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*Full Length Research Paper*

# Maternal and fetal determinants of mortality in babies with birth asphyxia at Osogbo, Southwestern Nigeria

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**Birth Asphyxia, defined as a simultaneous occurrence of hypoxic and ischaemic insult severe enough to cause metabolic acidosis, neonatal encephalopathy and multiorgan system dysfunction which now manifest with failure of a newborn to initiate and sustain respiration at birth. Maternal and fetal risk factors have been identified as major predispositions to birth asphyxia. The aim of the present study therefore, was to identify the maternal and fetal perinatal factors contributing to poor outcome (mortality) in babies admitted for birth asphyxia in our hospital in Southwestern Nigeria so as to anticipate the management. Consecutive babies with birth asphyxia were those with APGAR score of ≤ 7 at five minutes[2] and/or did not cry immediately after delivery in the presence of neurologic symptoms, admitted into special care baby's unit were studied. Of the 1163 babies admitted between 2010 and 2013, 415 (35.7%) were asphyxiated; 227 (54.7%) were males, 188 (45.3%) females, F:M was 1.2:1; However, 99 (23.9%) of the 415 asphyxiated babies died; 11 (11.1%) and 88 (88.9%) had moderate and severe asphyxia respectively. Also, 56 (56.6%) were males and 43 (43.4%) females. Significantly higher proportion of babies of mothers who had no antenatal care, mothers from low socioeconomic class 4 and 5, and who delivered outside the health facility (outborn) died ( p at least 0.001). More babies who suffered fetal distress, breech delivery and who had meconium stained liquor died (p is at least 0.04). Therefore, multiprong approach to reduce mortality from birth asphyxia is necessary like improvement of social status of women through educational and economic empowerment; provision of affordable, adequate, well equipped and cheap antenatal care to all pregnant mothers; provision of functional delivery health facilities to attend to mothers in labour to detect high risk mothers for better anticipatory care.**

**Keywords:** Maternal, Fetal, Determinants, Birth Asphyxia, Outcome, Nigeria

## INTRODUCTION

Birth Asphyxia, defined as a simultaneous occurrence of hypoxic and ischaemic insult severe enough to cause metabolic acidosis, neonatal encephalopathy and multiorgan system dysfunction which now manifest with failure of a newborn to initiate and sustain respiration at birth (Aslam et al., 2014; Lincetto, 2007). Intrapartum asphyxia accounts for 25 to 30% of stillbirths (Lincetto, 2007; Bryce et al., 2005; Lawn et al., 2007). Asphyxia occurs when there is an impairment of blood-gas exchange, resulting in hypoxemia and hypercapnia. The combination of hypoxia and ischemia results in a cascade of biochemical changes, which lead to neuronal cell death and brain damage (Aslam et al., 2014). Continuous asphyxia also lead to multiple organ systems dysfunction.

Birth asphyxia is a serious clinical problem worldwide and contributes greatly to neonatal mortality and morbidity (Aslam et al., 2014; Pitsawong and Panichkul, 2012). It is a leading cause of neonatal mortality and one of the leading causes of neonatal deaths within first week of life (Bryce et al., 2005). It is strongly associated with 1.1 million intrapartum stillbirths and is responsible for long-term neurological disability and impairment (Aslam et al., 2014; Lawn et al., 2007).

The actual number of deaths in the developing countries may not be known since most births and deaths occur in the community and are unregistered or unreported. However, it is estimated that about 23% of 4 million neonates that die annually in developing countries die from birth asphyxia, Nigeria inclusive (Lincetto, 2007). Maternal and fetal risk factors have been identified as major predispositions to perinatal birth asphyxia (Kaye, 2003). Known maternal risk factors include increasing or decreasing maternal age, non-attendance for antenatal care, prolonged rupture of membranes, augmentation of labour with oxytocin, ante partum hemorrhage, severe eclampsia, pre-eclampsia, ante partum, intrapartum anemia and fetal risk factors like meconium stained fluid, multiple births, low birth weight infants, malpresentation (Kaye, 2003; Majeed et al., 2007). The prognosis and severity of the symptoms in a child with birth asphyxia depend on the risk factors and management of the patient. Asphyxia can therefore be prevented or anticipated to a large extent when maternal and/or fetal adverse factors are recognized and adequately taken care of. The aim of the present study therefore, was to identify the maternal and fetal perinatal factors contributing to poor outcome (mortality) in babies admitted for birth asphyxia in our hospital in Southwestern Nigeria so as to anticipate the management.

