez A., 2006; Lopez & Mathers, 2006). Approximately 24% of neonatal deaths occurred each year due to birth asphyxia (United Nations, 2013). Birth asphyxia occurs when an inadequate amount of oxygen is delivered to the fetus, usually during labour and childbirth, leading to the risk of death (stillbirth or neonatal death) or lifelong disability in the surviving infant.

Causes of birth asphyxia may be maternal or fetal. Those who survive asphyxia at birth may have a chance to develop neurological complications including epilepsy, cerebral palsy and developmental delay (Haider & Bhutta, 2006). Risk factors of birth asphyxia have been divided into antepartum, intrapartum and fetal. Risk factors include increasing or decreasing maternal age, prolonged rupture of membranes, meconium stained fluid, multiple births, non-attendance for antenatal care, low birth weight infants, malpresentation, augmentation of labour with oxytocin, antepartum hemorrhage, severe eclampsia and pre-eclampsia, antepartum and intrapartum anemia (Kaye, 2003; Majeed, Memon, Majeed, Shaikh, & Rajar, 2007).

Birth asphyxia is one of the potential factors associated with neonatal mortality in Gitwe District Hospital. The neonatal mortality rate decreased slowly comparing to the other health indicators such as infant and under 5 years children mortality rates. Therefore, this study aims to determine the factors associated with birth asphyxia as the major complication among newborns delivered at Gitwe District Hospital. The hospital is located in Ruhango district, the southern province of Rwanda.

## 2.0 Materials and Methods

The data were extracted from mothers and neonates files stored in maternity and neonatology units of Gitwe District Hospital, with the aim of exploring the antepartum, intrapartum and fetal risk factors associated with birth asphyxia. As part of this survey, a case-control study was carried out. Neonates who were born with asphyxia were taken as cases and those without it as controls. All births in the period from September 2016 to January 2017 constituted a cohort of live births from mothers living in the Southern province, Ruhango district. All birth asphyxia which occurred in the reference period in the study area have been considered and included, likewise, the controls represented the profile of healthy neonates. Births which occurred outside Gitwe District Hospital but took postnatal care service in the hospital were also included. Multiple live-born babies were excluded.

The total number of 248 neonates were observed, among them 54 birth asphyxia occurred in the study period. The other 194 were considered as controls.

The outcome was birth asphyxia set as a binary variable of any birth with the APGAR score at 1 min is 0–3. The independent variables were maternal factors that include antepartum, intrapartum, and fetal risk factors. The data were analysed using STATA 12 through the bivariate and multivariate logistic regression models, reporting crude and adjusted Odds Ratio (OR) with their 95% CI at 5% significance level.

### 3.0 Results

During the period of 5 months (September 2016 – January 2017), among 248 neonates who were born at Gitwe District Hospital, 54 were of birth asphyxia (cases) and rest of 194 were normal (control). Male neonates were 147 (59.27%) and females were 101 (40.73%). The mean of maternal age in asphyxia group was  $29.05 \pm 6.12$  while the mean of maternal age in control group was  $27.96 \pm 6.41$ .

#### 3.1 Antepartum Risk factors

Among various investigated antepartum risk factors, birth asphyxia was found to be significantly associated with birth asphyxia. In fact, mothers at age of  $\geq 35$  years were at higher risk of developing birth asphyxia as compare to younger mothers (aOR= 2.2, 95% CI: 1.20-2.80). Risk increases significantly among mothers who experienced HIV infections (aOR= 5.8, 95%CI: 1.84-52.0). Mothers who have not attended antenatal care adequately were also at high risk of developing birth asphyxia (aOR= 1.30, 95% CI: 1.10-2.17). However, the marital status of the mother, parity, and gravida was found to be not related to an increased risk of birth asphyxia (Table 1).

