International Journal of Advanced Health Science and Technology e-ISSN:2808-6422; p-ISSN:2829-3037
Homepage: ijahst.org Vol. 6 No. 2, pp. 74-80, February 2026

RESEARCH ARTICLE OPEN ACCESS
Manuscript received November 10, 2025; revised January 10, 2026; accepted January 15, 2026; date of publication February 30, 2026
Digital Object Identifier (DOI): https://doi.org/10.35882/ijahst.v6i2.574

How to cite: Eni Rahayu, Sulikah, Budi Joko Santosa and Tutiek Herlina, "Analysis of Lungs Maturity Induction (LMI) in Preterm Labor on Neonatal Asphyxia Status at dr. Sayidiman Regional General Hospital, Magetan", International Journal of Advanced Health Science and Technology, Vol. 6 No. 2, pp. 74-80, February 2026.

Analysis of Lungs Maturity Induction (LMI) in Preterm Labor on Neonatal Asphyxia Status at dr. Sayidiman Regional General Hospital, Magetan

Eni Rahayu, Sulikah, Budi Joko Santosa and Tutiek Herlina

Department of Midwifery, Poltekkes Kemenkes Surabaya, Surabaya, Indonesia

Corresponding author: Eni Rahayu (e-mail: enyzra@gmail.com)

ABSTRACT Neonatal asphyxia remains a major contributor to neonatal morbidity and mortality, particularly among preterm infants whose lungs are physiologically immature and lack adequate surfactant production. At Dr. Sayidiman Regional General Hospital, Magetan, neonatal mortality due to asphyxia remains considerably high, indicating the need for effective preventive interventions. Lungs Maturity Induction (LMI) is widely recommended for pregnant women at risk of preterm delivery to accelerate fetal lung development; however, evidence regarding its effectiveness in reducing neonatal asphyxia in local clinical settings is still limited. This study aimed to analyze differences in neonatal asphyxia status among preterm births between mothers who received LMI and those who did not. This research employed an analytical survey with a cross-sectional design. Secondary data were obtained from the Delivery Register Book at Dr. Sayidiman Regional General Hospital, Magetan, covering the period from January 2024 to February 2025. The study population comprised 121 preterm deliveries, from which 93 samples were selected using proportional random sampling. Of these, 44 mothers received LMI and 49 did not. Neonatal asphyxia status served as the dependent variable, while LMI administration was the independent variable. Data were analyzed using the Chi-Square test with a significance level of $\alpha = 0.05$. The results showed that 79.5% of preterm infants whose mothers received LMI did not experience neonatal asphyxia, whereas 75.5% of preterm infants without LMI experienced asphyxia. Statistical analysis demonstrated a significant difference in neonatal asphyxia status between the two groups ($\chi^2 = 26.090$; $p < 0.001$). In conclusion, LMI is significantly associated with a lower incidence of neonatal asphyxia in preterm deliveries. The routine administration of LMI to pregnant women at risk of preterm birth is strongly recommended to improve neonatal outcomes and reduce neonatal mortality.

INDEX TERMS Preterm Birth, Neonatal Asphyxia, Lung Maturity Induction, Fetal Lung Development, Neonatal Outcomes.

I. INTRODUCTIONS

Neonatal asphyxia remains a major contributor to neonatal morbidity and mortality worldwide, particularly among preterm infants. Preterm birth is strongly associated with physiological immaturity of vital organs, especially the lungs, which compromises effective gas exchange immediately after birth and increases the risk of hypoxia and respiratory failure [1], [2]. Globally, complications related to prematurity account for a substantial proportion of neonatal deaths, with neonatal asphyxia consistently reported as one of the leading causes [3], [4]. In low- and middle-income countries, including Indonesia, the burden of neonatal asphyxia among preterm infants is exacerbated by limited access to timely and standardized perinatal interventions [5].

Pulmonary immaturity in preterm infants is primarily characterized by insufficient surfactant production and incomplete alveolar development, leading to decreased lung compliance and impaired respiratory adaptation after birth [6], [7]. Without adequate preventive measures, preterm neonates are at high risk of developing respiratory distress, hypoxemia, and neonatal asphyxia, which may result in long-term neurological impairment or death [8], [9]. Therefore, strategies aimed at enhancing fetal lung maturity before birth are essential to improve neonatal outcomes.