The special care babies unit of Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Southwestern Nigeria provides care for at risk and ill babies. It offers special care for babies delivered in the hospital (inborn) and those delivered outside the teaching hospital (outborn). Mainly the outborns are delivered in the homes and health institutions in Osogbo, the Osun state capital and the adjoining towns and villages of about 50 kilometers radius.

## PATIENTS AND METHODS

After appropriate Ethical Clearance was obtained from the Research and Ethical Clearance Committee of the institution and Informed consent from parents of each baby and permission from the clinical staff of the maternity and neonatal unit, consecutive newborn infants with birth asphyxia brought into the Special care baby unit (SCBU) of the hospital were registered into the research proforma designed for the study and prospectively studied. Babies with birth asphyxia were those with APGAR score of ≤ 7 at five minutes[2] and/or did not cry immediately after delivery in the presence of neurologic symptoms. Mild-Moderate Asphyxia is regarded as Apgar score at 1 min is 4–7 and Severe Asphyxia as Apgar score at 1 min is 0–3 (Pitsawong and Panichkul, 2012). For babies delivered outside the health facility, birth asphyxia was presumed in baby whom there was history that the baby had failed to cry or breathe at birth or had gasped for a long time or had to be stimulated for a prolonged period of time or was unable to suck in the first 24 hours with or without associated pallor, cyanosis, neurologic dysfunction and multisystemic affectation like respiratory distress, abdominal distension, coma or seizures. Exclusion Criteria were:

a) Birth weight less than 1000 g and less than 28 week gestation.

b) Babies with obvious congenital or chromosomal congenital anomalies including congenital heart defects or features suggestive of congenital infections

The collected data were entered into a research proforma designed for the study. Information obtained included maternal age, parity, working and educational status, past medical and obstetric history, history of present pregnancy which include history of hypertension, febrile illnesses, antepartum haemorrhage (APH), jaundice, convulsion or any medical conditions like diabetes mellitus, bronchial asthma and sickle cell anaemia. Also, history of antenatal care (whether taken or not) and where. Place and mode of delivery, reason(s) for instrumental delivery or caesarean section, duration of labour, duration of drainage of liquor and its characteristics, use of any drug, babies condition at birth, details of infant resuscitation methods were obtained from the mother, her relatives and/or case notes. Also, labour charts and referral note from health facility where feasible were assessed. The gestational age (GA) in weeks was determined using the mother's dates and Ballard's gestational assessment chart. The socio-economic class of the parents was assessed based on occupation and educational levels attained by both parents as described by Oyedeji (Oyedeji, 1985).

The data generated was entered into IBM personal computer. Analysis of the data was undertaken with the statistical package for the social sciences (SPSS version 17). Both maternal and fetal characteristics were compared among babies who survived asphyxia and those who died. Simple frequencies and chi square test of significance were calculated.

**Table 1.** Showing comparison of selected of maternal sociodemographic profile between babies who survived and died from perinatal asphyxia

| Variable | Mothers of Babies who survived n = 316 | Mothers of Babies who died n = 99 | $X^2$ | *p value* |
|---|---|---|---|---|
| **Age (years)** | | | | |
| <18 (n=49) | 38 | 18 (36.7) | | |
| 18-35 (n=297) | 229 | 69 (23.2) | | |
| >35 (n=59) | 49 | 12 (20.3) | 2.8 | 0.2 |
| **Socioeconomic status** | | | | |
| 1 and 2 (n=79) | 72 | 07 (8.9) | | |
| 3 (n=111) | 84 | 23 (20.7) | | |
| 4 and 5 (n=225) | 160 | 69 (30.7) | 15.1 | 0.001 |
| **Antenatal care** | | | | |
| Yes (=269) | 242 | 27 (10,0) | | |
| No (n=146) | 74 | 72 (49.3) | 80.2 | 0.000 |
| **Place of delivery** | | | | |
| Inborn (n=178) | 160 | 18 (10.1) | | |
| Outborn (n=237) | 156 (65.8) | 81 (34.2) | 32.3 | 0.000 |

Significant (S) = $p<0.05$.