**Table 1:** Antepartum factors of Mothers and their association with Birth asphyxia: Gitwe District Hospital (September 2016 – January 2017)

	Cases n (%)	Controls n (%)	Crude OR(95%CI)	Adjusted OR(95%CI)
<b>Marital status</b>				
Married	47(87.0)	162(83.5)	1.0	-
Unmarried	7(13.0)	32(16.5)	0.75(0.3 – 1.81)	N/A
<b>Age (years)</b>				
< 20	4(7.41)	19(9.79)	0.74(0.24 – 2.26)	N/A
20 – 34	41(75.93)	140(72.16)	1.0	-
35+	9(16.67)	35(18.04)	2.9(1.40 – 3.03)**	2.2(1.20 – 2.80)**
<b>ANC visits</b>				
Attended	27(50.0)	109(56.19)	1.0	
Not attended	27(50.0)	85(43.81)	1.80(1.51 – 2.47)*	1.30(1.10 – 2.17) **
<b>Parity</b>				
Primipara(I)	19(35.19)	80(41.24)	0.77(0.41 – 1.45)	N/A
Multipara(II-IV)	26(48.15)	98(50.52)	1.0	-
Grandmultipara (V+)	9(16.67)	16(8.25)	2.22(0.92 – 5.36)	N/A

<b>Gravidity</b>				
Primigravida(I)	14(25.93)	69(35.57)	2.3(1.2 – 4.3)	N/A
Multigravida(II-IV)	30(55.56)	107(55.15)	1.0	-
Grandmultigravida(V+)	10(18.52)	18(9.28)	3.0(0.3 – 7.3)	N/A
<b>Preexisting conditions</b>				
None	45(83.33)	182(93.81)	1.0	-
HIV+	5(9.26)	2(1.08)	9.8(1.84 – 52.0)**	5.8(1.84 – 52.0)**
Other <sup>†</sup>	4(7.41)	10(5.11)	1.2(0.12 – 7.2)	N/A

Note. <sup>†</sup>: hypertensive disorder, syphilis, and urinary infections OR: odds ratio, CI: confidence intervals, ANC: antenatal care, \*  $p \leq 0.05$ , \*\*  $p \leq 0.01$ , N/A: not applicable.

### 3.2. Intrapartum Risk Factors

The data of this study showed that deliveries that took place at home were more prone to the risk of developing Birth asphyxia (aOR=3.31, 95% CI: 2.2 – 6.7). Prolonged labour duration (aOR=2.0, 95% CI: 2.41 – 12.3) was also increased the risk of birth asphyxia mortality. Breech presentation of the fetus( aOR = 2.8, 95%CI:1.4 – 18.5), as well as eclampsia (aOR=2.2, 95% CI: 3.1 – 15.6), were significantly associated with increased risk of developing birth asphyxia (Table 2).

**Table 2:** Intrapartum Factors of Mothers and their association with Birth asphyxia: Gitwe District Hospital (September 2016 – January 2017)

	Cases n(%)	Controls n (%)	Crude OR(95%CI)	Adjusted OR(95%CI)
<b>Place of delivery</b>				
Hospital	41(75.93)	106(54.64)	1.0	-
Health Center	10(18.52)	72(37.11)	0.89( 0.24 – 3.28)	N/A
Home	3(5.56)	12(6.19)	3.38(2.2 – 6.8)**	3.31(2.2 – 6.7)**
<b>Delivery assistance</b>				
Doctor	27(48.05)	75(38.66)	1.0	-
Midwife/nurse	26(50.00)	102(52.58)	0.83(0.45 – 1.53)	N/A
None	1(1.85)	11(5.67)	0.31(0.4 – 2.5)	N/A
<b>Mode of delivery</b>				
Vaginal	32(59.26)	122(62.89)	1.0	-
C-section	22(40.74)	68(30.93)	1.53(0.82 – 2.8 )	N/A
<b>Delivery complication</b>				
None	47(87.04)	170(87.63)	1.0	-
Hemorrhage	3(5.56)	15(7.73)	0.7(0.19 – 2.51)	N/A
Eclampsia	2(3.70)	3(1.55)	2.44(3.4 – 15.0) *	2.2(3.1 – 15.6) *
Other <sup>†</sup>	2(3.70)	6(3.09)	0.4(0.2 – 3.41)	N/A

**Fetal presentation**

Head/vertex	40(73.62)	163(80.30)	1.0	-
Feet/breech	5(9.70)	9(4.29)	2.9(1.6 – 15.0)**	2.8(1.4 – 18.5) **
Transverse	3(5.56)	3(1.55)	1.2(0.7 – 3.0)	N/A
Missing	6(11.12)	19(13.86)	0.7(0.9 – 3.6)	N/A

Note. OR: † = preeclampsia, uterine rupture, obstructed labour odds ratio, CI: confidence intervals

\*p ≤ 0.05, \*\* p ≤ 0.01, N/A: not applicable.

