

RISK FACTORS ASSOCIATED WITH THE INCIDENCE OF NEONATORUM ASPHYXIA IN NEWBORNS: A LITERATURE REVIEW

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ABSTRACT

Background: Neonatal asphyxia remains one of the leading causes of neonatal morbidity and mortality worldwide, particularly in developing countries. The occurrence of neonatal asphyxia is influenced by various maternal, obstetric, and neonatal factors, with inconsistent findings reported across studies. Therefore, a comprehensive synthesis of the available evidence is needed to identify the most significant risk factors and support evidence-based prevention strategies. **Objective:** This study aimed to identify and analyze the risk factors associated with neonatal asphyxia based on published scientific literature. **Methods:** This study employed a literature review design by analyzing ten national and international scientific articles published between 2020 and 2025. The reviewed studies included case-control, cross-sectional, systematic review, and meta-analysis designs. Articles were selected based on predetermined inclusion and exclusion criteria. Data were extracted according to study characteristics, research design, sample size, and reported risk factors, and subsequently synthesized using a narrative approach. **Results:** The findings demonstrated that the most consistently reported risk factors for neonatal asphyxia were prematurity, low birth weight (LBW), premature rupture of membranes (PROM), meconium-stained amniotic fluid, prolonged labor, abnormal gestational age, maternal hypertension, maternal anemia, fetal malpresentation, and delivery interventions such as cesarean section, labor induction, and instrumental delivery. Several studies also identified primiparity, advanced maternal age, placental abnormalities, fetal distress, and umbilical cord complications as contributing factors. Among these, prematurity, LBW, PROM, and meconium-stained amniotic fluid were the most frequently reported determinants across the reviewed studies. **Conclusion:** Neonatal asphyxia is a multifactorial condition resulting from the interaction of maternal, obstetric, and neonatal factors. Early identification of high-risk pregnancies through comprehensive antenatal care, appropriate intrapartum management, and timely neonatal resuscitation are essential strategies to reduce the incidence of neonatal asphyxia and improve neonatal survival outcomes. (Umami et al., 2025)

Keywords: Risk Factors; Incidence; Neonatal Asphyxia; Neonatorum

Introduction

Neonatal asphyxia remains one of the leading causes of neonatal morbidity and mortality worldwide, particularly in developing countries. This condition occurs when a newborn fails to initiate and sustain spontaneous breathing immediately after birth, resulting in hypoxia, organ damage, and even death if not promptly managed (Kementrian Kesehatan, 2023).

According to the World Health Organization (WHO, 2023), approximately 2.3 million newborns die during the neonatal period each year, with nearly 47% of under-five deaths occurring within the first 28 days of life. Intrapartum complications, including neonatal asphyxia, are among the major contributors to neonatal mortality. In Indonesia, neonatal asphyxia continues to be one of the leading causes of neonatal death, following low birth weight (LBW) and prematurity, highlighting the importance of early prevention and appropriate management in maternal and neonatal healthcare services (Mariana & Ashriady, 2020).

The occurrence of neonatal asphyxia is influenced by various maternal, obstetric, and neonatal factors. A literature review conducted by (Yanti, 2023) identified several factors associated with neonatal asphyxia, including meconium-stained amniotic fluid, prolonged labor, complicated delivery, prematurity, gestational age, low birth weight (LBW), antepartum hemorrhage, premature rupture of membranes (PROM), breech delivery, and umbilical cord entanglement. These findings are consistent with the systematic review and meta-analysis conducted,

which analyzed 80 studies in China and reported a neonatal asphyxia prevalence of 4.8%. The study identified prematurity, fetal distress, meconium-stained amniotic fluid, fetal malpresentation, and placental complications as the major risk factors. Furthermore, another systematic review involving 737,839 neonates reported an overall incidence of neonatal asphyxia of 7%, with instrumental delivery, primiparity, prematurity, and low birth weight being the most prominent associated risk factors (Su et al., 2024).

