DOI:https://doi.org/10.53555/nnmhs.v9i3.1568 Publication URL: https://nnpub.org/index.php/MHS/article/view/1568

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

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Abstract

Every year, approximately 4 million babies die before reaching their first birthday. The majority of these deaths occur in developing countries, particularly in Asia-Pacific and Sub-Saharan Africa. Perinatal asphyxia is one of the leading causes of perinatal and early neonatal mortality in developing countries, accounting for a quarter of all neonatal deaths and nearly half of all third-trimester stillbirths. Every year, roughly four million babies are born asphyxiated, resulting in one million deaths and one million serious neurological consequences such as cerebral palsy, mental retardation, and epilepsy. Recognizing and managing 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 focusing on maternal characteristics that may influence a child's risk of BA. This is due to the fact that these factors may aid in the development of new primary prevention strategies to reduce neonatal mortality and long-term disability. This study presents the incidence of Birth Asphyxia (BA) babies born in public referral hospitals in low-income communities, as well as the associated obstetric and neonatal risk factors and mortality outcomes. Improving care for high-risk women during labor and delivery has been shown to reduce the risk of perinatal events and the development of BA.

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

INTRODUCTION

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.[1–3] Even though a lot of these deaths are caused by problems with infections and premature births, birth asphyxia is also a major cause. Birth asphyxia (BA) is defined by the World Health Organization (2012) as "failure to start or keep breathing at birth". The multi-organ dysfunction that often follows is thought to be the cause of 23% of neonatal deaths (globally) and 26% of the one million intrapartum stillbirths that are seen each year.[4,5]

Unfortunately, many of those who make it through have long-term neurodevelopmental problems like cerebral palsy, epilepsy, and learning disabilities.[6] Almost all of the deaths and illnesses caused by BA happen in low- and middle-income countries, especially those with a high birth rate, like India, Pakistan, and Nigeria.[4,5] There are a number of foetal (like being born too early), obstetric/intrapartum (like a long labor), and maternal (like a mother's socioeconomic status) factors that can affect a baby's chance of dying if they don't start or keep breathing.[6,7]

Without a doubt, recognizing and managing these risk factors in a timely manner would be expected to play a big role in reducing the often-devastating effects of BA. Given that obstetric care can be poor or hard to find in low-resource settings,[8] there is a case for focusing on maternal characteristics that may affect a child's risk of BA. This is because these factors may help develop new primary prevention strategies to reduce neonatal mortality and long-term disability.[9] Majeed et al. (2007)[10] say that a possible way to deal with BA is to look for maternal factors, such as health conditions and traits that have biological links to birth outcomes.

But there isn't a lot of evidence about which maternal factors might increase the risk of birth asphyxia. It's also not clear how important the different maternal factors that might be important are. So, it's a big challenge for people who want to come up with and use primary prevention strategies for BA in communities with few resources. This article examines the maternal risk variables that are associated with birth asphyxia in communities with limited resources.

METHODS

Protocol

This research was conducted in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 initiative's requirements. These components formed the basis for the regulations that were implemented.

Eligibility Criteria

The goal of this literature review on the accuracy of maternal risk factors for birth asphyxia in communities with limited resources was to assess the extant research on these two topics. These are the primary concerns presented by the current research being undertaken. 1) Articles must be written in English and highlight the maternal risk factors for birth asphyxia in communities with limited resources in order to be considered for publication. 2) Articles published after 2017 but before the period of this systematic review were considered for this evaluation. The following sorts of writing will not be accepted for inclusion in the anthology: editorials, submissions without a DOI, reviews of previously published articles, and entries that are substantially identical to those already published in the journal.

Search Strategy

The search for studies to be included in the systematic review was carried out from February, 27th 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 "communality"[All Fields] OR "communally"[All Fields] OR "commune"[All Fields] OR "communes"[All Fields] OR "community s"[All Fields] OR "communitys"[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.

