

MATERNAL RISK FACTORS FOR BIRTH ASPHYXIA IN LOW-RESOURCE COMMUNITIES: SYSTEMATIC REVIEW

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Abstract

Asphyxia is a condition in which a subject's gas exchange is blocked, resulting to progressive hypoxia, hypercarbia, and acidosis. The severity and length of the disruption determines which of these conditions will develop first. Each year, more than four million infants pass away before reaching their first birthday. The vast majority of these fatalities take place in countries that are still developing, mainly in sub-Saharan Africa and the Asia-Pacific region. As compared to the other ASEAN countries, the infant mortality rate in Indonesia is the highest. This leads to the baby being born prematurely, unable to breathe properly, and with birth defects. Indonesia has the highest neonatal mortality rate despite a steady decline from 102,700 in 2000 to 60,986 in 2017. According to the findings of study, mothers who are young, women who have anemia, and mothers who do not receive dietary assistance are all at risk for asphyxia. During pregnancy, variables that increase the likelihood of the mother or baby experiencing asphyxia include prolonged labor, malpositions, instrument-assisted births, infections, and others. It is challenging to eradicate the risk factors that contribute to birth asphyxia in developing countries. Because of a great number of causes. According to tales from the past, traditional midwives delivered babies despite having insufficient levels of training. They investigate the limited resources and educational opportunities available in rural areas, where it was standard practice to give birth at home with untrained midwives.

Keyword: *Birth Asphyxia; Hypoxia; Low-Resource; Maternal; Obstetrics; Risk*

INTRODUCTION

Asphyxia is defined as a condition in which a subject's gas exchange is impaired, resulting in progressive hypoxia, hypercarbia, and acidosis depending on the extent and duration of the interruption.¹ There are no specific biochemical criteria for birth asphyxia, or impaired gas exchange during the perinatal period. As a result, labeling a neonate with "asphyxia" should be done with caution. Unfortunately, this term is frequently incorrectly associated with poor neurodevelopmental outcome, also known as cerebral palsy.²

That although issues with infections and premature births are responsible for a significant number of these fatalities, birth asphyxia is also a major contributing factor. It is believed that the multi-organ failure that frequently follows is the root cause of 23% of neonatal fatalities (globally) and 26% of the one million intrapartum stillbirths that take place each year in the United States. Every year, about 4 million babies die before their first birthday. Most of these deaths happen in developing countries, especially in the Asia-Pacific and Sub-Saharan parts of Africa.³⁻⁵

Regional subgroup study showed that East and Central African countries had 18.0 and 9.1% pooled prevalence of perinatal asphyxia, respectively.⁶ Indonesia has the highest neonatus death rate of the ASEAN countries. This causes by premature birth, asphyxia, and birth defects. Indonesia had the greatest neonatal death rate, despite the fact that the trend fell steadily from 102.700 in 2000 to 60.986 in 2017. This was followed by the Philippines, Vietnam, Myanmar, Cambodia, Thailand, Laos, and Malaysia accordingly in that order. On the other hand, the trend of live births was lowest in Indonesia and greatest in the Philippines during that time period.⁷

Unfortuitously, a significant number of those who survive the experience are left with long-term neurodevelopmental issues like as cerebral palsy, epilepsy, and learning difficulties. Many foetal (such as being delivered prematurely), obstetric / intrapartum (such as a prolonged labor), and maternal (such as a mother's socioeconomic position) factors might increase a baby's likelihood of dying if they do not start or maintain breathing.^{8,9}

Correctly identifying and trying to manage these risk factors in a timely manner is expected to play a significant role in reducing the often-devastating effects of BA. Given that obstetric care can be inadequate or difficult to obtain in low-resource settings, there is a case to be made for concentrating on maternal characteristics that may influence a child's risk of BA.¹⁰ These factors may assist design primary prevention measures to reduce newborn death and long-term impairment.¹¹ Majeed et al. (2007)¹² suggest looking for maternal factors including health issues and features that affect birth outcomes to treat BA.

