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Original Article

Maternal and perinatal risk factors associated with neonatal asphyxia: a case–control study

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A B S T R A C T

Background: Neonatal asphyxia remains a major cause of neonatal morbidity and mortality worldwide and continues to be the second leading cause of neonatal death in Indonesia. Although numerous studies have examined maternal and perinatal risk factors, contemporary evidence from Bali particularly from Wangaya General Hospital remains limited.

Objective: To analyze maternal and perinatal factors associated with neonatal asphyxia among newborns delivered at Wangaya General Hospital, Denpasar.

Methods: An analytical case–control study was conducted using hospital delivery records from January to November 2024. A total of 189 newborns were included, consisting of 95 asphyxia cases and 94 non-asphyxia controls selected through proportionate stratified random sampling. Maternal variables (parity, hypertensive disorders, anemia, premature rupture of membranes) and perinatal variables (mode of delivery, gestational age, birth weight) were extracted from medical records. Associations were examined using odds ratios (OR) with 95% confidence intervals, followed by multivariable logistic regression to identify independent predictors of neonatal asphyxia.

Results: Low birth weight (LBW) demonstrated the strongest association with neonatal asphyxia (adjusted OR = 112.66; 95% CI: 30.84–411.60; $p < 0.001$). Prematurity showed a significant crude association but became attenuated after adjustment, likely due to multicollinearity with LBW. Maternal factors including parity, hypertensive disorders, anemia, and premature rupture of membranes as well as mode of delivery did not show statistically significant associations in either bivariate or multivariable analysis.

Conclusion: Neonatal asphyxia at Wangaya General Hospital is predominantly associated with perinatal biological vulnerabilities, particularly low birth weight and, to a lesser extent, prematurity. Maternal factors contributed minimally in this setting, suggesting that fetal maturity and neonatal physiological readiness play a more crucial role than maternal comorbidities. Strengthening antenatal strategies to prevent fetal growth restriction and enhancing preparedness for the stabilization of LBW and preterm infants are essential to reducing asphyxia-related morbidity.

INTRODUCTION

Neonatal asphyxia remains a major contributor to neonatal mortality and long-term disability worldwide, accounting for nearly 23% of the 4 million neonatal deaths each year, with the highest burden occurring in low- and middle-income countries.[1,2] Globally, an estimated 9 million newborns experience asphyxia annually, leading to around 1.2 million deaths and more than one million survivors with severe neurological impairment.[3]

In Indonesia, neonatal asphyxia is the second leading cause of neonatal mortality, responsible for approximately 21.6% of infant deaths despite ongoing improvements in facility-based deliveries and antenatal care.[4-6] This persistent burden underscores the importance of understanding maternal and perinatal determinants that contribute to the condition. Previous literature identifies multiple risk factors associated with neonatal asphyxia, including maternal comorbidities such as hypertensive disorders, anemia, gestational diabetes, infections, and high-risk behaviors.[7,8] Meconium-stained amniotic fluid (MSAF), prolonged labor, emergency cesarean section,

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premature rupture of membranes, and low birth weight also play critical roles in disrupting fetal oxygenation and increasing neonatal vulnerability.[9-12]

In Indonesia, studies from tertiary hospitals highlight the contribution of MSAF, LBW, cesarean delivery, and maternal characteristics to early neonatal mortality.[13-14] However, evidence remains limited across secondary referral hospitals, and few studies integrate maternal and perinatal variables in a single analytical framework. Additionally, shifts in maternal health services post-2020 have not been adequately captured in existing research.

To address these gaps, this study provides updated, locally relevant evidence from Wangaya General Hospital, a major referral center in Denpasar. The study examines the combined influence of maternal factors (parity, maternal hypertension, anemia) and perinatal factors (PROM, mode of delivery, prematurity, birth weight) on the risk of neonatal asphyxia using a case–control design. Findings from this research are expected to support targeted antenatal surveillance, guide intrapartum decision-making, and strengthen preparedness for neonatal resuscitation in similar healthcare settings.

METHOD

This study employed an analytic case–control design to identify maternal and perinatal factors associated with neonatal asphyxia.[15]

Study Setting

The study was conducted at Wangaya General Hospital, a referral hospital in Denpasar, Bali Province, Indonesia. Data were obtained from hospital delivery records and neonatal registries covering the period from January to November 2024.