## RESULTS

### Admissions, Gender and Places of birth and mortality

One thousand, one hundred and sixty three babies were admitted into special care baby's unit between 2010 and 2013. Six hundred and thirty five (54.6%) were males while 528 (45.4%) were females, M:F ratio was 1.2:1. Seven hundred and thirty three (63.0%) were delivered by spontaneous vertex while 430 (37.0%) were delivered by caesarean section.

Of the 1163 babies, 415 (35.7%) were asphyxiated; 227 (54.7%) were males, 188 (45.3%) females, F:M was 1.2:1; 308 (74.2%) was delivered by SVD while 107 (25.8%) by caesarean section.

One hundred and seventy eight (42.9%) of the 415 asphyxiated babies were inborn while 237 (57.1%) were outborns. Also of the outborns, 64 (27.0%) were from State hospitals, 35 (14.8%) from Mission hospital, 49 (20.7%) from Primary health care centres/maternity centres, 35 (14.8%) from Private hospital, 28 (11.8%) from mission house and 26 (11.0%) from home, in-transit and traditional birth attendants while of the 178 in-borns, 68 (38.2%) were booked while 110 (61.8%) were unbooked.

In all, of the 415 asphyxiated babies, 269 (64.8%) had some forms of antenatal care while 146 (35.20%) had no formal antenatal care.

However, 99 (23.9%) of the 415 asphyxiated babies died; 11 (11.1%) and 88 (88.9%) had moderate and severe asphyxia respectively. Also, 56 (56.6%) were males and 43 (43.4%) females. There is no gender differences among the mortality $p = 0.1$.

### Maternal sociodemograhic and perinatal adverse factors

Table 1 Shows comparison of selected of maternal sociodemographic profile between babies who survived and died from perinatal asphyxia. Significantly higher proportion of babies of mothers who had no antenatal care, mothers from low socioeconomic class 4 and 5, and who delivered outside the health facility (outborn) died ( p at least 0.001).

Table 2 shows some adverse maternal perinatal factor between babies who survived and died from perinatal asphyxia. Leading adverse maternal factors that contributed to asphyxia were prolonged labour, premature rupture of membrane, preterm labour, prolonged second stage of labour, obstructed labour, maternal malaria and antepartum haemorrhage. However, when the adverse maternal perinatal factors were compared between babies who survived and died from perinatal asphyxia; significantly higher proportion of babies of mothers who had prolonged labour, premature rupture of membrane, prolonged second stage of labour, obstructed labour and pregnancy induced hypertension died (p is at least 0.01) as shown in Table 3.

### Fetal adverse factors

Some adverse fetal factors among 415 babies who died from perinatal asphyxia are presented in Table 4. Main fetal factors that contributed to asphyxia were fetal distress, preterm labour, meconium stained liquor, premature rupture of membrane, intrauterine growth restriction and macrosomia. However, significantly higher