Yet, there is not a great deal of research regarding the maternal variables that can raise the risk of birth asphyxia. There is also a lack of clarity regarding the relative importance of the several maternal variables that could be essential. So, it is a significant obstacle for those who wish to devise and implement primary prevention techniques for BAC in communities that have a limited amount of resources. The maternal risk factors that are connected with birth asphyxia in communities with minimal resources are investigated in this study..

METHODS

Protocol

All data collection, analysis, and reporting for this study followed the guidelines established by the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 project. The regulations that were put into place were developed using these elements as their foundation.

Eligibility Criteria

The purpose of this literature review on the consistency of maternal risk factors for birth asphyxia in low-resource communities was to evaluate the existing research on these two topics. These constitute the primary concerns raised by the current study. 1) To be considered for publication, articles must always be written in English and highlight the maternal risk factors for birth asphyxia in low-income communities. 2) For this evaluation, articles published after 2015 but before the period of this systematic review were considered. Editorials, submissions without a DOI, reviews of previously published articles, and entries that are substantially identical to those already released from the journal will not be accepted for inclusion in the anthology.

Search Strategy

The search for studies to be included in the systematic review was carried out from March, 3rd 2023 using the PubMed and SagePub databases by inputting the words: "maternal risk factors"; "birth asphyxia" and "low-resource communities". Where ("maternally"[All Fields] OR "maternities"[All Fields] OR "maternity"[All Fields] OR "mothers"[MeSH Terms] OR "mothers"[All Fields] OR "maternal"[All Fields]) AND ("risk factors"[MeSH Terms] OR ("risk"[All Fields] AND "factors"[All Fields]) OR "risk factors"[All Fields]) AND ("asphyxia neonatorum"[MeSH Terms] OR ("asphyxia"[All Fields] AND "neonatorum"[All Fields]) OR "asphyxia neonatorum"[All Fields] OR ("birth"[All Fields] AND "asphyxia"[All Fields]) OR "birth asphyxia"[All Fields]) AND "low-resource"[All Fields] AND ("communal"[All Fields] OR "communalism"[All Fields] OR "communalities"[All Fields] OR "communalism"[All Fields] OR "communally"[All Fields] OR "commune"[All Fields] OR "communes"[All Fields] OR "community s"[All Fields] OR "communities"[All Fields] OR "residence characteristics"[MeSH Terms] OR ("residence"[All Fields] AND "characteristics"[All Fields])

OR "residence characteristics"[All Fields] OR "communities"[All Fields] OR "community"[All Fields]) is used as search keywords.

Data retrieval

After reading the abstract and title of each study, the authors made the decision as to whether or not the study satisfied the inclusion criteria. Following that, the authors decided to use historical literature as their primary source material for this subject. Following an exhaustive review of a large number of investigations, which all unequivocally pointed to the same pattern, this conclusion was drawn. All contributions are required to be written in English and can't have been seen in print anywhere else. Only studies that fulfilled all of the inclusion criteria were included for analysis in the systematic review. This narrows the search results down to only those that are pertinent to the query.

The results of studies that do not fulfill our requirements are not reviewed by our team. Following that, the research will be scrutinized in great detail. The following pieces of information were uncovered when conducting the analysis for the study: names, authors, publication dates, location, study activities, and parameters. After the search results were imported into an Endnote file, duplicate articles were subsequently eliminated from the database. In order to determine which of the remaining publications were relevant to this study, the titles and abstracts of all of the papers were independently examined by two different reviewers.