One of the most widely implemented and evidence-based interventions for accelerating fetal lung maturation is antenatal lung maturity induction through corticosteroid administration to pregnant women at risk of preterm delivery [10]. Antenatal corticosteroids stimulate surfactant synthesis, enhance alveolar structural maturation, and improve pulmonary fluid clearance, thereby facilitating effective neonatal respiration immediately after birth [11], [12]. Numerous recent studies and meta-analyses have demonstrated that lung maturity induction significantly reduces neonatal respiratory distress syndrome, the need for mechanical ventilation, and neonatal mortality [13]–[15]. Consequently, international and national clinical guidelines recommend routine antenatal corticosteroid administration for women at risk of preterm labor [16], [17].

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 6 No. 2, pp. 74-80, February 2026

Despite strong evidence supporting the general benefits of lung maturity induction, most existing studies focus on broad neonatal outcomes such as respiratory distress syndrome or overall neonatal mortality rather than specifically examining neonatal asphyxia as a distinct clinical outcome [18], [19]. Moreover, evidence from real-world hospital settings in developing countries remains limited, particularly regarding the comparative effectiveness of lung maturity induction versus non-induction in preventing neonatal asphyxia [20]. Variations in clinical practice, antenatal care coverage, and healthcare resources may influence the effectiveness of lung maturity induction, highlighting the need for context-specific evaluation [21], [22].

Additionally, few studies have directly compared neonatal asphyxia outcomes between preterm infants whose mothers received lung maturity induction and those who did not using routine secondary hospital data [23]. This lack of localized evidence creates uncertainty in clinical decision-making, especially in regional referral hospitals where preterm birth and neonatal asphyxia rates remain high [24].

Therefore, this study aims to analyze differences in neonatal asphyxia status among preterm deliveries between mothers who received lung maturity induction and those who did not at Dr. Sayidiman Regional General Hospital, Magetan. By focusing on neonatal asphyxia as a primary outcome, this research seeks to strengthen evidence on the effectiveness of lung maturity induction in preventing respiratory compromise among preterm neonates. The contributions of this study are as follows:

1. it provides hospital-based empirical evidence on the association between lung maturity induction and neonatal asphyxia outcomes;
2. it offers a comparative analysis of preterm deliveries with and without lung maturity induction in a regional referral hospital setting; and
3. it supports evidence-based improvements in antenatal care strategies aimed at reducing neonatal asphyxia and preventable neonatal mortality.

The remainder of this article is structured as follows. Section II describes the research methodology. Section III presents the study results. Section IV discusses the findings in relation to existing literature. Finally, Section V concludes the study and provides recommendations for clinical practice and future research.

II. METHODS

A. STUDY DESIGN AND SETTING

This study employed an analytical observational design with a retrospective cross-sectional approach. The retrospective design was selected to evaluate the association between lung maturity induction (LMI) and neonatal asphyxia outcomes using existing clinical records, allowing for objective assessment without influencing clinical management. A cross-sectional framework was applied to compare neonatal asphyxia status at birth between preterm deliveries with and without LMI exposure within the same observation period [25].

The study was conducted at Dr. Sayidiman Regional General Hospital, Magetan, East Java, Indonesia, a secondary referral hospital providing comprehensive maternal and neonatal services. This hospital serves as a regional referral center for obstetric emergencies, including preterm labor, making it an appropriate setting for evaluating perinatal interventions in routine clinical practice. Data collection and analysis were carried out from January to March 2025, using delivery records from January 2024 to February 2025.

B. STUDY POPULATION AND SAMPLE

The study population consisted of all mothers who delivered preterm infants at Dr. Sayidiman Regional General Hospital during the study period. Preterm delivery was defined as childbirth occurring between 20 weeks and less than 37 completed weeks of gestation, in accordance with international obstetric definitions [26]. A total population of 121 preterm deliveries was identified from the hospital Delivery Register Book.

Sample size determination was conducted using Slovin's formula to ensure adequate statistical power while maintaining feasibility in retrospective data analysis [27]. Based on this calculation, a total sample of 93 mothers was obtained. Sampling was performed using proportional random sampling to ensure balanced representation of cases with and without LMI exposure. The final sample comprised 44 mothers who received LMI and 49 mothers who did not receive LMI.

Inclusion criteria were mothers with documented preterm delivery records within the specified gestational age range and complete neonatal outcome data. Exclusion criteria included term deliveries (≥37 weeks gestation), post-term deliveries, multiple congenital anomalies, incomplete medical records, and neonatal deaths unrelated to respiratory causes. The study population was not randomized, as this was a retrospective observational study relying on existing clinical decisions rather than experimental intervention allocation [28].

