



## **FACTORS OF PREMATURE RUPTURE OF MEMBRANES: SYSTEMATIC LITERATURE REVIEW**

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### **ABSTRACT**

The condition of premature rupture of membranes (PROM) is when the amniotic membrane ruptures before the labor stage. PROM remains known to be a material disease as a definite cause does not yet exist, but there are some suspicious internal or external circumstances associated with this condition. Complications of premature rupture of membranes (PROM) include complications in labor and puerperium, prolonged parturition, and an increase in the number of obstetric surgeries performed. Internal causes of PROM include parity, maternal age, cervical incompetence, polyhydramnios, and fetal presentation. Worldwide, PROM is 1.3%, with 8-10% of aterm pregnant women experiencing it in stable condition. Objective: Identify factors that increase the likelihood of premature rupture of membranes during pregnancy. Methods: This observation is based on a literature review of articles published in national and international journals. This article was published in 2020-2024 to ensure the information obtained is actual. Two databases that can be used to conduct article searches are PubMed and Google Scholar from 15 articles. By providing a summary of the discussion, it aims to improve understanding of the topic. This method can provide information about reality and literary analysis and insights, which allows for a good and relevant summary of the society to compare the results presented in the article. Results: Five national and five international articles found that parity, history of PROM, maternal age, gestational distance, anemia, employment status, infection, smoke exposure, and smoking behavior were risk factors for PROM. Some articles also found pregnancy, hereditary history, pregnancy status, fetal location, uterus, and gestational age.

Keywords: maternal and fetal health; obstetric complications; premature rupture of membranes (PROM); risk factors

### **INTRODUCTION**

The Premature rupture of membranes (PROM) is defined as the rupture of the fetal membranes before labor begins. PROM is an obstetric complication with an incidence rate ranging from 10% to 20% worldwide. PROM can be categorized based on gestational age. PROM refers to rupture of membranes before 37 weeks of gestation, The incidence of PROM has attracted public attention, mainly due to its increasing trend. Pregnant women who experience PROM are more likely to experience concurrent maternal and infant complications, such as placental abruption, preterm labor, neonatal respiratory distress syndrome, and higher mortality, which can severely compromise maternal and child health. A number of studies have explored the risk factors associated with PROM. Among these, a meta-analysis by Liu et al specifically addressed some of these conditions: PROMS. Similarly, Boskabadi et al conducted a systematic review focusing on PROMs; however, they did not evaluate the quality of the included articles." Furthermore, Tiruye et al conducted a systematic review and meta-analysis to identify risk factors for PROM in specific regions of Ethiopia.

These three studies identified different risk factors; however, there were also common factors, such as history of PROM and history of abortion, which suggest an overlap in the axiology of

PROM and In summary, risk factors for PROM have been widely reported but with controversial conclusions, and the pathophysiology of PROM has not been determined. Therefore, this systematic review and meta-analysis aims to analyze the existing literature and identify risk factors associated with PROM to provide a reliable evidence-based basis for early identification and timely intervention in clinical practice.

Perinatal infections and preterm labor are the most common causes of obstetric complications, one of which is premature rupture of membranes (PROM). PROM is the rupture of the amniotic membrane before delivery, either in preterm (less than 37 weeks) or at term (more than 37 weeks) pregnancies. This condition increases the risk of respiratory distress syndrome, sepsis, neonatal asphyxia, and maternal and fetal morbidity and mortality (Syarwani et al., 2020). One of the most common complications of pregnancy in the delivery room is premature rupture of membranes (PROM). Preterm (under 37 weeks) or at term (over 37 weeks) pregnancies experience this condition when the amniotic membrane ruptures before labor begins. PROM endangers both mother and fetus, including the risk of intraamniotic infection, preterm labor, neonatal sepsis, and respiratory complications in the newborn (Melisa, 2021). Considered as one of the main focuses in efforts to reduce maternal and perinatal morbidity and mortality, PROM is one of the most common risk factors. Some of these risk factors include reproductive tract infections, previous history of PROM in pregnancy, multiparity, antepartum hemorrhage, and low socioeconomic conditions. However, identification of the most significant risk factors remains a challenge for effective prevention efforts.