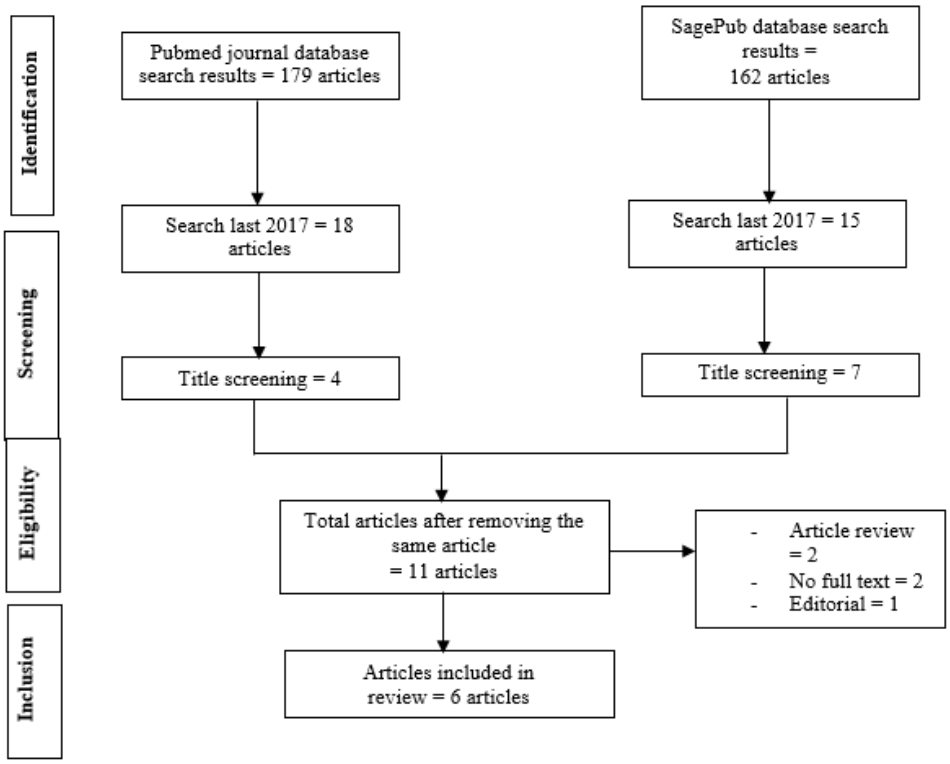

Figure 1. Article search flowchart

Data retrieval

The writers determined whether or not each study met the inclusion criteria after reviewing the abstract and title. After that, the authors chose historical literature as their sources for this topic. This conclusion was reached after a thorough examination of numerous studies, all of which revealed the same pattern. All submissions must be written in English and have never been published before. The systematic review only looked at studies that met all of the inclusion criteria. This restricts search results to only those that are relevant.

We do not review study results that do not meet our criteria. The research will then be thoroughly examined. During the course of the study's examination, the following information was discovered: names, authors, publication dates, location, study activities, and parameters. Duplicate articles were removed after the search results were imported into an Endnote file. Two separate reviewers evaluated the titles and abstracts of the remaining papers in order to select those within the scope of this review.

Quality Assessment and Data Synthesis

Before deciding which papers to investigate further, each author independently reviewed the studies listed in the publication's title and abstract. Then, we will evaluate all papers that meet the review's inclusion criteria and thus deserve to be included. Based on our findings, we will then decide which papers to include in the review. This criterion determines which manuscripts will be reviewed. To make the selection of papers for review as simple as possible. What previous studies were conducted, and what aspects of these investigations qualified them for inclusion in the review?