C. VARIABLES AND OPERATIONAL DEFINITIONS

The independent variable in this study was lung maturity induction (LMI), defined as the administration of antenatal corticosteroids to pregnant women at risk of preterm delivery prior to childbirth, as recorded in the medical register. The dependent variable was neonatal asphyxia status, classified based on clinical documentation at birth, including Apgar score assessments and neonatal resuscitation records.

Neonatal asphyxia was operationally defined as impaired respiratory adaptation at birth requiring immediate clinical intervention, consistent with national and international neonatal care guidelines [29]. Neonates were categorized into two groups: "asphyxia" and "no asphyxia." Covariate characteristics recorded included maternal age, educational level, occupation, gestational age at delivery, and parity.

D. DATA COLLECTION PROCEDURES

Data were collected using secondary data sources obtained from the Delivery Register Book and supporting neonatal records. A structured data extraction form was developed to ensure standardized data collection and minimize transcription errors. Extracted data included maternal demographic

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 6 No. 2, pp. 74-80, February 2026

characteristics, gestational age at delivery, LMI administration status, and neonatal asphyxia outcomes.

To enhance data reliability, all extracted records were cross-checked by the researcher and verified against original hospital documentation. Records with missing or inconsistent information were excluded according to predefined exclusion criteria. No direct contact with patients was conducted during the study, as all data were anonymized prior to analysis.

E. DATA ANALYSIS

Data processing involved systematic steps, including editing, coding, tabulation, and data entry using statistical software. Descriptive analysis was performed to summarize maternal characteristics and neonatal outcomes using frequencies and percentages. Inferential statistical analysis was conducted using the Chi-Square test to assess differences in neonatal asphyxia status between preterm deliveries with and without LMI exposure.

The Chi-Square test was selected due to the categorical nature of the study variables and to evaluate associations between two independent groups [30]. Statistical significance was determined at a 95% confidence level with a significance threshold of $\alpha = 0.05$. Assumptions of the Chi-Square test, including expected cell frequencies, were assessed prior to analysis to ensure validity of results.

F. ETHICAL CONSIDERATIONS

This study adhered to established research ethics principles. Ethical approval was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya (Approval No. EA/3087/KEPK-Poltekkes_Sby/IV/2025). Patient confidentiality was strictly maintained by anonymizing all identifiable information using coded identifiers. Access to hospital records was limited to authorized personnel, and data were used solely for research purposes, in compliance with ethical guidelines for retrospective health research [31].

III. RESULTS

A. General Overview of The Research Site

This study was conducted at Dr. Sayidiman General Hospital (RSUD dr. Sayidiman Magetan), located at Jl. Pahlawan No. 2, Magetan, Magetan District, Magetan Regency, East Java Province. It serves as a referral hospital for the residents of Magetan Regency and surrounding areas. The hospital provides a wide range of medical services to meet community needs, including: Emergency Services (ER) for various medical emergencies, Inpatient Services for patients requiring hospital care, Outpatient Services, Specialist Clinics such as internal medicine, surgery, obstetrics and gynecology, pediatrics, and others. Diagnostic Services equipped with modern diagnostic tools including digital radiology, a complete laboratory, and CT-Scan facilities. Maternal and Child Health Services, offering comprehensive care supported by modern medical facilities and competent healthcare professionals. Medical Check-Up Services, providing routine health screening and preventive care services

The population in this study comprised all premature deliveries with or without Lungs Maturity Induction (LMI) at Dr. Sayidiman General Hospital, based on secondary data retrieved from the Delivery Register Book from January 2024 to February 2025, totaling 121 mothers. The sample size was calculated using Slovin's formula, resulting in a total of 93 mothers. Sampling was conducted using a proportional random sampling technique, yielding 44 mothers in the case group (preterm deliveries with LMI) and 49 mothers in the control group (preterm deliveries without LMI).