**Table 2.** Some adverse maternal perinatal factor among 415 babies who had perinatal asphyxia

| Variable | No of mothers affected n(%) |
|---|---|
| Prolonged labour | 78 (18.8) |
| Premature rupture of membrane | 64 (15.4) |
| Preterm labour | 56 (13.5) |
| Prolonged second stage of labour | 53 (12.8) |
| Obstructed labour | 50 (12.0) |
| Maternal malaria | 49 (11.8) |
| Antepartum haemorrhage | 42 (10.1) |
| Pregnancy induced hypertension | 34 (8.2) |
| Post-term/Postdate labour | 32 (7.7) |
| Maternal anaemia | 27 (6.5) |
| Maternal infection including Urinary tract infections | 23 (5.5) |
| Maternal sedation | 20 (4.8) |
| Gestational diabetes mellitus | 11 (2.7) |
| Chorioamnionitis | 10 (2.4) |
| Eclampsia | 9 (2.2) |
| Sickle cell anaemia | 8 (1.9) |
| Precipitate labour | 6 (1.4) |
| Maternal demise (death) | 6 (1.6) |
| Ruptured uterus | 4 (1.0) |
| Maternal trauma including Road traffic accident | 4 (1.0) |
| Not known | 78 (18.8) |
| Total | 415+ |

+Multiple factors were seen in some

**Table 3.** Showing Comparison of some adverse maternal perinatal factor between babies who survived and died from perinatal asphyxia

| Variable | No of mothers who lost babies to asphyxia n(%) N=415 | Mothers of Babies who survived n = 316 | Mothers of Babies who died n = 99 | p value | $X^2$ | |
|---|---|---|---|---|---|---|
| Prolonged labour | 78 (18.8) | 42 (13.3) | 36 (36.4) | 26.2 | 0.000 | S |
| Premature rupture of membrane | 64 (15.4) | 39 (12.3) | 25 (25.3) | 9.6 | 0.002 | S |
| Preterm labour | 56 (13.5) | 36 (11.4) | 20 (20.2) | 4.0 | 0.05 | |
| Prolonged second stage of labour | 53 (12.8) | 34 (10.8) | 19 (19.2) | 4.8 | 0.03 | S |
| Obstructed labour | 50 (12.0) | 29 (9.2) | 21 (21.2) | 10.3 | 0.001 | S |
| Maternal malaria | 49 (11.8) | 37 (11.7) | 12 (12.1) | 0.01 | 0.9 | |
| Antepartum haemorrhage | 42 (10.1) | 28 (8.9) | 14 (14.1) | 2.3 | 0.1 | |
| Pregnancy induced hypertension | 34 (8.2) | 20 (6.3) | 14 (14.1) | 6.1 | 0.01 | S |
| Post-term/Postdate labour | 32 (7.7) | 27 (8.5) | 5 (5.0) | 0.8 | 0.4* | |
| Maternal anaemia | 27 (6.5) | 20 (6.3) | 7 (7.1) | 0.001 | 1.0* | |
| Maternal infection including Urinary tract infections | 23 (5.5) | 17 (5.4) | 6 (6.1) | 0.0 | 1.0* | |
| Maternal sedation | 20 (4.8) | 16 (5.1) | 4 (4.0) | 0.02 | 0.9* | |
| Gestational diabetes mellitus | 11 (2.7) | 6 (1.9) | 5 (5.1) | 1.8 | 0.2* | |
| Chorioamnionitis | 10 (2.4) | 5 (1.6) | 5 (5.1) | 2.5 | 0.1* | |
| Eclampsia | 9 (2.2) | 4 (1.3) | 5 (5.1) | 3.5 | 0.06* | |
| Sickle cell anaemia | 8 (1.9) | 7 (2.2) | 1 (1.0) | 0.00 | 1.00* | |
| Precipitate labour | 6 (1.4) | 5 (1.6) | 1 (1.0) | 0.00 | 1.00* | |
| Maternal demise (death) | 6 (1.6) | 3 (0.9) | 3 (3.0) | 1.1 | 0.3* | |
| Ruptured uterus | 4 (1.0) | 1 (0.3) | 3 (3.0) | 3.3 | 0.07* | |
| Maternal trauma including Road traffic accident | 4 (1.0) | 2 (0.6) | 2 (2.0) | 0.4 | 0.5* | |
| Not known | 78 (18.8) | 53 (16.8) | 25 (25.3) | 3.6 | 0.06 | |
| **Total** | **415+** | **316+** | **99+** | | | |

+Multiple factors were seen in some; * Yates corrections applied
S= Significant;