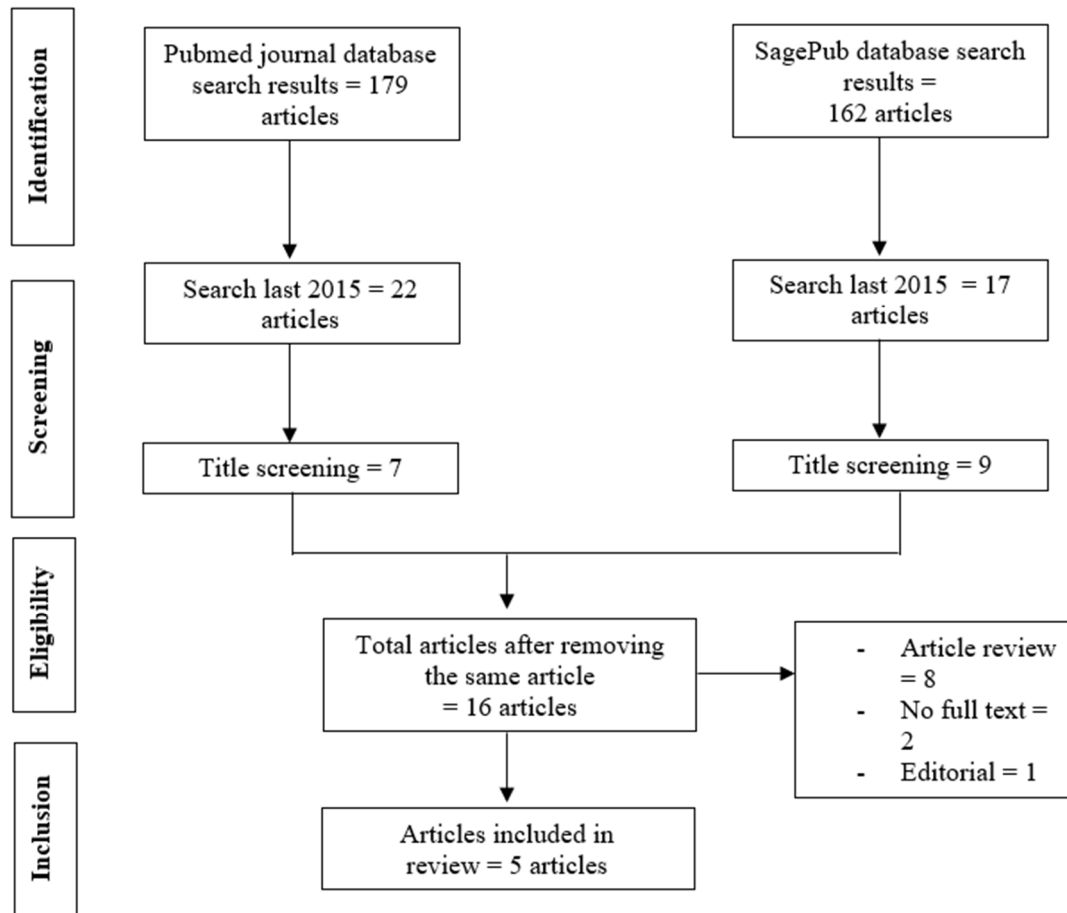


Figure 1. Article search flowchart

Quality Assessment and Data Synthesis

Before determining which papers to study further, each author conducted their own independent examination of the research that were listed in the title and abstract of the publication. The next step will be for us to analyze all of the papers that fit the criteria for inclusion in the review and so ought to be included. Upon the conclusion of our investigation, we will select the relevant research papers for inclusion in the review. The manuscripts that will be examined are going to be chosen based on this criterion. in order to simplify the process of selecting articles for further assessment as much as is humanly possible. Which earlier studies were carried out, and which specific characteristics of these investigations made it possible for them to be incorporated into the review, if any?