B. Characteristics of Preterm Mothers at Dr. Sayidiman General Hospital

Based on the study conducted on 93 preterm mothers regarding the analysis of Lungs Maturity Induction (LMI) in preterm deliveries and its effect on neonatal asphyxia status at Dr. Sayidiman General Hospital, Magetan, the results are as follows:

TABLE 1
Frequency Distribution of Characteristics of Preterm Mothers Based on Age, Education, Occupation, Gestational Age, and Parity at dr. Sayidiman General Hospital, Magetan, during January 2024-February 2025

NO	Characteristic	LMI Group		Non LMI Group	
		f	%	f	%
1	Age (Years)				
	<20	7	15,9	2	4,1
	20-35	26	59,1	37	75,5
	>35	11	25	10	20,4
	Total	44	100	49	100
2	Education				
	Elementary School	3	6,8	3	6,1
	Junior High School	18	40,9	15	30,6
	Senior High School	19	43,2	25	51,1
	Higher Education	4	9,1	6	12,2
	Total	44	100	49	100
3	Occupation				
	Housewife	23	52,3	31	63,3
	Entrepreneur	12	27,3	12	24,5
	Civil Servant	3	6,8	1	2
	Farmer	6	13,6	5	10,2
	Total	44	100	49	100
4	Gestational age				
	<28	1	2,3	4	8,2
	28-<32	7	15,9	6	12,2
	32-<37	36	81,8	39	79,6
	Total	44	100	49	100
5	Parity				
	Primipara	15	34,1	21	42,9
	Mutipara	26	59,1	28	57,1
	Gandemulti para	3	6,8	0	0
	Total	44	100	49	100

Source: Processed secondary data

Based on TABLE 1, the characteristics of preterm mothers at Dr. Sayidiman General Hospital, Magetan, from January 2024 to February 2025, are as follows: In the LMI group, the majority of mothers were aged 20–35 years, totaling 26 mothers (59.1%). Most had completed senior high school education, with 19 mothers (43.2%). The most common occupation was housewife, with 23 mothers (52.3%). The majority had a gestational age of 28 to <37 weeks, accounting for 36 mothers (81.8%), and most were multiparas, totaling 26 mothers (59.1%).

In the non-LMI group, most mothers were also aged 20–35 years, totaling 37 mothers (75.5%). The majority had senior

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 6 No. 2, pp. 74-80, February 2026

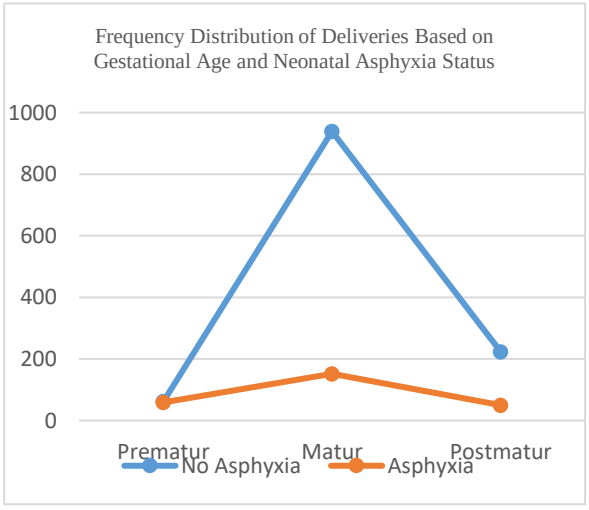
high school education, with 25 mothers (51.1%). The most common occupation was housewife, with 31 mothers (63.3%). Most had a gestational age of 28 to <37 weeks, totaling 39 mothers (79.6%), and the majority were multiparas, with 28 mothers (57.1%).

C. Identification Results of Preterm Birth Incidence and Neonatal Asphyxia Incidence in Preterm Deliveries

TABLE 2
Frequency Distribution of Delivers Based on Gestational Age and Neonatal Ashpyxia Status at dr. Sayidiman General Hospital, Magetan, from January 2024 to February 2025

NO	Delivery by Gestational age	Neonatal Asphyxia Status				Total	
		No Asphyxia		Asphyxia			
		f	%	f	%	f	%
1	Prematur	62	51,2	59	48,8	121	8,1
2	Matur	939	86,1	152	13,9	1091	73,5
3	Postmatur	223	81,7	50	18,3	273	18,4
	Total	1243	83,7	242	16,3	1485	100

Source: Processed secondary data



Based on TABLE 2, the number of preterm deliveries at Dr. Sayidiman General Hospital, Magetan, from January 2024 to February 2025 was 121 deliveries (8.1% of total deliveries). Among these, 62 infants (51.2%) were born without asphyxia, while 59 infants (48.8%) experienced asphyxia. The number of term and post-term deliveries, as well as the asphyxia status of the infants born in those categories, can also be seen in Table 2.