**Table 4.** Some adverse fetal factors among 415 babies who died from perinatal asphyxia

| Variable | No of babies affected n (%) |
|---|---|
| Fetal distress | 109 (26.3) |
| Preterm labour | 56 (13.5) |
| Meconium stained liquor | 47 (11.3) |
| Premature rupture of membrane | 29 (7.0) |
| Intrauterine growth restriction | 29 (7.0) |
| Macrosomia | 27 (6.5) |
| Multiple gestation | 25 (6.0) |
| Congenital anomalies | 13 (3.1) |
| Cord prolapsed | 12 (2.9) |
| Postdate/post-term | 12 (2.9) |
| Malpresentaion including face | 12 (2.9) |
| Breech delivery | 11 (2.7) |
| Difficult extraction | 11 (2.7) |
| Polyhydraminous | 8 (1.9) |
| Oligohydraminous | 6 (1.4) |
| Shoulder dystocia | 05 (1.2) |
| Cord round the neck | 04 (1.0) |
| Hand prolapsed | 02 (0.5) |
| Unknown | 45 (10.8) |
| **Total** | **415+** |

+Multiple factors were seen in some

**Table 5.** Comparison of some adverse maternal perinatal factor between babies who survived and died from perinatal asphyxia

| Variable | No of babies affected n (%) | Mothers of Babies who survived n = 316 | Mothers of Babies who died n = 99 | p value | $X^2$ |
|---|---|---|---|---|---|
| Fetal distress | 109 (26.3) | 71 (22.5) | 38 (38.4) | 9.9 | 0.002 S |
| Preterm labour | 56 (13.5) | 46 (14.6) | 10 (10.1) | 1.3 | 0.3 |
| Meconium stained liquor | 47 (11.3) | 32 (10.1) | 15 (15.2) | 4.7 | 0.03 S |
| Macrosomia | 27 (6.5) | 24 (7.6) | 3 (3.0) | 1.9 | 0.17* |
| Premature rupture of membrane | 29 (7.0) | 22 (7.0) | 7 (7.1) | 0.0 | 1.00* |
| Intrauterine growth restriction | 29 (7.0) | 22 (7.0) | 7 (7.1) | 0.0 | 1.00* |
| Multiple gestation | 25 (6.0) | 19 (6.0) | 6 (6.1) | 0.0 | 1.00* |
| Malpresentaion including face | 12 (2.9) | 11 (3.5) | 1(1.0) | 0.9 | 0.3* |
| Difficult extraction | 11 (2.7) | 10 (3.2) | 1 (1.0) | 0.7 | 0.4* |
| Breech delivery | 11 (2.7) | 5 (1.6) | 6 (6.1) | 4.3 | 0.04 S |
| Postdate/post-term | 12 (2.9) | 10 (3.2) | 2 (2.0) | 0.06 | 0.8* |
| Congenital anomalies | 13 (3.1) | 9 (2.4) | 4 (4.0) | 0.07 | 0.8* |
| Cord prolapsed | 12 (2.9) | 7 (2.2) | 5 (5.1) | 1.3 | 0.3* |
| Polyhydraminous | 8 (1.9) | 7 (2.2) | 1 (1.0) | 0.1 | 0.7* |
| Oligohydraminous | 6 (1.4) | 5 (1.6) | 2 (2.0) | 0.00 | 1.0* |
| Shoulder dystocia | 05 (1.2) | 3 (0.9) | 2 (2.0) | 0.1 | 0.7* |
| Hand prolapsed | 02 (0.5) | 2 (0.6) | 0 (0.0) | 0.00 | 1.00* |
| Cord round the neck | 04 (1.0) | 2 (0.6) | 2 (2.0) | 0.4 | 0.5* |
| Unknown | 45 (10.8) | 23 (7.3) | 22 (22.2) | 17.4 | 0.00 S |
| **Total** | **415+** | **316+** | **99+** | | |

+Multiple factors were seen in some
* Yates corrections applied
S= Significant

proportion of babies who suffered fetal distress, breech delivery and who had meconium stained liquor died (p is at least 0.04).