Several studies conducted in Indonesia have also reported consistent findings. (Putri & Isfaizah, 2025) found that labor induction, prolonged labor, and premature rupture of membranes were significantly associated with neonatal asphyxia. (Dewanta et al., 2022) reported that premature rupture of membranes, prematurity, and maternal hypertension during pregnancy were significant risk factors, whereas (Shanun Shari Sakunti et al., 2024), identified maternal anemia, premature rupture of membranes, low birth weight, and gestational age as important determinants of neonatal asphyxia. Other studies have also demonstrated that fetal malpresentation, meconium-stained amniotic fluid, abnormal gestational age, and cesarean section contribute to an increased risk of neonatal asphyxia.

Although numerous studies have identified risk factors associated with neonatal asphyxia, the reported findings remain inconsistent across different populations and study designs. Therefore, synthesizing the available evidence is essential to identify the most consistently reported risk factors (Mustika Handayani & Nelya Bella, 2022).

This study was conducted as a literature review to analyze and summarize the evidence regarding risk factors associated with neonatal asphyxia in newborns based on ten national and

international scientific articles. The findings of this review are expected to provide evidence-based information to support early identification of high-risk pregnancies, improve antenatal and intrapartum care, and contribute to the prevention of neonatal asphyxia (Mulyani & Suyani, 2023)

Research Method

This study employed a literature review using a narrative review approach to identify risk factors associated with neonatal asphyxia in newborns. The study used secondary data obtained from national and international scientific articles published between 2020 and 2025 (Grant & Booth, 2023).

The literature search was conducted through Google Scholar, PubMed, ScienceDirect, and Garuda databases using the keywords "neonatal asphyxia," "birth asphyxia," "risk factors," "asfiksia neonatorum," and "newborn" combined with the Boolean operators AND and OR. Articles were included if they were published in English or Indonesian, available in full text, focused on risk factors for neonatal asphyxia, and published between 2020 and 2025. Duplicate articles, incomplete publications, and studies that did not meet the research objectives were excluded

(Grimshaw et al., 2021). A total of 10 eligible articles were included in the review. Data extracted from each study included the authors, publication year, study design, sample characteristics, research variables, and main findings. The collected data were analyzed using a narrative synthesis approach by comparing and summarizing the findings of the included studies to identify the most consistent risk factors associated with neonatal asphyxia in newborns (Barry et al., 2022).

Result

Based on the literature search conducted through several scientific databases, ten articles met the predetermined inclusion and exclusion criteria. The selected studies consisted of case-control studies, cross-sectional studies, systematic reviews, and meta-analyses published between 2020 and 2025. Most of the studies were conducted in Indonesia, while two studies were international systematic reviews and meta-analyses.

The synthesis of the reviewed articles demonstrated that neonatal asphyxia is influenced by various maternal, obstetric, and neonatal factors. The most consistently reported risk factors were prematurity, low birth weight (LBW), premature rupture of membranes (PROM), meconium-stained amniotic fluid, prolonged labor, and abnormal gestational age. In addition, several studies identified maternal hypertension during pregnancy, maternal anemia, fetal malpresentation, labor induction, cesarean section, instrumental delivery, fetal distress, and umbilical cord entanglement as significant factors associated with an increased risk of neonatal asphyxia.

These findings indicate that neonatal asphyxia is a multifactorial condition, emphasizing the importance of early identification and comprehensive management of maternal, obstetric,

and neonatal risk factors during antenatal, intrapartum, and neonatal care to reduce the incidence and adverse outcomes of neonatal asphyxia