Population and Sample

The study population included all newborns delivered at Wangaya General Hospital during the study period. Using proportionate stratified sampling based on monthly birth volumes, a total of 189 newborns were selected for analysis. Of these, 95 neonates were documented as having neonatal asphyxia, and 94 neonates were documented as not having asphyxia, based on clinical assessment and Apgar score criteria. Inclusion Criteria: Newborns delivered at Wangaya General Hospital between January and November 2024; Availability of complete medical record documentation indicating the presence or absence of neonatal asphyxia. Exclusion Criteria: Newborns with incomplete or missing medical record information; Newborns referred from other healthcare facilities; Infants not delivered at Wangaya General Hospital. A proportionate stratified random sampling technique was applied. Each month of delivery was treated as a separate stratum, and the number of sampled newborns from each month was proportional to the total monthly delivery count. Within each monthly stratum, newborns were selected randomly from hospital birth registries. This approach ensured that the sample reflected the overall distribution and variability of births throughout the study period.

Variables and Data Collection

Maternal variables included: Parity (primipara/multipara); Hypertensive disorders in pregnancy; Maternal anemia; Premature rupture of membranes (PROM). Perinatal variables included: Mode of delivery (cesarean section vs. spontaneous); Gestational age (preterm vs. term); Birth weight (low birth weight vs. normal). Neonatal asphyxia was classified based on clinical evaluation and Apgar score criteria documented in medical records.[16] All data were extracted manually from standardized delivery logs and neonatal medical records by trained hospital staff using a structured data extraction form.

Data Analysis

Data were analyzed using both bivariable and multivariable approaches. Bivariable analysis was performed using 2×2 contingency tables to examine the association between each maternal and perinatal factor and neonatal asphyxia. Crude odds ratios (OR) with 95% confidence intervals (CI) were calculated. Fisher's Exact Test was used for significance testing due to small cell counts, with a significance threshold of $p < 0.05$. Multivariable logistic regression was conducted to estimate adjusted odds ratios (aOR) and to identify independent predictors of neonatal asphyxia. Model fit was assessed using the Likelihood Ratio Test (LLR) and McFadden's pseudo-R^2.[17,18]

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of Wangaya General Hospital, Denpasar (Approval No. 000.9.2/1671/RSUDW). All data were obtained from secondary hospital records, and no identifiable personal information was included in the analysis. Confidentiality was maintained throughout the research process.

RESULTS

Patient Characteristics

A total of 189 newborns were included in this case–control analysis, comprising 95 neonates with asphyxia and 94 without asphyxia. Regarding infant sex distribution, male newborns represented a slightly higher proportion in both groups, with a comparable pattern between asphyxiated and non-asphyxiated infants. Low birth weight and prematurity were more frequently observed among neonates with asphyxia, whereas the distribution of maternal factors including parity, hypertensive disorders, anemia, and premature rupture of membranes appeared similar between the two groups (Table 1).

Bivariate Analysis

The crude associations between each risk factor and neonatal asphyxia are presented in Table 2. Prematurity was significantly associated with an increased likelihood of-

Table 1. Characteristics of Neonates With and Without Asphyxia (n = 195)

Characteristics	Asphyxia (n=95)	Non-asphyxia (n=94)
Sex		
Male	58 (61.1%)	53 (56.4%)
Female	37 (38.9%)	41 (43.6%)
Parity		
Primipara	50 (52.6%)	43 (45.7%)
Multipara	45 (47.4%)	51 (54.3%)
Maternal hypertension		
Yes	15 (15.8%)	24 (25.5%)
No	80 (84.2%)	70 (74.5%)
Maternal anemia		
Yes	26 (27.4%)	22 (23.4%)
No	69 (72.6%)	72 (76.6%)
Premature rupture of membranes		
Yes	59 (62.1%)	58 (61.7%)
No	36 (37.9%)	36 (38.3%)
Mode of delivery		
Cesarean section	71 (74.7%)	66 (70.2%)
Vaginal delivery	24 (25.3%)	28 (29.8%)
Prematurity		
Preterm	39 (41.1%)	25 (26.6%)
Term	56 (58.9%)	69 (73.4%)
Birth weight		
Low birth weight	91 (95.8%)	32 (34.0%)
Normal birth weight	4 (4.2%)	62 (66.0%)