RESULT

First study findings the prevalence of neonatal asphyxia was 9.3%. Neonatal asphyxia was more common in babies born to mothers who did not receive nutritional counseling during pregnancy [AOR = 5.64; 95% CI (1.48-21.60); p = 0.01] and in babies born to mothers who had anaemia at 36 weeks gestation [AOR = 2.69; 95% CI (0.95-7.65); p = 0.06].¹³ Antepartum hemorrhage [AOR=7.17; 95% CI = 1.73–29.72], LBW [AOR=2.87; 95% CI = 1.01–8.13], preterm birth [AOR=3.4; 95% CI = 1.04–11.16], CS delivery [AOR=2.75; 95% CI = 1.01–7.42], instrumental delivery [AOR=4.88;

95% CI = 1.35–17.61], fetal distress [AOR=4.77; 95% CI = 1.52–14.92] and meconium-stained amniotic fluid [AOR = 9.02; 95% CI = 2.96–30.24] were significantly associated with perinatal asphyxia in other study.¹⁴

The overall rate of newborn asphyxia was 2.28 per 1000 births throughout the time period covered by the study carried out by Wood et al (2021). The rate was 2.5 per 1,000 births in urban hospitals and 1.35 per 1000 births in rural hospitals (OR = 1.86, 95% CI = 1.58-2.19). The rate of moderate or severe neonatal hypoxic-ischemic encephalopathy was 0.9/1,000 and was unrelated to urban hospital birth (OR = 1.12, 95% CI 0.82-1.53) hospital volume was also unrelated to asphyxia or moderate or severe neonatal hypoxic-ischemic encephalopathy. The rate of moderate or severe neonatal hypoxic-ischemic encephalopathy was unrelated to urban hospital.¹⁵

Table 1. The literature include in this study

Author	Origin	Method	Sample	Recommendation
Abubakari, 2019 ¹³	Ghana	Cross sectional study	108 mothers	In the Upper West Region of Ghana, a mother's dietary behaviors throughout pregnancy have the potential to positively effect the delivery outcome.
Mulugeta, 2020 ¹⁴	Ethiopia	Case-control study	213 (71 cases selected using lottery method and 142 controls systematically) subjects	Antepartum haemorrhage, cesarean section delivery, instrumental delivery, fetal distress, meconium-stained amniotic fluid, low birth weight, and preterm birth were identified as independent risk factors for perinatal asphyxia.
Wood, 2021 ¹⁵	Canada	Retrospective cohort study	No describe	Asphyxia and moderate or severe baby hypoxic-ischemic encephalopathy occurred at similar rates in rural and metropolitan hospitals in Alberta, and this finding was independent of hospital traffic.
Sunny, 2021 ¹⁶	Nepal	Observational study, Cross sectional	63,099 pregnant women admitted and a total of 60,742 deliveries were conducted in the hospitals.	In contrast to countries that have easier access to resources, the incidence of birth asphyxia is significantly higher in Nepal. The presence of BA is linked to a number of obstetric and neonatal risk factors, in addition to a significantly increased chance of death before discharge. It is possible that initiatives that aim to enhance management and lower BA rates will have a major impact on patient outcomes in regions that are constrained by a lack of resources.
Wosenu, 2018 ¹⁷	Ethiopia	Sase-control study	270 (90 cases and 180 controls) participants	Birth asphyxia was brought on by factors including a lengthy labor, a delivery by cesarean section (CS), meconium-stained amniotic fluid (AF), fetal discomfort, and a low birth weight. Hence, efforts should be made to improve the quality of intrapartum care services in order to reduce prolonged labor and difficulties with the fetus. Moreover, mothers who have meconium-stained amniotic fluid should be identified and a close follow-up should be performed on them.

Ayebare, et al (2022) showed the maternal age <19 years (aOR = 1.92 [1.27–2.91]), syphilis infection (aOR = 2.45 [1.08–5.57]), and a high white blood cell count (aOR = 2.26 [1.26–4.06]) were linked with delivery asphyxia. Referral (aOR = 1.75 [1.10–2.79]), induction / augmentation of labour (aOR = 2.70 [1.62–4.50]), prolonged labour (aOR = 1.88 [1.25–2.87]), obstructed labour (aOR = 3.40 [1.70–6.83]), malpresentation / malposition (aOR = 3.00 [1.44–6.27]) and assisted vaginal delivery (aOR = 5.54 [2.30–13.40]) were associated with birth asphyxia.