RESULT

According Sunny, et al (2021)[11] study, the incidence of BA was six cases per one thousand term livebirths, and the risk was greatest for mothers aged 35 and older. The following factors were found to be predictive of birth asphyxia: instrumented vaginal delivery (aOR = 4.4, 95% CI = 3.1-6.1), fetal distress in labor (aOR = 1.9, 95% CI = 1.0-3.6), malposition (aOR = 1.8, 95% CI = 1.0-3.0), birth weight less than 2,500 g (aOR = 2.0, 95% CI = 1.3-2.9), gestational age 42 weeks (aOR Babies with BA had an adjusted odds ratio of 42.6, with a 95% confidence interval ranging from 32.2-56.3. This represents a 43-fold increased risk of pre-discharge mortality.

Wosenu, et al (2018) study in Ethiophia 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), cesarean section 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 low birth weight (AOR = 7.72, 95% CI = 1.88-31.68) were factors which significantly increased the odds of birth asphyxia.

Table 1. The litelature include in this study

Author	Origin	Method	Sample	Recommendation
Sunny, 2021[11]	Nepal	Observational study, Cross sectional	63,099 pregnant women admitted and a total of 60,742 deliveries were conducted in the hospitals.	Nepal has a higher prevalence of birth asphyxia than countries with greater access to resources. BA is connected with a variety of obstetric and neonatal risk factors and a high risk of pre-discharge mortality. In areas with limited resources, interventions to improve management and reduce rates of BA could have a significant influence on patient outcomes.
Wosenu, 2018[12]	Ethiopia	Sase-control study	270 (90 cases and 180 controls) participants	Birth asphyxia was caused by prolonged labor, cesarean section (CS) delivery, meconium-stained amniotic fluid (AF), fetal discomfort, and low birth weight. Thus, efforts should be made to improve the quality of intrapartum care services in order to minimize protracted labor and fetal problems, as well as to identify moms with meconium-stained amniotic fluid and conduct a tight follow-up.
Wood, 2021[13]	Canada	Retrospective cohort study	No describe	This study found that rural and metropolitan hospitals in Alberta had comparable rates of asphyxia and moderate or severe infant hypoxic-ischemic encephalopathy, with no correlation to hospital volume.
Manandhar, 2019[14]	Nepal	Cross-sectional study	1,284 babies	This hospital had a decreased prevalence of perinatal asphyxia compared to other similar tertiary care institutions. Perinatal asphyxia is a leading cause of illness and mortality among newborns.
Ebenezer, 2019[15]	India	Retrospective study	14,000 deliveries	In a large tertiary hospital in South India with 14,000 annual deliveries, a policy of rigorous audits of stillbirths and birth asphyxia, electronic fetal monitoring, and the introduction of standardised criteria for trial of scar have decreased perinatal mortality and the rate of babies born with birth asphyxia over the past 18 years, without an increase in the caesarean section rate.
Egharevba, 2018[16]	Nigeria	Descriptive, retrospective study	347 patients	The prevalence of perinatal asphyxia in Irrua Specialist Hospital is comparable to figures from other developing countries. Mortality is linked to a lack of antenatal care and HIE stage III. Continuous efforts should be made to improve antenatal care uptake, and high-risk pregnancies should be delivered in centers with neonatal care facilities.

During the study period conducted by Wood, et al (2021)[13], the overall rate of neonatal asphyxia was 2.28 per 1000 births, with 2.5/1000 in urban hospitals and 1.35/1000 in rural hospitals, OR = 1.86, 95% CI (1.58-2.19). The rate of moderate or severe neonatal hypoxic-ischemic encephalopathy was 0.9/1000 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.

In Manandhar, et al (2019)[14] study, a total of 1284 infants born over a six-month period were enrolled, and 47 (3.66%) were asphyxiated, with a 95% confidence interval of (2.64-4.68%). The average birth weight of asphyxiated infants was 2759.75 grams, and the average gestational age was 37.57 weeks. 15 (32%) of asphyxiated infants were normal, 15 (32%) were in stage I of Hypoxic Ischemic Encephalopathy, 14 (30%) were in stage II, and 3 (6%) were in stage III. Twenty-three (49%) of asphyxiated infants had prenatal risk factors, while all 47 infants had intrapartum risk factors.