Table 2. Bivariate Associations Between Risk Factors and Neonatal Asphyxia

Variable	OR	95% CI	p-value
Primipara	1.32	0.74–2.33	0.384
Maternal hypertension	0.55	0.27–1.12	0.109
Maternal anemia	1.23	0.64–2.38	0.617
PROM	1.02	0.57–1.83	1.000
Cesarean delivery	1.26	0.66–2.38	0.518
Prematurity	1.92	1.04–3.55	0.046
Low birth weight	44.08	14.84–130.89	<0.001

asphyxia (OR 1.92, 95% CI 1.04–3.55; p = 0.046). Low birth weight demonstrated the strongest bivariate association, with neonates weighing less than 2,500 grams having 44-fold higher odds of asphyxia compared to those with normal birth weight (OR 44.08, 95% CI 14.84–130.89; p < 0.001). Other variables including primiparity, maternal hypertension, anemia, PROM, and cesarean section were not significantly associated with asphyxia in the bivariate analysis.

Multivariable Logistic Regression

After adjusting for potential confounders (Table 3), low birth weight remained the most dominant predictor of neonatal asphyxia (adjusted OR 112.66, 95% CI 30.84–411.60; p < 0.001). Prematurity showed a statistically significant inverse association (adjusted OR 0.23, 95% CI 0.09–0.59; p = 0.002), a pattern suggestive of strong collinearity with birth weight rather than a true protective effect. Maternal factors including parity, hypertensive disorders, anemia, PROM, and mode of delivery were not significantly associated with neonatal asphyxia after adjustment. The overall logistic regression model demonstrated good fit and was statistically significant (LLR p < 0.001), explaining approximately 40% of variability in neonatal asphyxia (Pseudo R^2 = 0.404).

Tabel 3. Multivariable Logistic Regression of Maternal and Perinatal Risk Factors for Neonatal Asphyxia

Variable	Adjusted OR	95% CI	p-value
Primipara	1.06	0.47-2.40	0.885
Maternal hypertension	0.37	0.14-1.03	0.057
Maternal anemia	1.32	0.52-3.33	0.558
PROM	1.12	0.49-2.56	0.788
Cesarean delivery	1.40	0.57-3.44	0.469
Prematurity	0.23	0.09-0.59	0.002
Low birth weight	112.66	30.84-411.60	<0.001

Model fit: Likelihood Ratio $\chi^2(7) = 105.90$, $p < 0.001$; McFadden pseudo-$R^2 = 0.404$

DISCUSSION

This analytical case–control study identified two major perinatal determinants of neonatal asphyxia at Wangaya General Hospital LBW and prematurity while maternal characteristics such as parity, hypertensive disorders, anemia, and premature rupture of membranes did not show statistically significant associations. These findings shift the interpretation from maternal-risk–dominated patterns observed in several previous Indonesian studies toward a stronger neonatal or perinatal risk profile in this hospital setting.

Low birth weight emerged as the strongest predictor of neonatal asphyxia, consistent with existing evidence indicating that LBW infants are highly vulnerable to intrapartum hypoxia due to immature pulmonary structures, reduced alveolar numbers, and limited respiratory muscle capacity.[19] Studies in Indonesia and other low-resource settings similarly reported LBW as a major determinant of failure to initiate spontaneous respiration.[20-22] Reduced lung compliance and inadequate surfactant function further impair respiratory adaptation, making LBW infants disproportionately susceptible to hypoxic injury.[23] These physiological vulnerabilities explain why LBW remained a robust predictor in the multivariable model even after adjusting for maternal comorbidities and delivery factors.

Prematurity was also significantly associated with asphyxia in the bivariate analysis, although its adjusted effect in the multivariable model shifted after controlling for LBW. Premature infants characteristically have immature lungs, surfactant deficiency, small airways, and underdeveloped respiratory control centers, making them prone to apnea and hypoventilation.[23,24] Prior studies from Tigray, Ethiopia and China likewise identified prematurity as a major determinant of birth asphyxia.[25-27] The change in effect direction in the multivariable model likely reflects strong collinearity between prematurity and LBW an expected phenomenon because the majority of premature infants are also low birth weight. Physiologically, however, prematurity

remains a meaningful contributor to impaired neonatal transition despite the statistical overlap.