Table 1. Characteristics of the Reviewed Articles

No	Author	Title/Year	Respondents	Purpose	Research Method	Result
1	Yanti, N.R., Fitriana, D., Takki, W.A., et al.	<i>Faktor Risiko Terjadinya Asfiksia Neonatorum pada Bayi Baru Lahir (2023)</i>	5 scientific articles	To identify factors associated with neonatal asphyxia in newborns.	Literature Review	Meconium-stained amniotic fluid, prolonged labor, complicated labor, prematurity, gestational age, LBW, antepartum hemorrhage, PROM, breech delivery, and umbilical cord entanglement were associated with neonatal asphyxia.
2	Su, Y.J., Liu, W., Xing, R., Yu, Z., Peng, Y., & Luo, W.	<i>Prevalence and Risk Factors Associated with Birth Asphyxia among Neonates Delivered in China: A Systematic Review and Meta-analysis (2025)</i>	80 studies	To estimate the prevalence and identify risk factors for birth asphyxia among neonates in China.	Systematic Review and Meta-analysis	The prevalence of neonatal asphyxia was 4.8%. Placental abruption, placenta previa, advanced maternal age, prematurity, fetal distress, meconium-stained amniotic fluid, breech presentation, and fetal malformations were significant risk factors.
3	Putri, A., & Isfaizah	<i>Hubungan Faktor Risiko Asfiksia Neonatorum pada Bayi Baru Lahir di RSUD Dr. Gunawan Mangunkusumo (2025)</i>	88 newborns	To determine the relationship between risk factors and neonatal asphyxia.	Quantitative Case-Control Study	Labor induction, prolonged labor, and PROM were significantly associated with neonatal asphyxia.
4	Handayani, A.M., & Bella, F.N.	<i>Analisis Faktor Risiko terhadap Kejadian Asfiksia pada BBL di RSU Mayjen H.A.</i>	176 newborns	To analyze the risk factors associated with	Analytical Cross-Sectional Study	Maternal age and gestational age were significantly associated with neonatal asphyxia, whereas parity and

No	Author	Title/Year	Respondents	Purpose	Research Method	Result
		<i>Thalib Kerinci</i> (2022)		neonatal asphyxia.		delivery history were not associated.
5	Dewanta, D.G.S., Padma, G.D., & Wiraningrat, I.G.A.A.N.	<i>Faktor Risiko yang Berhubungan dengan Kejadian Asfiksia pada Neonatus di RSIA Dedari Kupang</i> (2022)	80 newborns	To evaluate risk factors associated with neonatal asphyxia.	Observational Analytic Case-Control Study	PROM, prematurity, and maternal hypertension during pregnancy were significantly associated with neonatal asphyxia.
6	Mariana, D., & Ashriady	<i>Analisis Faktor Risiko Umur Kehamilan Ibu dan Jenis Persalinan terhadap Kejadian Asfiksia pada Bayi Baru Lahir</i> (2020)	108 newborns	To analyze gestational age and delivery type as risk factors for neonatal asphyxia.	Case-Control Study	Cesarean section increased the risk of neonatal asphyxia by 2.469 times. Post-term pregnancy also increased the risk.
7	Putri, Y.N., Lalandos, J.L., & Setiono, K.W.	<i>Analisis Faktor Risiko pada Ibu dan Bayi terhadap Asfiksia Neonatorum di RSUD Prof. Dr. W.Z. Johannes Kupang</i> (2020)	116 respondents (58 cases; 58 controls)	To analyze maternal and neonatal factors associated with neonatal asphyxia.	Observational Analytic Case-Control Study	Maternal education, gestational age, fetal malpresentation, and meconium-stained amniotic fluid were significantly associated with neonatal asphyxia.
8	Sakunti, S.S., Fitriani, R., Jalaluddin, S., & Tihardimanto, A.	<i>Analisis Faktor Risiko Asfiksia Neonatorum di RSUD Labuang Baji Makassar Tahun 2021</i> (2024)	94 newborns (47 cases; 47 controls)	To identify maternal and neonatal risk factors associated with neonatal asphyxia.	Observational Analytic Case-Control Study	Maternal anemia, PROM, low birth weight, and gestational age were significantly associated with neonatal asphyxia, while maternal age, parity, preeclampsia,