**3.3. Fetal risk factors**

The risk for developing birth asphyxia was higher in the infant of lower birth weight i.e. less or equal to 2.5 kg (OR = 4.2, 95% CI: 2.4 – 8.5, p = <0.01) as compared to the infant with the weight of >2.5 kg. Sex of neonate, birth rank, and gestational age was not associated with Birth asphyxia.

**Table 3:** Fetal risk factors and their association with Birth asphyxia: Gitwe District Hospital (September 2016 – January 2017)

	Cases n (%)	Controls n (%)	Crude OR(95%CI)	Adjusted OR(95%CI)
<b>Sex of neonate</b>				
Female	14(16.87)	69(83.13)	1.0	-
Male	40(24.24)	125(75.76)	1.57(0.8 – 3.1)	N/A
<b>Birth weight(grammes)</b>				
NBW(> = 2500)	15(17.86)	69(82.14)	1.0	-
LBW(< 2500)	39(23.78)	125(76.22)	5.40(2.7 – 8.77) **	4.2(2.4 – 8.5) **
<b>Gestational age</b>				
Term	41(24.81)	150(75.19)	1.0	-
Preterm	13(22.81)	44(7.19)	1.08(0.5 – 2.2)	N/A
<b>Birth rank</b>				
I	22(21.65)	76(78.35)	0.9(0.5 – 1.9)	N/A
II-IV	24(21.55)	91(78.45)	1.0	-
V+	8(22.86)	27(77.14)	1.07(0.4 – 2.5)	N/A

Note. OR: odds ratio, CI: confidence intervals, LBW: lower birth weight, NBW: normal birth weight

\*\* p ≤ 0.01, N/A: not applicable

**4.0 Discussion**

The objective of this study was to evaluate the antepartum, intrapartum and fetal risk factors of birth asphyxia among newborns who delivered at Gitwe District Hospital. In this study, the maternal age, the insufficient ANC visits, HIV infections were reported as antepartum maternal risk factors. Intrapartum risk factors which showed the significant association were home delivery without a qualified birth attendant, breech presentation, eclampsia, and long labour duration. The fetal risk factor which significantly associated with birth asphyxia was

lower birth weight. The study indicated that maternal age of 35 years and above, and insufficient ANC visits have been one of the main risk factors for developing birth asphyxia. These findings were different from those mentioned by Pitsawong and Panichkul; Nayeri, Shariat, Dalili, Adam, Mehrjerdi, and Shakeri; Onyearugha and Ugboma in 2012; and Lee et al. in 2008 in the previous studies which reported young maternal age (20–25 years) and primigravida as the important birth asphyxia risk factors. The past study by Pitsawong and Panichkul (2012) and that by Nayeri (2012) reported pre-term delivery as one of the significant risk factors of birth asphyxia. This study failed to prove this association; even though preterm babies face multiple morbidities including organ system, immaturity especially lung maturation causing respiratory failure (Lee, et al., 2008), the improvement in the post-natal care particularly among the preterm newborns makes actually a preterm delivery to be not a risk factor of birth asphyxia as found in this study.

The reduction of the factors that associated with birth asphyxia in low-income and developing countries is a difficult task due to various reasons. One of these reasons was reported by Lee et al. in 2008 and Rani, Chawla, Huria, and Jain in 2012 to be the delivery conducted by untrained traditional birth attendants. This reflects our limited resources and uneducated rural areas where, due to the lack of awareness and resources, home births by untrained birth attendants were customary (Lee, et al., 2008). In the study area, most deliveries occurred at hospitals but those births which took place at home were found to be the significant risk factor for causing birth asphyxia. These findings are in line with those previously reported by Rani et al. (2012).