## DISCUSSIONS

Birth asphyxia is one of the leading indications for admission and cause of mortality in our unit. This is similar to what is obtained in many studies from similar developing countries. Birth asphyxia accounted for 35.7% of the admissions in the present study. Previous study in the same unit has shown asphyxia as the leading cause of mortality in our unit (Adebami et al., 2010). In a multicentre prospective study involving 4267 deliveries in eight countries over a three month period in east, central and southern African, asphyxia incidence rate among newborns was 22.9% which is lower than what is obtained in the present study. However, the study design and time of study differed. While the present study examined cases of asphyxia severe enough to be admitted in contrast to multicentre study which examined asphyxia at deliveries (Kinoti, 1993).

In the present study, 23.9% of the asphyxiated babies died. This is similar to the observation by WHO that 23% of neonatal deaths in low income countries are due to asphyxia.[2] This value is within the range known for mortality rate resulting from asphyxia in the developing countries. Mortality from birth asphyxia in the developing countries ranged between 25% to 50% (Lawn et al., 2007).

The present study also showed that predisposition to asphyxia morbidity and mortality is multifactorial and may involve complex factors interacting. Both maternal and fetal factors were found to be significant predisposition to the occurrence of asphyxia mortality in the present study. However, socio-demographically, maternal age did not have significant relationship with survival in birth asphyxia. This finding was consistent with findings of Shireen et al (2009), Bhuiyan and Crawford studies (Crawford, 1996). who also found that maternal age as an isolated event cannot be considered as a risk factor for birth asphyxia. Among the significant factors were babies of mothers from low socioeconomic class, babies of mothers who did not receive antenatal care and babies of mothers who delivered outside hospital facility (outborns). Padayachee and Ballot (Padayachee and Ballot, 2013) in a study in Johannesburg also found that low socioeconomic class and poor booking are predisposition to birth asphyxia. Similarly, Etuk (Etuk and Etuk, 2001), also showed that birth asphyxia was more prevalent in the unbooked cases. Quite often, low socioeconomic class, babies of mothers who did not receive antenatal care and babies of mothers who delivered outside hospital facility (outborns) as adverse perinatal factors co-exist, necessitating a simultaneous discussion of their roles. For example, the role of mothers of low socioeconomic class was intertwined with those of mothers who did not attend antenatal care and those who delivered outside the health facilities. This may be a reflection of poverty, ignorance and poor health seeking behavior of mothers in developing countries and especially in the region of present study (Alex-Hart et al., 2014). Also, health financing in Nigeria is mostly out of pocket hence, pregnant women of low socioeconomic status may not have enough fund to attend health facilities to detect their risk factors. National health insurance in Nigeria only covered about 3% of the population under the formal sector health insurance program and 70.8% of Nigerians live below the poverty line and cannot afford health care costs (Vonke and Sunday, 2014).

Leading adverse maternal factors to the development of birth asphyxia and also mortality from asphyxia in the present study were prolonged labour, premature rupture of membrane, preterm labour, prolonged second stage of labour, Obstructed labour and antepartum haemorrhage. This is similar to findings by Aslam et al in Pakistan (Aslam et al., 2014), Shireen et al in Bangladesh (Shireen et al., 2009) and Padayachee et al in Johonnesburg (Padayachee and Ballot, 2013). Aslam et al found home delivery, poor booking and preeclampsia as major risk factors for asphyxia in Pakistan (Aslam et al., 2014) while Shireen et al found pre-eclampsia, prolonged rupture of membranes, cephalopelvic disproportion, prolonged labour, obstructed labour and oxytocin use as major disposition to birth asphyxia in Bangladesh (Shireen et al., 2009). It therefore, means that good antenatal care and active management of labour can to a large extent prevent birth asphyxia morbidity and mortality.

Main fetal factors predisposing to asphyxia were fetal distress, preterm labour, meconium stained liquor. Also, higher proportion of babies delivered breech, babies who suffered fetal distress or had meconium stained liquor died. These could be causes or effects of asphyxia. Perinatal and neonatal mortality indices are indicators of the social, educational and economic development of a community, hence the role of perinatal asphyxia which is a major factor contributing to perinatal and neonatal mortality is enormous.