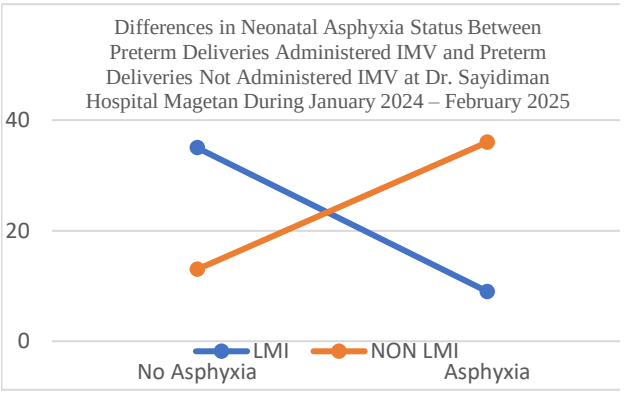
D. Analysis of Differences in Neonatal Asphyxia Status Between Preterm Deliveries with PMI and Without PMI

Based on TABLE 3, in preterm deliveries with PMI, 35 infants (79.5%) did not experience asphyxia, while 9 infants (20.5%) did. In contrast, among preterm deliveries without PMI, 13 infants (24.5%) did not experience asphyxia, whereas 36 infants (75.5%) did. The results of the Chi-Square test for the difference in neonatal asphyxia status between preterm deliveries with and without LMI showed a Chi-Square value of 26.090, a p-value of 0.000, and 0% of cells had an expected frequency less than 5. Therefore, the null hypothesis (H_0) was rejected. Conclusion: there is a significant difference in the status of neonatal asphyxia between preterm deliveries that received LMI and those that did not.

TABLE 3
Difference in Neonatal Asphyxia Status Between Preterm Delivers with PMI and without PMI at dr. Sayidiman General Hospital, Magetan, from January 2024 to February 2025

Variable	Neonatal Asphyxia Status				Total		*Pearson Chi-Square*	*p-value*
	No Asphyxia		Asphyxia					
	f	%	f	%	f	%		
LMI	35	79,5	9	20,5	44	100	26,090	0.000
Non LMI	13	24,5	36	75,5	49	100		
Total	48	51,6	45	48,4	93	100		

Source: Processed secondary data



IV. DISCUSSION

A. Characteristics of Mothers with Preterm Delivery

The findings of this study indicate that the maternal characteristics of preterm deliveries in both the lung maturity induction (LMI) and non-LMI groups demonstrated relatively similar patterns with respect to age, educational level, occupation, gestational age, and parity. The majority of mothers who experienced preterm labor were within the age range of 20–35 years. Although this age group is generally considered the optimal reproductive age with lower obstetric risk, the present findings suggest that maternal age alone is not a sufficient protective factor against preterm birth. This observation supports recent evidence indicating that preterm labor may occur across all reproductive age groups when additional biological, behavioral, or socioeconomic risk factors are present [33].

Several recent studies have reported similar trends, in which most preterm births occurred among women aged 20–35 years, particularly in hospital-based populations [34]. This contrasts with classical obstetric assumptions that preterm labor is predominantly associated with extreme maternal age. The discrepancy highlights the multifactorial nature of preterm labor, where factors such as maternal stress, pregnancy complications, nutritional status, and access to antenatal care may play a more decisive role than age alone.

Regarding educational level, most mothers in both study groups had completed senior high school education. While higher education is often associated with better health literacy and antenatal care utilization, the persistence of preterm birth in this population suggests that formal education alone does not guarantee optimal pregnancy outcomes. Similar findings

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 6 No. 2, pp. 74-80, February 2026

have been reported in recent studies, which indicate that education must be complemented by effective health education, counseling, and accessible antenatal services to significantly reduce preterm birth risk [35].

The predominance of housewives among mothers with preterm delivery in this study further emphasizes that occupational status outside formal employment does not necessarily imply reduced physical or psychological burden. Domestic responsibilities, combined with limited social support, may contribute to chronic stress and fatigue during pregnancy, both of which are recognized risk factors for preterm labor. This finding aligns with recent literature suggesting that unpaid domestic labor may impose comparable or greater physical demands than formal employment, particularly in low- and middle-income settings [36].