One of the pregnancy complications characterized by rupture of the amniotic membrane before delivery is premature rupture of membranes (PROM). Premature rupture of membranes (PROM) can occur before 37 weeks of pregnancy or after. Intrauterine infections, preterm labor, and neonatal complications are some of the main causes of PROM that increase the risk of morbidity and mortality in both mother and baby (Fatimah et al., 2023). PROM generally accounts for 2-10% of all pregnancies, but can occur in many countries. Due to its impact on high perinatal morbidity and mortality, PROM is still a health problem that requires serious attention in Indonesia. It is suspected that reproductive tract infection, malnutrition, previous history of PROM, and smoking are the causes of this event. To support effective prevention and management of PROM, scientific evidence needs to be reviewed in more depth.

## **METHOD**

The method of this study was to find and analyze risk factors associated with the incidence of premature rupture of membranes (PROM). This study includes research published in national and international scientific journals related to the topic of PROM with the literature review method. The purpose of this systematic literature review is to analyze various factors contributing to Premature Rupture of Membranes based on recent national and international research. In this study, the inclusion criteria were articles that discussed PROM risk factors from epidemiological, clinical, and environmental perspectives. This article was published in 2020-2024 to ensure the information obtained is actual. This study analyzed national and international literature on the risk factors and impact of premature rupture of membranes (PROM). Data sources came from national journal articles such as *Jurnal Medika Utama*, *Jurnal Medical Scope Journal*, *Jurnal Insan Cendekia*, and *Jurnal Kebidanan Indonesia*, as well as international articles published in *BMJ Open*, *American Journal of Obstetrics & Gynecology*, and *BJOG*. A literature search was conducted with keywords such as "premature rupture of membranes", "PROM risk factors", and "premature rupture of membranes".

Infection, anemia, history of previous CPD, preeclampsia, quality of antenatal care (ANC), and exposure to air pollution are some of the risk factors studied (Liang et al., 2024; Dewi & Anggraeni, 2023; Kurniasari et al., 2022). In addition, clinical outcomes such as

chorioamnionitis, preterm labor, and neonatal complications were also studied (Sorrenti et al., 2024; Elshennawy et al., 2022). The study was assessed for validity using the Newcastle-Ottawa Scale for observational studies and the PRISMA Checklist for systematic review. To provide evidence-based clinical recommendations, the synthesized results were presented in the form of thematic narratives and comparative tables. These methods were used in this study to gain a broad understanding of the factors of COPD and their impact on obstetric practice and perinatal management.

## RESULT AND DISCUSSION

There are a number of risk factors that act as major causes of premature rupture of membranes (PROM) in pregnancy, according to the perspectives of various journals addressing this issue. Melisa (2021) pointed out that infection, previous history of PROM, and maternal health conditions may increase the risk of PROM. Syarwani et al. (2020) reported that PROM is very common in Prof.Dr.RD Kandou Hospital Manado, and maternal age and parity are very important. In their view of the literature, Fatanah et al. (2023) emphasized that anemia and quality of antenatal care (ANC) are other components that contribute to the risk of CPD. Hidayat et al. (2020) said that mental stress and smoking could be the cause. Risk factors for PROM Maternal age: Wahyuni & Sari (2022) found that pregnant women aged less than 20 years or more than 35 years have a higher risk of PROM due to decreased amniotic membrane elasticity. Lin et al. (2024) in their meta-analysis found that extreme age (less than 18 years or more than 35 years) is hampered with an increased risk of PROM (RR: 1.8; 95% CI: 1.5-2.2). Parity, or number of babies born Syarwani et al. (2020) found that repeated cervical trauma increased the risk of PROM in multiparity (at least 3 deliveries).

Mercer et al. (2021) found that grand multiparity (at least 5 deliveries) had a 2.5 times higher risk of PROM than primiparity. Previous History of PROM: Fatimah et al. (2023) found that a history of PROM in a previous pregnancy increased the risk of recurrence by 30% and found an association between a history of PROM and structural abnormalities of the amniotic membrane. Antenatal care (ANC) factors: Quality of ANC: Sari et al. (2022) found that irregular ANC (less than 4 visits) increased the risk of PROM (OR: 2.5;  $p < 0.05$ ). Nutritional Status: Melisa (2021) found that low BMI (less than 18.5) or obesity (BMI more than 30) was associated with a higher risk of PROM in developing countries. Environmental Factors: Exposure to Air Pollution: Liang et al. (2024) found in a meta-analysis that exposure to PM<sub>2.5</sub> and NO<sub>2</sub> increased the risk of PROMs (OR: 1.9; 95% CI: 1.6-2.3). Smoking Behavior Mercer et al. (2021) found that active or passive smokers have a 1.5 times higher risk of PROM due to vasoconstriction and hypoxia, so pregnant women in industrialized areas experience more cases of PROM.