Ebenezer, et al (2019)[15] study showed the perinatal mortality rate fell from 44 per 1,000 births in the year 2,000 to 16.4 per 1,000 births in the year 2018 ($P < 0.001$); this represents a significant decrease. The rate of babies born with birth asphyxia who needed to be admitted to the neonatal unit declined from 24 per 10,00 births in 2001 to 0.7 per 1,000 births in 2018 ($P < 0.01$). This represents a significant drop in the incidence of the condition. The overall percentage of cesarean sections was kept quite close to thirty percent.

Egharevba, et al (2019)[16] showed perinatal asphyxia was responsible for 45 out of 347 admissions (or 13%). The individuals had a mean gestational age of 39.2 weeks (standard deviation: 2.2 weeks) and a mean birth weight of 3020 grams (standard deviation: 520 grams). A lack of prenatal care and HIE stage III were important factors that were strongly related with mortality. The mortality rate was 31.1%.

DISCUSSION

Perinatal asphyxia is one of the leading causes of perinatal and early neonatal mortality in developing nations, accounting for a quarter of the world's three million neonatal deaths and nearly half of the world's 2.6 million third-trimester stillbirths. Approximately four million babies are born asphyxiated each year, resulting in one million deaths and one million serious neurological consequences, including cerebral palsy, mental retardation, and epilepsy.[17,18]

Hypoxic Ischemic Encephalopathy is the chief complication of perinatal asphyxia (HIE). HIE is a disordered neurological function syndrome characterized by difficulty initiating and maintaining respiration, abnormal muscle tone and reflexes, a subnormal level of consciousness, and seizures. According to the Levene Classification, it is divided into various stages. In severe HIE (HIE stage III), the infant is comatose, severely hypotonic, and unable to maintain spontaneous respiration.[13,19]

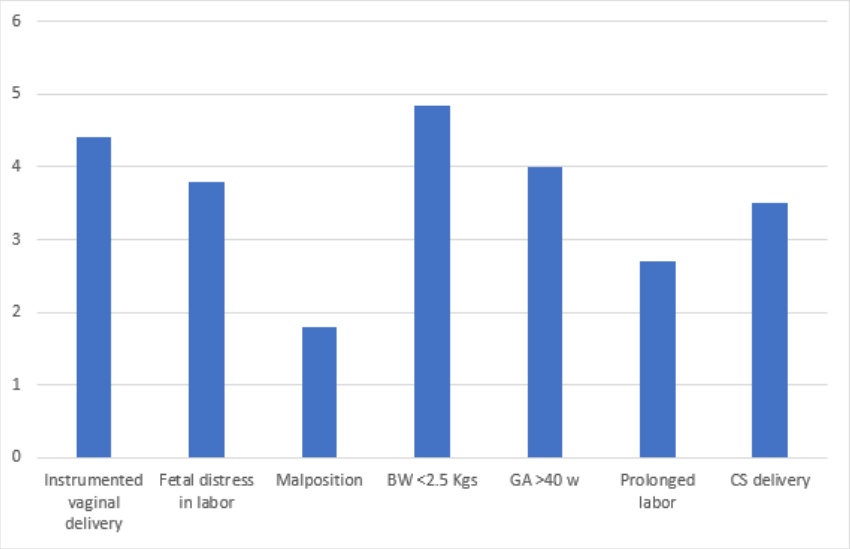

Figure 2. OR of the risk factors that cause BA

In this study, infants born via instrumental delivery had a higher chance of developing BA compared to those born via spontaneous vaginal birth. BA was a concern for newborns whose moms experienced fetal discomfort and malpresentation during labor. Compared to infants with a birth weight between 2500 and 4000 grams, those with a birth weight of less than 2500 grams were twice as likely to develop BA. The risk of BA in infants born at gestational ages 42 weeks or beyond was double that of infants born between 37 and 41 weeks. Male infants were more susceptible to BA than female neonates.[11]