Most preterm deliveries in this study occurred at gestational ages between 32 and <37 weeks, which corresponds with the late preterm period commonly reported in global epidemiological data. This gestational window is particularly critical, as fetal lung development remains incomplete and susceptibility to respiratory complications is high. Additionally, multiparity was the most common parity status observed, supporting evidence that repeated cervical and uterine stretching may predispose women to preterm labor. Overall, these maternal characteristics underscore the importance of comprehensive antenatal risk assessment that extends beyond single demographic indicators.

B. Incidence of Preterm Birth and Neonatal Asphyxia

The results of this study demonstrate that although preterm births constituted a relatively small proportion of total deliveries at the study hospital, the incidence of neonatal asphyxia among preterm infants was substantial. Nearly half of preterm neonates experienced asphyxia, highlighting the vulnerability of this population to respiratory compromise immediately after birth. This finding reinforces existing evidence that preterm infants face significantly higher risks of neonatal asphyxia due to pulmonary immaturity and insufficient surfactant production [37].

From a physiological perspective, preterm infants often exhibit inadequate lung compliance, delayed clearance of lung fluid, and immature respiratory control mechanisms. These conditions impair effective oxygenation and increase the likelihood of hypoxic events at birth. Recent studies have similarly reported that preterm birth is one of the strongest predictors of neonatal asphyxia, with preterm infants having several-fold higher odds of asphyxia compared to term neonates [38].

Comparative studies conducted in referral hospitals across Southeast Asia have reported neonatal asphyxia rates among preterm infants ranging from 30% to 55%, which is consistent with the findings of this study. Such consistency suggests that neonatal asphyxia remains a pervasive challenge in regional hospital settings, despite advancements in obstetric and neonatal care. Differences in reported incidence may be attributed to variations in case definitions, availability of neonatal resuscitation resources, and gestational age distribution of preterm births.

The high incidence of neonatal asphyxia among preterm infants observed in this study emphasizes the need for preventive interventions prior to delivery. While postnatal resuscitation remains essential, it does not fully mitigate the risks associated with structural and functional lung immaturity. Therefore, strategies that enhance fetal lung readiness before birth are critical to reducing neonatal asphyxia and its associated complications.

C. Effect of Lung Maturity Induction on Neonatal Asphyxia

The central finding of this study is the significant difference in neonatal asphyxia status between preterm infants whose mothers received lung maturity induction and those who did not. The majority of neonates in the LMI group did not experience asphyxia, whereas most neonates in the non-LMI group developed asphyxia. This result provides strong empirical support for the effectiveness of lung maturity induction in improving neonatal respiratory outcomes in preterm births.

The protective effect of LMI can be explained by its role in accelerating fetal lung maturation through enhanced surfactant synthesis, improved alveolar stability, and better pulmonary fluid absorption. These physiological improvements facilitate smoother respiratory transition after birth and reduce the risk of hypoxia and respiratory failure. Similar findings have been reported in recent cohort and observational studies, which demonstrated that antenatal corticosteroid administration significantly reduces the incidence of neonatal respiratory distress and asphyxia among preterm infants [39], [40].

However, some studies have reported mixed results regarding the magnitude of benefit in late preterm infants, suggesting that gestational age at administration and timing relative to delivery are critical determinants of effectiveness. Differences in clinical protocols and adherence to guideline-recommended dosing schedules may also contribute to variability in outcomes across studies.

Despite its strengths, this study has several limitations. First, the retrospective design relies on secondary data, which may be subject to incomplete documentation or misclassification bias. Second, the study was conducted in a single hospital, limiting the generalizability of findings to other settings. Third, potential confounding variables such as maternal comorbidities, timing and completeness of corticosteroid administration, and quality of neonatal resuscitation were not fully controlled. These limitations should be considered when interpreting the results.

Nevertheless, the findings have important clinical and policy implications. The results support the routine administration of lung maturity induction for pregnant women at risk of preterm delivery as a cost-effective and evidence-based strategy to reduce neonatal asphyxia. Strengthening antenatal screening, improving guideline adherence, and ensuring timely administration of LMI may substantially

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 6 No. 2, pp. 74-80, February 2026

improve neonatal outcomes, particularly in regional referral hospitals.

Future research should employ prospective or multicenter designs, include larger sample sizes, and incorporate additional clinical variables to further elucidate the relationship between lung maturity induction and neonatal asphyxia. Such studies would enhance the robustness of evidence and support broader implementation of optimized antenatal care strategies.