Sunny, et al.,¹⁶ showed there were six cases of BA for every thousand full-term live births, and the risk was highest for women aged 35 and up. Instrumented vaginal delivery (aOR = 4.4, 95% CI = 3.1-6.1), fetal distress in delivery (aOR = 1.9, 95% CI = 1.0-3.6), malposition (aOR = 1.8, 95% CI = 1.0-3.0), birth weight (BW) <2,500 g (aOR = 2.0, 95% CI = 1.3-2.9), and gestational age (GA) of 42 weeks (aOR = 4.4, 95% CI = The adjusted odds ratio for babies with BA was 42.6, and the 95% confidence interval ranged from 32.2 to 56.3. This means that the chance of dying before getting out of the hospital is 43 times higher.

Wosenu, et al (2018)¹⁷ conducted a study in Ethiopia. They showed that birth asphyxia risk was significantly increased by the presence of factors such as prolonged labor (AOR = 2.75, 95% CI = 1.18-6.94), CS delivery (AOR = 3.58, 95% CI = 1.13-11.31), meconium stained amniotic fluid (AOR = 7.69, 95% CI = 2.99-17.70), fetal distress (AOR = 5.74, 95% CI= 1.53, 21.55), and LBW (AOR = 7.72, 95% CI = 1.88-31.68) were factors which significantly increased the odds of birth asphyxia.

DISCUSSION

Birth asphyxia causes 25% of the world's three million neonatal fatalities and nearly half of its 2.6 million third-trimester stillbirths in underdeveloped nations. Four million newborns are asphyxiated each year, resulting in one million fatalities and one million neurological disorders such cerebral palsy, mental retardation, and epilepsy.^{18,19} HIE is the main

complication of prenatal hypoxia. HIE is a neurological condition that causes difficulty breathing, altered muscle tone and reflexes, a low level of consciousness, and seizures. Levene Classification divides it into stages. The newborn is unconscious, hypotonic, and unable to breathe in stage III HIE.^{15,20}