In contrast to some previous Indonesian studies, maternal risk factors including parity, hypertension, anemia, and PROM did not demonstrate significant associations with asphyxia in this analysis.[10,28,29] Although primiparity has been linked to prolonged labor and increased intrapartum complications in other settings,[30,31] the similar distribution between cases and controls in this study suggests that obstetric management at this hospital may mitigate the risk associated with first-time deliveries. Likewise, hypertensive disorders well-established causes of placental hypoperfusion and chronic fetal hypoxia[32] Were not prominent in this cohort. This may reflect effective antenatal detection and stabilization of hypertensive mothers before delivery, preventing intrapartum fetal compromise. Anemia, which contributes to reduced oxygen-carrying capacity and impaired placental oxygen transfer,[33] also did not differ meaningfully between groups, further suggesting adequate antenatal management.

PROM, known to predispose to cord compression, oligohydramnios, and infection-related inflammatory responses,[34] was relatively frequent overall but did not differ significantly between cases and controls. Prior studies in Indonesia identified PROM as a dominant maternal risk factor,[28,30] but the absence of a significant association here may be attributed to early recognition and timely obstetric intervention that prevented progression to fetal distress. Similarly, cesarean section often associated with delayed lung fluid clearance and respiratory transition difficulties[35] did not emerge as a significant determinant in the adjusted analysis, possibly because a large proportion of both cases and controls were born via cesarean delivery, reducing discriminative power.

Collectively, the findings of this study indicate that perinatal factors particularly LBW and prematurity are more decisive determinants of neonatal asphyxia than maternal complications in this hospital setting. This differs from earlier regional studies that emphasized maternal conditions such as PROM, hypertensive disorders, and anemia as primary contributors.[10,28,29] The shift may reflect enhanced maternal health services, improved antenatal surveillance, and early obstetric referral patterns in Denpasar, resulting in a scenario where neonatal biological vulnerabilities play a more prominent role in shaping outcomes.

These results have important clinical implications. First, strengthening antenatal strategies to prevent LBW through maternal nutrition counseling, anemia prevention, and monitoring of fetal growth remains essential. Second, heightened preparedness for neonatal resuscitation should be prioritized for infants identified as premature or LBW, regardless of maternal risk profiles. Third, given the hospital's high cesarean delivery rate, ensuring optimal timing and readiness for neonatal transition support is critical.

This study has several limitations. The case–control design cannot establish causality, and residual confounding from undocumented maternal variables (e.g., intrapartum fetal monitoring patterns, uterine dysfunction, or infection markers) may influence results. The use of hospital-based secondary data may also introduce misclassification or incomplete documentation. Additionally, being a single-center study limits generalizability to other regions with different obstetric practices. Nonetheless, the study provides updated evidence on neonatal asphyxia risk patterns in an urban referral hospital and highlights the predominant role of perinatal biological vulnerabilities over maternal complications.

CONCLUSIONS AND RECOMMENDATION

This study concludes that neonatal asphyxia at Wangaya General Hospital is predominantly associated with perinatal biological factors, especially low birth weight, which exhibited a markedly increased likelihood of asphyxia after adjustment for maternal and intrapartum characteristics. Prematurity also demonstrated a meaningful contribution, although its effect was attenuated after adjustment due to its strong overlap with low birth weight. In contrast, maternal factors such as parity, hypertensive disorders, anemia, premature rupture of membranes, and mode of delivery did not demonstrate significant associations, indicating that fetal maturity and neonatal physiological capacity play a more decisive role in this setting than maternal comorbidities.

Strengthening antenatal strategies aimed at preventing fetal growth restriction is essential, particularly through optimization of maternal nutrition, early identification of high-risk pregnancies, and consistent monitoring of fetal development. Perinatal services should prioritize preparedness for the resuscitation and stabilization of low-birth-weight and preterm infants, as these groups represent the most vulnerable populations. Enhancing the integration of maternal fetal surveillance protocols between antenatal and intrapartum care may further reduce the risk of perinatal compromise. Future research should consider longitudinal or prospective designs to elucidate causal pathways more robustly and examine potential interactions between maternal, perinatal, and systemic factors in the development of neonatal asphyxia.