Findings showed that the majority of the mothers of affected neonates received counselling regarding birth asphyxia during antenatal care visits. However, the majority of women may not be expected to be familiar with or adopt appropriate preventive attitudes with respect to birth asphyxia during their pregnancies as contrary to past studies (Onyearugha & Ugboma, 2012; Ibrahim & Parkash, 2002). For reducing the burden of birth asphyxia, women need to be educated with not only about her pregnancy but also with respect to the intrapartum complications such as birth asphyxia.

The study by Lee et al. (2008), and Khreisat and Hababbeh (2005) found that preterm delivery and maternal fever were significantly associated with birth asphyxia. Their findings were not similar to those in this study. However, HIV infections were found to be a potential antepartum risk factor of birth asphyxia. Furthermore, premature infants are more vulnerable to ischemia due to incomplete blood-brain barrier formation (Lee, et al., 2008).

Regarding the mode of delivery, it was shown that most of the cases and control were delivered by normal vaginal delivery; this result was very much similar to the findings of two studies conducted in Pakistan by Bibi (2012); and Saeed et al. (2012) on the same issue. In our study, meconium-stained amniotic fluid, contrary to a previous study (Pitsawong & Panichkul, 2012), was found not to be present as one of the risk factor of birth asphyxia.

In this study, the breech presentation was 2.8 times more likely to cause birth asphyxia than other fetal presentations. These findings were in line with previous studies (Pitsawong & Panichkul, 2012; Chandra, Ramji, & Thirupuram, 1997). According to Pitsawong and Panichkul (2012), this may be explained by the fact that breech presentation had a higher risk of umbilical cord prolapse, head entrapment, birth trauma and perinatal mortality.



In this study, low birth weight is one of the major risk factors for causing birth asphyxia; the study findings are in line with those reported in the previous study by Pitsawong and Panichkul (2012). This may be due to the fact that mother of low birth weight babies often related to complications of such as maternal hypertension and diabetes that were present before the baby is delivered (Baker, Campbell, & Lees, 2006). Hypertension can cause a decrement in blood flow resulting in asphyxia (Majeed, Memon, & Rajar, 2007). In our study, factors such as sex of neonate, birth rank, and gestational age were not associated significantly with birth asphyxia same as indicated in past study by Mir, Faquih, and Legnain( 1989). Similarly to the findings from Lee et al (2008), eclampsia found to be associated significantly with increased risk of birth asphyxia. Factors such as the previous history of birth asphyxia, presence of maternal hypotension, antepartum hemorrhage and diabetes mellitus were not evaluated as significant risk factors of birth asphyxia but they were more commonly present in mother of affected neonates (Pitsawong & Panichkul, 2012; Lee, et al., 2008; Nayeri et al. 2012).

This study was hospital-based and addressed a common problem in our community. The majority of the study population as not being delivered under the care of trained professionals primarily at home and private clinics also reflects another important issue pertaining to mortality and morbidity.

The strength of this study lies in its case-control design where the important risk factors of birth asphyxia were examined. All attempts were made to ensure that the data collected was reliable and valid, and the methods were reproducible. However, our study has some limitations.

The first limitation was that our study was conducted in one district hospital of Gitwe and data couldn't predict the overall situation in the country. The second limitation was a short sample size of the study – collected in short period of time – which may reduce the power of the study. The third limitation was that not all documented risk factors of birth asphyxia were considered here due to the use of hospital records which were filled with limit information.

## 5.0 Conclusion and recommendation

The majority of these factors may be controllable and manageable by means of good and prenatal care. Therefore, there is an urgent need to develop strategies for their early identification and their management by involving women, families, communities, community health workers, health professionals and policy makers. In addition to what they do, community health workers should be trained for emergency obstetric care, basic newborn care including preliminary resuscitation measures to provide skilled birth attendance and encourage early recognition and referral to avoid a home delivery.

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## Declaration

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## Author’s contribution

Author 1 involved with the study design, conception of the research work, acquisition, analysis, interpretation of data, drafting the manuscript, and revising critically for important intellectual content and final approval of the version to be published

Author 2 involved in the collection of data, reviewing and editing the manuscript

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