No	Author	Title/Year	Respondents	Purpose	Research Method	Result
						and delivery method were not.
9	Wang, Y., Xiao, S., Zhang, S., & Qiu, C.	<i>Incidence of Neonatal Asphyxia and Associated Risk Factors: A Systematic Review and Cumulative Meta-analysis (2025)</i>	737,839 neonates (18 studies)	To estimate the incidence of neonatal asphyxia and identify its associated risk factors.	Systematic Review and Cumulative Meta-analysis	The pooled incidence of neonatal asphyxia was 7%. Instrumental delivery, primiparity, prematurity, and low birth weight were identified as significant risk factors.
10	Wang, Y., Xiao, S., Zhang, S., & Qiu, C.	<i>Incidence of Neonatal Asphyxia and Associated Risk Factors: A Systematic Review and Cumulative Meta-analysis (2025)</i>	737,839 neonates from 18 studies	To analyze the incidence of neonatal asphyxia and identify the associated risk factors to provide evidence for reducing neonatal asphyxia incidence and mortality.	Systematic Review and Cumulative Meta-analysis	The pooled incidence of neonatal asphyxia was 7% (95% CI: 5%–8%). Instrumental delivery (OR=3.10; 95% CI: 1.79–5.38), primiparity (OR=3.51; 95% CI: 2.15–5.74), preterm birth (OR=2.18; 95% CI: 1.54–3.09), and low birth weight (OR=2.85; 95% CI: 2.33–3.49) were identified as significant risk factors for neonatal asphyxia.

Based on the synthesis of the ten reviewed articles, prematurity was the most consistently reported risk factor associated with neonatal asphyxia. Six studies demonstrated that preterm infants have a higher risk of experiencing respiratory adaptation disorders due to pulmonary immaturity. In addition, low birth weight (LBW) and premature rupture of membranes (PROM) were also frequently identified as significant risk factors for neonatal asphyxia.

Obstetric factors, including prolonged labor, meconium-stained amniotic fluid, fetal malpresentation, and operative delivery (cesarean section, labor induction, and instrumental delivery), were also found to increase the risk of neonatal asphyxia. Furthermore, several

studies reported that maternal hypertension during pregnancy, maternal anemia, and primiparity contributed to a higher incidence of neonatal asphyxia.

Overall, the findings of this literature review indicate that neonatal asphyxia is a multifactorial condition influenced by a combination of maternal, obstetric, and neonatal factors. However, the most consistently reported risk factors across all reviewed articles were prematurity, low birth weight (LBW), premature rupture of membranes (PROM), abnormal gestational age, and meconium-stained amniotic fluid. These findings highlight the importance of early identification and appropriate management of high-risk pregnancies to reduce the incidence and adverse outcomes of neonatal asphyxia.

Discussion

The findings of this literature review indicate that neonatal asphyxia is a multifactorial condition influenced by maternal, obstetric, and neonatal factors. Across the ten reviewed articles, the most consistently reported risk factors were prematurity, low birth weight (LBW), premature rupture of membranes (PROM), abnormal gestational age, meconium-stained amniotic fluid, prolonged labor, maternal hypertension, maternal anemia, fetal malpresentation, and operative delivery.

Prematurity was the most frequently reported risk factor for neonatal asphyxia. Six of the reviewed studies (Yanti et al., 2023; Dewanta et al., 2022; Sakunti et al., 2024; Su et al., 2025; Wang et al., 2025; Handayani & Bella, 2022) found a significant association between preterm birth and neonatal asphyxia. Preterm infants have immature lungs and inadequate surfactant production, resulting in impaired respiratory adaptation after birth. In addition, the meta-analysis by Wang et al. (2025) demonstrated that preterm infants had more than twice the risk of developing neonatal asphyxia (OR = 2.18), confirming prematurity as one of the strongest predictors of this condition.

Low birth weight (LBW) was also consistently associated with neonatal asphyxia. Studies by Yanti et al. (2023), Sakunti et al. (2024), and Wang et al. (2025) reported that LBW significantly increased the risk of asphyxia because infants with low birth weight generally have immature organ systems and reduced pulmonary function. Wang et al. (2025) further reported that LBW increased the risk of neonatal asphyxia by 2.85 times, highlighting its important role in neonatal morbidity.

Premature rupture of membranes (PROM) was another major risk factor identified in this review. Putri and Isfaizah (2025), Dewanta et al. (2022), and Sakunti et al. (2024) consistently found that PROM was significantly associated with neonatal asphyxia. PROM may lead to intrauterine infection, umbilical cord compression, and prolonged fetal hypoxia, all of which compromise oxygen delivery to the fetus before birth. These findings emphasize the importance of early diagnosis and timely management of PROM during pregnancy.