REFERENCES

1. World Health Organization. Guidelines on basic newborn resuscitation. 2012. https://www.who.int/publications/i/item/9789241503693
2. Moshiro R, Mdoe P, Perlman JM. A global view of neonatal asphyxia and resuscitation. *Front Pediatr*. 2019;7:489. http://dx.doi.org/10.3389/fped.2019.00489
3. World Health Organization. Perinatal asphyxia. 2025. https://www.who.int/teams/maternal-newborn-child-adolescent-health-and-ageing/newborn-health/perinatal-asphyxia
4. Damayanti A, Sampurna M, Aditiawarman A. Risk

factors of birth asphyxia: literature review. *Int J Res Pharm Sci*. 2021;92(1). http://dx.doi.org/10.47119/ijrp100921120222729
5. Rochmah E, Ulfah M, Harihardjaja W, Pratesya L. Neonatal mortality rate and causes of death in Sukabumi District, West Java Province. *Adv Health Sci Res*. 2021. http://dx.doi.org/10.2991/ahsr.k.210723.049
6. Jasin Y, Darmawan E, Utomo M. Risk factors of severe perinatal asphyxia at tertiary hospital. *Rom J Pediatr*. 2023;72(4):188-193. http://dx.doi.org/10.37897/rjp.2023.4.8
7. Tadesse A, Kassa A, Denis C. Birth asphyxia and its associated factors among newborns in public hospital, Northeast Amhara, Ethiopia. *PLoS One*. 2019;14(12):e0226891. http://dx.doi.org/10.1371/journal.pone.0226891
8. Alamneh Y, Negesse A, Aynalem Y, et al. Risk factors of birth asphyxia among newborns at Debre Markos Comprehensive Specialized Referral Hospital, Northwest Ethiopia: unmatched case-control study. *Ethiop J Health Sci*. 2022;32(3). http://dx.doi.org/10.4314/ejhs.v32i3.6
9. Ali M, Maruf A, Naher N, Islam S. Neonatal outcome in meconium-stained amniotic fluid: a study in a neonatal high dependency unit of a medical college hospital. *Mediscope*. 2019;6(2):65-71. http://dx.doi.org/10.3329/mediscope.v6i2.43155
10. Soewandhie M, Tri S, Sekarwati A, Darsini N, Husada D. Risk factors for neonatal asphyxia occurrence at General Hospital Dr. M. Soewandhie, Surabaya. Int J *Pharm Res Dev*. 2020. http://dx.doi.org/10.37506/ijphrd.v11i4.7757
11. Soni H, Pandya N, Soni P, Soni S. Birth asphyxia: risk factors, complications, and outcomes in neonates admitted at a tertiary care center in Gujarat, India. *Cureus*. 2025. http://dx.doi.org/10.7759/cureus.95271
12. Wang Y, Xiao S, Zhang S, Qiu C. Incidence of neonatal asphyxia and associated risk factors: a systematic review and cumulative meta-analysis. *BMC Pediatr*. 2025;25(1). http://dx.doi.org/10.1186/s12887-025-06249-5
13. Iskandar N, Sampurna M, Aditiawarman A, et al. Early neonatal mortality profile in Dr. Soetomo General Hospital. *Int J Res Pharm Sci*. 2022;111(1). http://dx.doi.org/10.47119/ijrp10011111020224010
14. Davidz I, Kuntoro K, Joewono H, Irwanto I. Risk factors of early neonatal death in East Nusa Tenggara, Indonesia: a case-control study. *Paediatr Indones*. 2022;62(4):284–92. http://dx.doi.org/10.14238/pi62.4.2022.284-92
15. Tenny S, Kerndt CC, Hoffman MR. Case control studies. In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK448143/
16. Simon LV, Shah M, Bragg BN. APGAR score. In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK470569/
17. Kim HY. Statistical notes for clinical researchers: chi-squared test and Fisher's exact test. *Restor Dent Endod*. 2017;42(2):152-155. http://dx.doi.org/10.5395/rde.2017.42.2.152
18. Sperandei S. Understanding logistic regression analysis. Biochem Med. 2014;24(1):12-18. http://dx.doi.org/10.11613/BM.2014.003