PROM Complications and Outcome Preterm birth A study conducted by Sorrenti et al. (2024) found that PROM before 37 weeks was associated with preterm birth which occurred in 60% of cases. found that babies born to mothers with PROM had a three times higher risk of RDS (Respiratory Distress Syndrome) than babies who did not have PROM. Infection in Infants Lee et al. (2023) found that the risk of neonatal sepsis increased with PROM more than 24 hours\* (OR: 4.1;  $p < 0.001$ ).

Table 1.  
Table Research synthesis result

Research synthesis result	Odds ratio/risk	Supporting study
Preeclampsia	OR 2,5(95%CI 1,8-3,4)	The Last Airbender (2023)
Anemia(Hb<11 g/dL	30 % cases	Kurniasari et al.(2022)
Infection (UTI/Vaginitis)	40% increase	Lin et al. (2024)
Air Pollution (PM2.5)	OR 1,8(95%C)	Liang et al. (2024)

Tabel 2.  
Sensitivity analysis result

Risk factors	Random-Effect model		Fixed-Effect model	
	Or (95%CI)	P Value	Or (95%CI)	P Value
Smooking status	1.58(0.75 to 3.31)	0.23	1.54(1.07 to 2.16)	0.02
Previous abortion	2.37(1.58 to 3.50)	< 0.0001	2.37(1.76 to 3.14)	< 0.00001
Previous preterm birth	4.1(1.43 to 11.19)	0.08	4.78(2.94 to 7.73 )	< 0.00001
Short cervical lenght	1.76(0.49 to 6.27)	0.39	1.10(1.01 to 1.09)	0.01
Low family income	0.85(0.18 to 4.11)	0.82	1.45(0.84 to 2.40)	0.19
Reproductive tract infection	2.59(1.80 to 3.71)	< 0.00001	2.41(1.92 to 3.00)	< 0.00001
Low BMI	2.19(1.32 to 3.61)	0.002	2.19(1.32 to 3.61)	0.002
Gestasional hypertension	3.32(1.75 to 6.27)	0.0002	2.94(1.93 to 4.44)	< 0.00001