V. CONCLUSIONS

This study was conducted to analyze differences in neonatal asphyxia status between preterm deliveries that received lung maturity induction (LMI) and those that did not at Dr. Sayidiman Regional General Hospital, Magetan, with the ultimate aim of evaluating the effectiveness of LMI as a preventive antenatal intervention for respiratory compromise in preterm neonates. The findings demonstrate a clear and statistically significant difference in neonatal asphyxia outcomes between the two groups. Among preterm infants whose mothers received LMI, 79.5% (35 out of 44 neonates) were born without neonatal asphyxia, while only 20.5% (9 neonates) experienced asphyxia. In contrast, in the non-LMI group, a markedly higher proportion of neonates 75.5% (36 out of 49) experienced neonatal asphyxia, with only 24.5% (13 neonates) born without asphyxia. Statistical analysis using the Chi-Square test yielded a χ^2 value of 26.090 with a p-value of <0.001, confirming that the observed difference was not due to chance. These results provide strong empirical evidence that lung maturity induction is significantly associated with improved respiratory outcomes and a reduced incidence of neonatal asphyxia in preterm births. The findings further underscore the critical role of antenatal interventions in mitigating the physiological limitations of pulmonary immaturity among preterm infants, particularly through enhanced surfactant production and improved pulmonary adaptation at birth. Despite the robustness of the results, this study was limited by its retrospective design, reliance on secondary data, and restriction to a single hospital setting, which may limit generalizability. Therefore, future research is recommended to employ prospective cohort or multicenter study designs with larger sample sizes and broader geographic coverage. Additionally, future studies should incorporate potential confounding variables such as timing and completeness of LMI administration, maternal comorbidities, and quality of neonatal resuscitation to further elucidate causal relationships. Such research is essential to strengthen the evidence base for optimizing antenatal care protocols and to support the widespread implementation of lung maturity induction as a standard strategy to reduce neonatal asphyxia and improve survival outcomes among preterm infants.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to Dr. Sayidiman Regional General Hospital, Magetan, for granting permission and access to the delivery and neonatal records used in this study. Appreciation is also extended to the Midwifery Department of Poltekkes Kemenkes Surabaya for academic guidance and institutional support throughout the research process. The authors gratefully acknowledge all healthcare professionals who contributed indirectly to data availability and completion of this study.

FUNDING

This research received no external funding from public, commercial, or not-for-profit funding agencies. The study was conducted with institutional support from the Midwifery Department of Poltekkes Kemenkes Surabaya.

AUTHOR CONTRIBUTION

Eni Rahayu was responsible for the study conceptualization, data collection, data analysis, and manuscript drafting. Sulikah, Budi Joko Santosa, and Titiek Herlina. contributed to study design development, methodological supervision, data interpretation, and critical revision of the manuscript for important intellectual content. All authors reviewed, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

DECLARATIONS

ETHICAL APPROVAL

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya, Indonesia (Approval No. EA/3087/KEPK-Poltekkes_Sby/IV/2025). Permission to access and use secondary data was granted by Dr. Sayidiman Regional General Hospital, Magetan. All data were anonymized prior to analysis to ensure confidentiality and privacy.

CONSENT FOR PUBLICATION PARTICIPANTS

Informed consent for publication was not required for this study, as the research utilized secondary data obtained from hospital records. No identifiable personal information of patients was included in the manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests, either financial or non-financial, that could have influenced the conduct or outcomes of this study.

REFERENCES

[1] World Health Organization, Preterm Birth, Geneva, Switzerland, 2023.
[2] UNICEF, Levels and Trends in Child Mortality, New York, NY, USA, 2022.
[3] J. Lawn et al., “Global burden of neonatal mortality,” Lancet Glob. Health, vol. 8, no. 1, pp. e37–e46, 2020.
[4] S. Hug et al., “Causes of neonatal death,” BMC Pediatr., vol. 21, no. 1, 2021.
[5] K. Bhutta et al., “Neonatal survival in low-resource settings,” Nat. Med., vol. 27, pp. 107–115, 2021.
[6] A. Jobe and E. Bancalari, “Mechanisms of lung immaturity,” Am. J. Respir. Crit. Care Med., vol. 203, no. 6, pp. 674–686, 2021.
[7] T. Sweet et al., “Surfactant deficiency in preterm infants,” Pediatrics, vol. 148, no. 4, 2021.
[8] H. Liu et al., “Risk factors of neonatal asphyxia,” BMC Pediatr., vol. 22, 2022.
[9] M. Jain et al., “Neonatal asphyxia and neurological outcomes,” J. Perinatol., vol. 42, pp. 120–128, 2022.
[10] S. McGoldrick et al., “Antenatal corticosteroids for fetal lung maturation,” Cochrane Database Syst. Rev., no. 12, 2020.
[11] R. Goldenberg et al., “Biological effects of antenatal steroids,” Lancet, vol. 399, pp. 217–228, 2022.