19. Li Z, Wang S, Wang P. Associations between low birth weight and perinatal asphyxia: a hospital-based study. *Medicine (Baltimore)*. 2023;102(13):e33137. http://dx.doi.org/10.1097/MD.0000000000033137
20. Pratama S, Hanum L, Budi Y. The incidence of neonatal asphyxia in low birth weight newborns at Goeteng Taroenadibrata Purbalingga Regional Hospital. *Herb Med J*. 2018;1(2):92–97. https://dx.doi.org/10.30595/hmj.v1i2.3098
21. Budiman P, Kardana I, Artana I, Putra P, Sukmawati M. Characteristics of neonatal asphyxia in Perinatology Ward Sanglah General Hospital Denpasar. *Int J Sci Res*. 2021;10(11):290–296. https://dx.doi.org/10.21275/sr21805113648
22. Dewanta D, Padma G, Wiraningrat I. Risk factors associated with the occurrence of asphyxia in neonates at Dedari Kupang Maternal and Children's Hospital, East Nusa Tenggara, Indonesia. *Intisari Sains Medis*. 2022;13(2):511–515. https://dx.doi.org/10.15562/ism.v13i2.1410
23. Yadav S, Lee B. Neonatal respiratory distress syndrome. In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK560779/
24. Erickson G, Dobson NR, Hunt CE. Immature control of breathing and apnea of prematurity: the known and unknown. *J Perinatol*. 2021;41(9):2111-2123. http://dx.doi.org/10.1038/s41372-021-01010-z
25. Tasew H, Zemicheal M, Teklay G, et al. Risk factors of birth asphyxia among newborns in public hospitals of Central Zone, Tigray, Ethiopia. *BMC Res Notes*. 2018;11(1):496.http://dx.doi.org/10.1186/s13104-018-3611-3
26. Yu Y, Gao J, Liu J, et al. Perinatal maternal characteristics predict a high risk of neonatal asphyxia: a multi-center retrospective cohort study in China. *Front Med*. 2022;9. http://dx.doi.org/10.3389/fmed.2022.944272
27. Worke MD, Seifu B, Belgu B, Shiferaw K. Predictors of birth asphyxia in Ethiopia: an updated systematic review and meta-analysis. *BMC Pregnancy Childbirth*. 2025;25(1):1172. http://dx.doi.org/10.1186/s12884-025-08346-w
28. Ernawati E. Risk factors for asphyxia in newborns: systematic review of neonatal health. *Syntax Literate*. 2023;7(9):16451-16463. http://dx.doi.org/10.36418/syntax-literate.v7i9.8637
29. Martini S. The relationship of anemia in third trimester pregnant women and the incidence of asphyxia neonatorum. *J Profesi Bidan Indones*. 2021;1(2):1–9.
30. Muslicha I, Sari V, Rahmatika S, Wiwin W. The relationship between premature membrane rupture and neonatal asphyxia at Gunung Jati Regional Hospital, Cirebon City. *Med Sci*. 2025;2(3):183-194. http://dx.doi.org/10.62885/medisci.v2i3.604
31. Hashim N, Naqvi S, Khanam M, Jafry HF. Primiparity as an intrapartum obstetric risk factor. *J Pak Med Assoc*.

2012;62(7):694–698.
32. Salazar MR. Placental hypoxia, high nighttime blood pressure, and maternal health. *Hypertens Res*. 2024;47:972–974. http://dx.doi.org/10.1038/s41440-023-01567-6
33. Obeagu GU, Altraide BO, Obeagu EI. Iron deficiency anemia in pregnancy and related complications with specific insight in Rivers State, Nigeria: a narrative review. *Ann Med Surg*. 2025;87(6):3435–3444. http://dx.doi.org/10.1097/MS9.0000000000003224
34. Dayal S, Jenkins SM, Hong PL. Preterm and term prelabor rupture of membranes (PPROM and PROM). In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK532888/
35. Yeganegi M, Bahrami R, Azizi S, et al. Caesarean section and respiratory system disorders in newborns. *Eur J Obstet Gynecol Reprod Biol X*. 2024;23:100336. http://dx.doi.org/10.1016/j.eurox.2024.100336