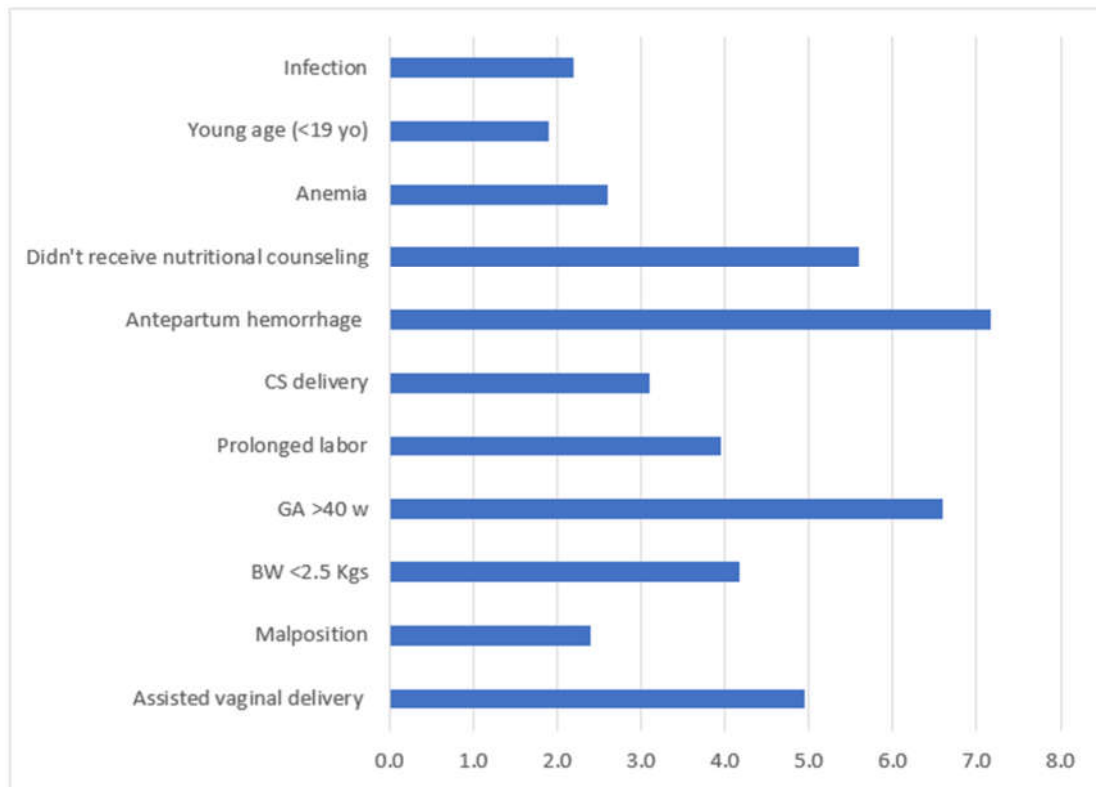


Figure 2. OR risk factor of BA in this study

BA incidence in developed countries ranged from 1.6% to 24.0%, depending on study type (single, multicenter, or population-based) and operational definition.^{15,17} In this study, **instrumental delivery infants** had a greater BA risk than spontaneous vaginal birth infants. Babies born to mothers with fetal pain and malpresentation were at risk for BA. BA was twice as prevalent in newborns under 2500 grams compared to those between 2500 and 4000 grams. BA risk was twofold for infants delivered at 42 weeks or older. BA affected boys more than girls.¹⁶

In a single-center Ethiopian study, birth asphyxia risk variables were **protracted labor, cesarean delivery, meconium-stained AF, fetal distress, and low birth weight**.¹⁷ Vacuum extraction greatly elevated BA risk in Thailand. BA was more likely in 42-week-old newborns. Instrumental delivery can cause prolonged hypoxia, trauma, and cerebral bleeding, which can cause brain injury and BA symptoms. Public hospitals have more complicated deliveries, hence they have less instrumentation.^{21,22}

Low birth weight and post-term newborns may have an increased risk of perinatal problems due to placental insufficiency, with post-term infants having the added risk of being larger.²³ Our dataset uses LMP for gestational dating, but the study found BA risk factors. Male infants have a higher BA risk, according to neonatal data. Gender differences in microglial activation, inflammation, and immature immunological response may affect BA outcomes, but they do not affect maternal or obstetric variables or BA risk.²⁴

Meconium-aspirated babies were more likely to develop BA. Higher-grade meconium was significantly linked to BA in a case-control study of hypoxic-ischemic encephalopathy in children born after 36 weeks.²⁵ Intrauterine meconium discharge can cause severe hypoxia during birth. Meconium aspiration had the highest adjusted risk.¹⁶ The BA pre-discharge death rate was 17%, which was high. This mortality rate is lower than the 31% mortality rate found in a Nepalese BA study.²⁶ Nigerian researchers found that hypoxia at birth killed over 30% of infants.⁹

Eliminating birth asphyxia risk factors in developing countries is difficult. For many reasons. As mentioned in earlier publications, traditional midwives without proper training delivered. They study limited resources and education in rural areas, where it was common to have babies at home with untrained midwives.⁹ However, home births increased the risk of birth asphyxia. Hospitals delivered most babies in the study. Less than half of affected neonates' mothers received birth asphyxia counseling, the findings showed. Birth asphyxia can be reduced by educating women about their pregnancies and postpartum issues. This will reduce disease prevalence.^{26,27}

CONCLUSION

Research shows that young mothers, anemia in mothers and mothers who do not receive nutritional counseling are at risk of experiencing asphyxia. Pregnancy factors that increase the risk of asphyxia include prolonged labour, malpositions, childbirth using tools, infections and others.

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