Depending on the type of study (single or multicenter or population-based) and operational definition of BA,[12,13] the reported incidence of BA in developed countries varied from 1.6% to 24.0%. The incidence was 24% in a multicentric research conducted in South India and 36% in a single center study conducted in Nepal.[14,15] According to systematic reviews and meta-analyses, the incidence of BA in Africa ranges from 15.9 to 22.3%.[20] Variation in the quality of intrapartum and perinatal care may account for the considerable difference in reported incidence.

In a single-center study conducted in Ethiopia, extended labor, cesarean delivery, meconium-stained amniotic fluid (AF), fetal distress, and low birth weight were identified as risk factors for birth asphyxia.[12] A study conducted in Thailand found that vacuum extraction dramatically increased the risk of BA. According to our findings, infants with a gestational age 42 weeks were more likely to have BA. Instrumental delivery poses a risk for prolonged hypoxia, trauma, and cerebral hemorrhage, all of which may contribute to Brain injury and clinical characteristics of BA. The lower prevalence of instrumentation in public hospitals compared to private hospitals reflects more complex births, which explains the higher rate of association observed with this feature.[14,21]

Due to placental insufficiency, both low birth weight and post-term newborns may have an increased risk of perinatal problems, with the added risk factors of bigger size in post-term infants.[22] In our dataset, gestational dating is based on the last menstrual period (LMP), but they study also detected these established risk factors for BA. While analyzing neonatal data, they study discovered that male infants have a greater risk of BA. It has been proposed that gender differences in microglial activation, inflammation, and immature immunological response influence BA outcomes; nevertheless, they study do not predict that gender influences maternal or obstetric variables and the real risk of BA.[23]

Study showed the babies with meconium aspiration had an increased risk of developing BA. In a case-control study of hypoxic-ischemic encephalopathy in children born after >36 weeks of gestation, meconium of a higher grade was found to be substantially linked with BA.[24] Intrauterine meconium discharge can worsen the respiratory condition during birth, leading in the risk of significant hypoxia. Meconium aspiration was associated with the highest risk, with an adjusted risk that was more than 20 times higher than any other risk.[11]

Significantly, they study study found that the pre-discharge death rate associated with BA was exceptionally high at 17%. Nevertheless, this mortality rate is lower than that recorded in a previous study on the consequences of BA in Nepal, which found a 31% mortality rate.[25] A study conducted in Nigeria revealed that the infant death rate for hypoxia at birth was greater than 30 percent. A more effective treatment technique based on the severity of BA may lower the risk of newborn mortality.[7]

In nations with low income and emerging economies, it is not an easy effort to eliminate the risk factors that can cause birth asphyxia. There are a number of reasons for this. One of them was the delivery that was carried out by traditional midwives who lacked the proper training, as was mentioned in earlier publications. This is a reflection of they study

limited resources and the lack of education that exists in rural areas, where, in the past, it was common practice to have babies at home with the assistance of untrained midwives.[7]

Nonetheless, those births that took place at home were determined to be a substantial risk factor for inducing birth asphyxia. In they study settings, the majority of deliveries took place in hospitals. According to the findings, less than half of the mothers of affected neonates had received counseling about birth asphyxia. Women need to educate themselves not just about their pregnancies but also about the potential issues that may develop after childbirth in order to lessen the impact of birth asphyxia. This will allow for a reduction in the overall incidence of the condition.[25,26]

CONCLUSION

The incidence of Birth Asphyxia (BA) babies born in public referral hospitals in low resources communties, as well as the associated obstetric and neonatal risk factors and mortality outcomes, is presented in this study. Improving care for high-risk women during labor and delivery can lower the risk of perinatal events and the development of BA.

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