In conclusion, multfactorial factors involved in predisposition of poor outcome in birth asphyxia in the present study were prolonged labour, premature rupture of membrane, prolonged second stage of labour, obstructed labour, pregnancy induced hypertension

fetal distress, breech delivery and presence of meconium stained liquor. Therefore, multiprong approach like improvement of social status of women through educational and economic empowerment; provision of affordable, adequate, well equipped and cheap antenatal care to all pregnant mothers to detect risk factors for birth asphyxia early; provision of functional delivery health facilities to attend to mothers in labour for better anticipatory care will significantly reduce this high and

unacceptable level of child wastage in the developing countries.

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### REFERENCES

Adebami OJ, Joel-Medewase VI, Oyedeji OA and Oyedeji GA (2010). A review of neonatal admissions in Osogbo, Southwestern Nigeria. Nig. Hosp. Pract. 5:36-41.

Alex-Hart BA, Dotimi DA, Opara PI (2014). Mothers' recognition of newborn danger signs and health seeking behaviour. Nig. J. Paed. 41 (3):199 –203

Aslam HM, Saleem S, Afzal R, Iqbal U, Saleem MS, Shaikh AWM, Shahid N (2014). Risk Factors of birth asphyxia. Italian J. Pediatrics. 40:94 DOI 10.1186/s13052-014-0094-2

Bryce J, Boschi-Pinto C, Shibuya K, Black RE (2005). WHO estimates of the causes of death in children. Lancet, 365(9465):1147–1152.

Crawford JS (1996). Maternal age as an isolated factor in the incidence of Perinatal asphyxia. Am. J. Obst. Gynecol. 94: 281-282.

Etuk SJ, Etuk IS (2001). Relative risk of Birth asphyxia in babies of booked woman delivered in unorthodox health facilities in Calabar, Nigeria. Acta Trop. 79: 143-147.

Kaye D (2003). Antenatal and intrapartum risk factors for birth asphyxia among emergency obstetric referrals in Mulago Hospital, Kampala, Uganda. East Afr. Med. J. 80(3):140–143

Kinoti SN (1993). Asphyxia of the newborn in east, central and southern Africa. East Afr. Med. J. 70(7):422-433

Lawn JE, Manandhar A, Haws RA, Darmstadt GL (2007). Reducing one million child deaths from birth asphyxia–a survey of health systems gaps and priorities. Health Res Policy Syst. 5:4

Lawn JE, Manandhar A, Haws RA, Darmstadt GL (2007). Reducing one million child deaths from birth asphyxia – a survey of health systems gaps and priorities. Health Res. Policy Syst. 5(1):4.

Lincetto O (2007). Birth Asphyxia - Summary of the previous meeting and protocol overview WHO Geneva 2007_birth_asphyxia02.pdf]

Majeed R, Memon Y, Majeed F, Shaikh NP, Rajar UD (2007). Risk factors of birth asphyxia. J. Ayub. Med. Coll. Abbottabad. 19(3):67–71.

Oyedeji GA (1985). Socio-economic and cultural background of hospitalized children in Ilesa. Nig. J. Paediatr. 12: 111-117.

Padayachee N, Ballot DE (2013). Outcomes of neonates with perinatal asphyxia at a tertiary academic hospital in Johannesburg, South Africa. S. Afr. J. CH. 7(3):89-94

Pitsawong C, Panichkul P (2012). Risk factors associated with birth asphyxia in Phramongkutklao Hospital. Thai. J. Obstet. Gynaecol. 19(4):165–171.

Shireen N, Nahar N, Mollah AH (2009). Risk Factors and Short-Term Outcome of Birth Asphyxiated Babies in Dhaka Medical College Hospital. Bangladesh J. Child Health. 33 (3): 84.

Vonke D, Sunday B (2014). The role of National Health Insurance Scheme in Health care demand in Jos, Central Nigeria. J. Soc. Sc. Public Policy. 6:1-16