Abnormal gestational age was also associated with neonatal asphyxia. Mariana and Ashriady (2020) reported that post-term pregnancy increased the risk of neonatal asphyxia because placental function gradually declines after 42 weeks of gestation, reducing oxygen and nutrient supply to the fetus. Similarly, Handayani and Bella (2022) and Putri et al. (2020) found

that gestational age was significantly related to neonatal asphyxia, indicating that both preterm and post-term pregnancies increase neonatal risk.

Obstetric complications, including prolonged labor, meconium-stained amniotic fluid, fetal malpresentation, and operative delivery, were also frequently associated with neonatal asphyxia. Yanti et al. (2023) and Putri and Isfaizah (2025) reported that prolonged labor increased fetal hypoxia due to prolonged uterine contractions and decreased placental perfusion. Meconium-stained amniotic fluid, reported by Yanti et al. (2023), Su et al. (2025), and Putri et al. (2020), may cause meconium aspiration syndrome, leading to airway obstruction and respiratory failure after birth. Furthermore, Su et al. (2025) identified breech presentation as a significant risk factor, while Wang et al. (2025) reported that instrumental delivery increased the risk of neonatal asphyxia by more than threefold (OR = 3.10). Mariana and Ashriady (2020) also found that cesarean section was associated with a higher risk of neonatal asphyxia, whereas Putri and Isfaizah (2025) identified labor induction as a significant contributing factor.

Maternal conditions also played an important role in the occurrence of neonatal asphyxia. Dewanta et al. (2022) found that maternal hypertension significantly increased the risk of neonatal asphyxia by reducing uteroplacental blood flow and fetal oxygenation. Likewise, Sakunti et al. (2024) reported that maternal anemia was associated with neonatal asphyxia because decreased maternal hemoglobin levels impair oxygen transport to the fetus. In addition, Wang et al. (2025) identified primiparity as a significant maternal risk factor, while Su et al. (2025) reported that advanced maternal age also increased the likelihood of neonatal asphyxia.

Overall, the reviewed studies consistently demonstrate that neonatal asphyxia results from the interaction of multiple maternal, obstetric, and neonatal factors rather than a single cause. Among all identified determinants, prematurity, low birth weight, premature rupture of membranes, abnormal gestational age, and meconium-stained amniotic fluid were the most consistently reported risk factors. These findings highlight the importance of comprehensive antenatal care, early identification of high-risk pregnancies, appropriate intrapartum management, and prompt neonatal resuscitation to reduce the incidence and adverse outcomes of neonatal asphyxia.

Conclusion and Suggestion

This literature review concludes that neonatal asphyxia is a multifactorial condition influenced by maternal, obstetric, and neonatal factors. The most consistently identified risk factors across the ten reviewed articles were prematurity, low birth weight (LBW), premature rupture of membranes (PROM), abnormal gestational age, and meconium-stained amniotic fluid. Early identification of these risk factors and appropriate maternal and neonatal care are essential to reduce the incidence of neonatal asphyxia.

Healthcare providers should strengthen antenatal and intrapartum care to identify and manage high-risk pregnancies early. Future research is recommended to include larger populations and multicenter studies to provide stronger evidence on the risk factors associated with neonatal asphyxia.

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AUTHOR CONTRIBUTIONS

VS: conceptual, data curation, formal analysis, investigation, methodology, roles/writing original draft; IKP: methodology, supervision, validation, writing review & editing