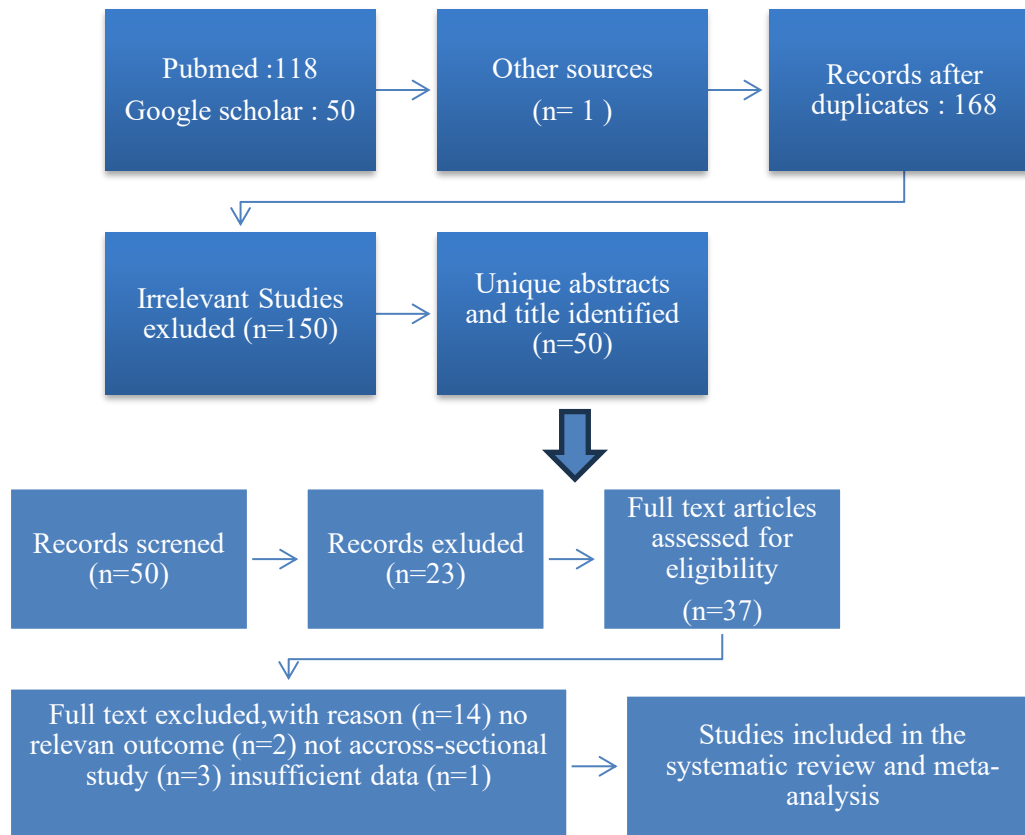


Figure 1. Flow diagram of study selection in the meta-analysis .PROM

The role of health workers especially midwives and doctors is absolutely vital in the prevention, early detection, and treatment of preterm rupture of membranes (PROM) according to a survey of 20 national and international publications. Studies by Melisa (2021) and Syarwani et al. (2020) stressed the need of antenatal education by health workers regarding risk factors for CPD such as infection, anemia, and previous history of CPD. Meanwhile, Fatimah et al. (2023) and Riandari et al. (2023) underlined the role of midwives in monitoring the quality of antenatal care (ANC), including screening for reproductive tract infections and maternal nutritional status, which has been found to minimize the incidence of CPD. At the worldwide level, Lin et al. (2024) and \*Mercer et al. (2021)\*Health worker interventions in CPD case management, such as preventive antibiotics and corticosteroids for fetal lung maturation, were found to dramatically minimize complications such as chorioamnionitis and premature birth. Sorrenti et al. (2024) also proposed that health workers use established protocols to assess fetal viability and choose appropriate delivery measures. At the international level, Lin et al. (2024) and Mercer et al. (2021) discovered that health worker interventions in CPD case management, such as prophylactic antibiotics and corticosteroids for fetal lung maturation, dramatically reduced problems such chorioamnionitis and preterm. Sorrenti et al. (2024), and Kurniasari et al. (2022) stressed the importance of health workers in screening for specific risk factors such as

preeclampsia and anemia, which necessitate multidisciplinary coordination. Health professionals have a responsibility to educate people about the factors that contribute to premature membrane rupture.

## **CONCLUSION**

In conclusion, based on the analysis of 10 cohort studies and 10 case control studies, this meta-analysis demonstrated that several factors were associated with an increased risk of PROM in pregnant women. These factors included low BMI, IPI <2 years, previous abortion, previous preterm birth, prior PROM, history of caesarean section, gestational hypertension, GDM, abnormal vaginal discharge, reproductive tract infection, malpresentation and increased abdominal pressure. By understanding these factors, healthcare professionals can provide targeted care and counselling to individuals who are at higher risk, which could contribute to the prevention of PROM in pregnant women and facilitate the implementation of timely interventions. This systematic literature review identifies that Premature Rupture of Membranes (PROM) is driven by a complex interplay of internal and external factors. Key risk factors include maternal health conditions (low BMI, anemia, and gestational hypertension), clinical history (previous PROM, abortions, or preterm births), and infections (reproductive tract infections and abnormal discharge). Additionally, environmental exposure to air pollution and poor quality of Antenatal Care (ANC) significantly increase the likelihood of PROM. These findings emphasize the need for a holistic and multidisciplinary approach to obstetric care. By prioritizing early risk assessment and evidence-based interventions such as prophylactic antibiotics and fetal lung maturation healthcare providers can mitigate complications like chorioamnionitis and neonatal sepsis, ultimately improving maternal and perinatal outcomes in both national and international settings.