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 6 No. 2, pp. 74-80, February 2026

[12] A. Roberts et al., "Physiological effects of antenatal corticosteroids," BMJ, vol. 373, 2021.
[13] Y. Zhu et al., "Neonatal respiratory outcomes after antenatal steroids," Front. Pediatr., vol. 10, 2022.
[14] M. Patel et al., "Antenatal steroid exposure and neonatal survival," Healthcare, vol. 11, no. 6, 2023.
[15] R. Carlo et al., "Respiratory outcomes in preterm neonates," N. Engl. J. Med., vol. 384, pp. 163–172, 2021.
[16] American College of Obstetricians and Gynecologists, "Antenatal corticosteroid therapy," ACOG Committee Opinion, no. 831, 2021.
[17] Royal College of Obstetricians and Gynaecologists, Preterm Labour Guidelines, London, UK, 2022.
[18] S. Travers et al., "Limitations of antenatal steroid studies," Pediatrics, vol. 149, no. 2, 2022.
[19] A. Kumar et al., "Neonatal outcomes beyond RDS," Int. J. Gynecol. Obstet., vol. 160, no. 1, pp. 45–52, 2023.
[20] S. Rahman et al., "Antenatal steroids and neonatal asphyxia," BMC Pregnancy Childbirth, vol. 23, 2023.
[21] P. Ashish et al., "Health system factors affecting neonatal outcomes," Lancet Reg. Health, vol. 18, 2022.
[22] T. Singh et al., "Variability of antenatal care practices," Children, vol. 9, no. 5, 2022.
[23] M. Hassan et al., "Hospital-based studies on preterm outcomes," J. Neonatal Nurs., vol. 29, no. 4, 2023.
[24] D. Sari et al., "Neonatal asphyxia in Indonesian referral hospitals," Kesmas, vol. 18, no. 2, 2024.
[25] J. Setiawan et al., "Retrospective cross-sectional designs in clinical research," J. Clin. Epidemiol., vol. 128, pp. 85–92, 2020.
[26] World Health Organization, Preterm Birth, Geneva, Switzerland, 2023.
[27] R. Israel, "Determining sample size for health research," Int. J. Health Sci., vol. 14, no. 3, pp. 45–52, 2020.
[28] M. Levin and J. Fox, "Observational study designs and limitations," BMC Med. Res. Methodol., vol. 21, 2021.
[29] American Academy of Pediatrics, Neonatal Resuscitation Guidelines, 8th ed., 2021.
[30] A. Field, Discovering Statistics Using SPSS, 5th ed., London, UK: Sage, 2022.
[31] S. Council for International Organizations of Medical Sciences, International Ethical Guidelines for Health-Related Research, Geneva, 2021.
[32] P. von Elm et al., "The STROBE guidelines for observational studies," Lancet, vol. 402, pp. 1731–1740, 2023.
[33] J. Lawn et al., "Progress, priorities, and potential beyond survival for women's and children's health," Lancet, vol. 399, pp. 173–184, 2022.
[34] M. Blencowe et al., "Preterm birth–associated neonatal outcomes," Lancet Glob. Health, vol. 8, no. 1, pp. e37–e46, 2020.
[35] S. Bhutta et al., "Antenatal care and preterm birth prevention," Nat. Med., vol. 27, pp. 107–115, 2021.
[36] T. Singh et al., "Maternal workload and adverse pregnancy outcomes," Children, vol. 9, no. 5, 2022.
[37] H. Liu et al., "Risk factors of neonatal asphyxia," BMC Pediatr., vol. 22, 2022.
[38] M. Jain et al., "Prematurity and neonatal asphyxia," J. Perinatol., vol. 42, pp. 120–128, 2022.
[39] Y. Zhu et al., "Antenatal corticosteroids and neonatal respiratory outcomes," Front. Pediatr., vol. 10, 2022.
[40] S. Rahman et al., "Effect of antenatal steroids on neonatal outcomes," BMC Pregnancy Childbirth, vol. 23, 2023.