REFERENCES

- Barry, E. S., Merkebu, J., & Varpio, L. (2022). State-of-the-art literature review methodology: A six-step approach for knowledge synthesis. *Perspectives on Medical Education*, 11(5), 281–288. <https://doi.org/10.1007/s40037-022-00725-9>
- Dewanta, D. G. S., Padma, G. D., & Wiraningrat, I. G. A. A. N. (2022). Faktor risiko yang berhubungan dengan kejadian asfiksia pada neonatus di RSIA Dedari Kupang, Nusa Tenggara Timur, Indonesia. *Intisari Sains Medis*, 13(2), 511–515. <https://doi.org/10.15562/ism.v13i2.1410>
- Grant, M. J., & Booth, A. (2009). A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal*, 26(2), 91–108. <https://doi.org/10.1111/j.1471-1842.2009.00848.x>
- Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McGuinness, L., McDonald, S., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., Moher, D., Glanville, J., Chou, R., Brennan, S. E., Boutron, I., Akl, E., ... Tetzlaff, J. M. (2021). Pragma PRISMA 2020. statement: an updated guideline for reporting systematic reviews. *Medicina Fluminensis*, 57(4), 444–465. https://doi.org/10.21860/medflum2021_264903
- Kementerian Kesehatan. (2023). *Profil Kesehatan Indonesia 2023*.
- Mariana, D., & Ashriady. (2020). Analisis Faktor Risiko Umur Kehamilan Ibu dan Jenis Persalinan terhadap Kejadian Asfiksia pada Bayi Baru Lahir di Kabupaten Mamuju. *Jurnal Kesehatan Terpadu (Integrated Health Journal)*, 11(2), 58–64.
- Mulyani, S., & Suyani. (2023). Faktor-Faktor Yang Berhubungan Dengan Kejadian Asfiksia Di RS PKU Muhammadiyah Karanganyar Tahun 2023. *Jurnal Ilmu Psikologi Dan Kesehatan*, 1(4), 145–154.
- Mustika Handayani, A., & Nelya Bella, F. (2022). Analisis Faktor Risiko Terhadap Kejadian Asfiksia Pada BBL di RSUD Mayjen H.A Thalib Kerinci. *Midwifery Health Journal*, 7(2), 2022.
- Putri, A., & Isfaizah. (2025). *Hubungan Faktor Resiko Asfiksia Neonatorum pada*. 7(1), 70–81.
- Shanun Shari Sakunti, Rini Fitriani, Syatirah Jalaluddin, & Andi Tihardimanto. (2024). Analisis Faktor Risiko Asfiksia Neonatorum di RSUD Labuang Baji Makassar Tahun 2021. *Alami Journal (Alauddin Islamic Medical) Journal*, 8(2), 63–73. <https://doi.org/10.24252/alami.v8i2.36692>
- Su, Y. J., Liu, W., Xing, R. R., Yu, Z. Bin, Peng, Y. M., & Luo, W. X. (2024). Prevalence and risk factors associated with birth asphyxia among neonates delivered in China: a

- systematic review and meta-analysis. *BMC Pediatrics*, 24(1). <https://doi.org/10.1186/s12887-024-05316-7>
- Umami, R., Sinaga, K., Surbakti, I. S., Sinaga, A., & Novianti. (2025). Faktor-Faktor yang Mempengaruhi Kejadian Asfiksia Neonatorum di Puskesmas Pagar Merbau Kec. Pagar Merbau Kab. Deli Serdang Provinsi Sumatera Utara Tahun 2023. *NAJ: Nursing Applied Journal*, 3(1), 163–177.
- Su, Y. J., Liu, W., Xing, R. R., Yu, Z. Bin, Peng, Y. M., & Luo, W. X. (2024). Prevalence and risk factors associated with birth asphyxia among neonates delivered in China: a systematic review and meta-analysis. *BMC Pediatrics*, 24(1). <https://doi.org/10.1186/s12887-024-05316-7>
- Umami, R., Sinaga, K., Surbakti, I. S., Sinaga, A., & Novianti. (2025). Faktor-Faktor yang Mempengaruhi Kejadian Asfiksia Neonatorum di Puskesmas Pagar Merbau Kec. Pagar Merbau Kab. Deli Serdang Provinsi Sumatera Utara Tahun 2023. *NAJ: Nursing Applied Journal*, 3(1), 163–177.
- WHO. (2023). Trends in maternal mortality estimates 2000 to 2023: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. In *WHO, Geneva*.
- Yanti, N. R. (2023). BARU LAHIR Pendahuluan Angka kematian bayi merupakan indikator. *Journal of Borneo Holistic Health*, 6(1).

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