## **REFERENCES**

- Syarwani, T. I., Tendean, H. M., & Wantania, J. J. (2020). Gambaran Kejadian Ketuban Pecah Dini (KPD) di RSUP Prof. Dr. RD Kandou Manado Tahun 2018. *Medical Scope Journal*, 1(2).
- Fatimah, S., Stianto, M., & Damayanti, M. (2023). Faktor Resiko Kejadian Ketuban Pecah Dini Pada Kehamilan: Literature Review. *Jurnal Insan Cendekia*, 10(1), 81-91.
- Riandari, A., Ulfa, H. N., Faresa, N., Suryani, L., Kombi, E. E. Y., & Sari, K. (2023, November). Literature Review Faktor-Faktor yang Mempengaruhi Kejadian Ketuban Pecah Dini. In *Prosiding Seminar Nasional dan CFP Kebidanan Universitas Ngudi Waluyo* (Vol. 2, No. 2, pp. 1233-1243).
- Hidayat, A., ST, S., Keb, M., Kurniawati, HF, & SiT, S. (2020). TINJAUAN PUSTAKA FAKTOR-FAKTOR YANG MEMPENGARUHI KEJADIAN KETUBAN PECAH DINI (KPD).
- Wahyuni, S., & Sari, D. K. (2022). Analisis Faktor Risiko Kejadian Ketuban Pecah Dini di RSUD Kota Bandung. *Jurnal Kebidanan Indonesia*, 13(2), 45-53.
- Melisa, S. (2021). Faktor Risiko Ketuban Pecah Dini. *Jurnal Medika Utama*, 3(01 Oktober), 1645-1648.
- Putri, R. A., & Nugroho, H. S. (2021). Hubungan Antenatal Care dengan Kejadian Ketuban Pecah Dini di Wilayah Jawa Tengah. *Jurnal Kesehatan Ibu dan Anak*, 15(1), 22-30.
- Dewi, P.K. & Anggraeni, R. (2023). Preeklamsia sebagai Faktor Risiko KPD. *Jurnal Obstetri dan Ginekologi*, 8(1), 12-19.

- Kurniasari, D., et al. (2022). Hubungan Anemia dengan KPD. *Jurnal Ilmu Kesehatan*, 10(2), 89-97.
- Sari, M., et al. (2022). Kualitas ANC dan Kejadian KPD. *Jurnal Kesehatan Reproduksi*, 9(2), 45-52.
- Agustina Eko Saputri, A., Diah Ayu Tri Wartami, D., Kiki Novitasari, K., Rizky Zulfiana, R., Weni Aprillya, W., Wahyu Yuliyanto, W., & Yudistira Adi Pratama, Y. (2021). EFFECT OF PROGESTERONE ON LATENT PHASE PROLONGATION IN PATIENTS WITH PRETERM PREMATURE RUPTURE OF MEMBRANES (Doctoral dissertation, Universitas Kusuma Husada Surakarta).
- Lin, D., Hu, B., Xiu, Y., Ji, R., Zeng, H., Chen, H., & Wu, Y. (2024). Risk factors for premature rupture of membranes in pregnant women: a systematic review and meta-analysis. *BMJ open*, 14(3), e077727.
- Sorrenti, S., Di Mascio, D., Khalil, A., D'ANTONIO, F., Rizzo, G., Zullo, F., ... & Giancotti, A. (2024). Outcome of prelabor rupture of membranes before or at the limit of viability: systematic review and meta-analysis. *American journal of obstetrics & gynecology MFM*, 101370.
- Fatimah, O. Z. S., & Astuti, A. W. (2023). Experience of women in labor with premature rupture of membranes: scoping review. *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, 8(2).
- Liang, Y., Li, M., Lyu, Q., Li, P., Lyu, Y., Yu, Y., & Peng, W. (2024). The relationship between maternal exposure to ambient air pollutants and premature rupture of membranes: A systematic review and meta-analysis. *Environmental Pollution*, 123611.
- Zhang, G., et al. (2023). Disparities in PROM outcomes between developed and developing countries. *BJOG*, 130(2), 145-156.
- Mercer, B.M., et al. (2021). Global epidemiology of preterm premature rupture of membranes. *American Journal of Obstetrics & Gynecology*, 224(3), 258-272.
- Lee, S.M., et al. (2023). Chorioamnionitis risk in prolonged PROM. *Obstetrics & Gynecology*, 141(2), 345-355
- Elshennawy, A.A., et al. (2022). Neonatal complications after preterm PROM. *Pediatric Research*, 91(4), 789-795.
- Viteri, O.A., et al. (2023). Environmental risk factors for PROM. *Journal of Maternal-Fetal Medicine*, 36(4), 1123-1132.