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Effectiveness of phototherapy in reducing pathological jaundice in newborns at Tenriawaru Hospital

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ABSTRACT

Introduction: Pathological jaundice remains a common neonatal condition characterized by an excessive rise in serum bilirubin, which may lead to severe complications such as acute bilirubin encephalopathy and kernicterus if not promptly treated. Phototherapy is the primary non-invasive intervention used to lower bilirubin levels by converting unconjugated bilirubin into water-soluble forms. Increasing cases of neonatal jaundice reported at Tenriawaru Hospital highlight the need to evaluate the clinical effectiveness of phototherapy within this setting. This study aims to determine the efficacy of phototherapy in reducing bilirubin levels among newborns diagnosed with pathological jaundice at Tenriawaru Hospital, Bone.

Methods: This quantitative descriptive study used secondary data obtained from neonatal medical records. Variables assessed included gestational age, initial bilirubin levels, duration of phototherapy, and post-therapy bilirubin levels. Data were analyzed using the chi-square test at the 0.05 significance level to identify associations between clinical factors and phototherapy outcomes.

Results: A total of 84 newborns with pathological jaundice underwent phototherapy. There was a statistically significant reduction in bilirubin levels after phototherapy ($p = 0.000$), indicating a strong therapeutic effect. The duration of phototherapy and the initial bilirubin concentration were found to influence treatment effectiveness, with more prolonged therapy associated with greater reductions in bilirubin.

Conclusion: Phototherapy is highly effective in reducing serum bilirubin levels among newborns with pathological jaundice at Tenriawaru Hospital. Timely initiation and adequate duration of phototherapy are critical for preventing complications and improving neonatal outcomes.

Keywords: Bilirubin, Newborn, Pathological Jaundice, Phototherapy, Treatment Effectiveness.

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INTRODUCTION

Neonatal jaundice remains one of the most prevalent clinical conditions encountered during the early days of life, affecting more than half of term newborns and an even higher proportion of preterm infants (Andolfo, Iolascon and Russo, 2025). While physiological jaundice is generally benign and self-limiting, pathological jaundice represents a more serious condition characterized by an early onset, rapid rise, or excessively high serum bilirubin levels (Çamur *et al.*, 2024). If not promptly managed, pathological jaundice can progress to severe complications such as acute bilirubin encephalopathy or kernicterus, leading to permanent neurological impairment or even death (Christensen *et al.*, 2025). The burden of this condition remains particularly significant in low- and middle-income countries, where gaps in early detection, timely intervention, and neonatal care facilities persist. In Indonesia, neonatal jaundice continues to contribute to neonatal morbidity and mortality, despite advancements in medical technology and increased awareness of newborn care (De Luca *et al.*, 2025).

Tenriawaru Hospital in Bone Regency has reported a notable increase in cases of neonatal jaundice over recent years, making it a critical public health concern. According to hospital records, cases of jaundice rose substantially, with 84 newborns diagnosed in 2025 alone. This upward trend highlights the importance of evaluating available interventions and understanding the factors that contribute to jaundice severity. Phototherapy remains the standard first-line treatment for pathological jaundice worldwide due to its proven ability to reduce unconjugated bilirubin through photo-isomerization. However, its effectiveness is influenced by several clinical and environmental factors, including gestational age, baseline bilirubin concentration, the duration and type of phototherapy used, and the infant's overall health status. Variability in treatment response highlights the need for context-specific evaluations to optimize clinical outcomes, particularly in district hospitals with diverse patient characteristics (Fajrian, 2020).

Despite numerous studies on neonatal jaundice, several gaps remain in the existing literature, especially in the Indonesian context (Flynn, 2025). Many previous studies have focused on physiological jaundice, maternal factors, or breastfeeding-related jaundice, while fewer have examined pathological jaundice specifically within regional hospital settings. Additionally, limited research has examined the relationship between initial bilirubin levels, phototherapy duration, and treatment effectiveness in rural or semi-urban healthcare facilities, where clinical resources may differ from those in tertiary centers (Ghavi *et al.*, 2025). Much of the available research also lacks a detailed analysis of how gestational age and perinatal conditions contribute to treatment success. These gaps hinder the development of evidence-based protocols tailored to the needs of local health systems (Huang *et al.*, 2025).

Furthermore, although phototherapy is widely implemented, there is insufficient data on its real-world effectiveness at Tenriawaru Hospital, where demographic characteristics, incidence trends, and clinical management practices may differ from those in other regions (Jalali *et al.*, 2024). Hospitals in rural areas often face challenges, including uneven access to equipment, variations in clinical monitoring, limited staff training, and differences in case severity at presentation. Understanding how these factors influence phototherapy outcomes is essential for enhancing neonatal care quality and preventing avoidable complications. Without systematic evaluation, healthcare providers struggle to determine the adequacy of current protocols or identify areas for improvement (Mahapatra *et al.*, 2025).

The novelty of this study lies in its focused assessment of phototherapy effectiveness specifically for pathological jaundice at Tenriawaru Hospital, an area where limited data is currently available. While many studies acknowledge phototherapy as an effective intervention,

fewer provide a detailed analysis of the relationship between therapy duration, initial bilirubin concentration, and treatment success in this specific clinical environment. This study fills that gap by quantifying treatment outcomes using real-world hospital data and evaluating statistical associations with factors such as gestational age and bilirubin levels. By doing so, it provides a more comprehensive understanding of the factors that contribute to successful phototherapy in this population.

Additionally, this research offers new insight by highlighting the increasing burden of pathological jaundice in Bone Regency and linking it to clinical decision-making regarding phototherapy initiation. The integration of epidemiological trends with treatment outcomes further enhances the novelty of this work, laying a foundation for developing more effective management strategies for neonatal jaundice. The study not only evaluates whether phototherapy works but also identifies which infants benefit the most and what clinical predictors can guide earlier intervention. Pathological jaundice continues to pose significant health risks for newborns, particularly in regions experiencing rising case numbers. The lack of context-specific evidence regarding the effectiveness of phototherapy and predictive clinical factors presents a critical gap in neonatal care research. This study contributes novel findings by analyzing phototherapy outcomes at Tenriawaru Hospital and identifying essential clinical correlates of treatment success. The results are expected to inform improved protocols, strengthen neonatal care practices, and ultimately reduce complications associated with pathological jaundice in newborns.

RESEARCH METHODOLOGY

Study Design

This study employed an analytical observational design with a quantitative approach, using a retrospective cohort method. The design was chosen to assess the effectiveness of phototherapy by comparing bilirubin levels before and after treatment, as well as examining clinical factors associated with treatment outcomes. A retrospective design is widely accepted in neonatal jaundice research due to the availability of reliable hospital records and the ethical feasibility of analyzing existing data.

Study Setting and Period

The study was conducted at Tenriawaru Regional General Hospital, Bone Regency, South Sulawesi, Indonesia. Data collection took place between January and December 2025, using documented medical records from the Neonatal Care Unit (NCU). This hospital serves as a referral center for maternal and neonatal care, making it an appropriate setting for investigating patterns of pathological jaundice and treatment outcomes.

Population and Sampling

All newborns diagnosed with pathological jaundice and treated with phototherapy at Tenriawaru Hospital.

Inclusion Criteria

- Newborns (0–28 days of life) diagnosed with pathological jaundice based on clinical and laboratory criteria.
- Underwent phototherapy as the primary treatment.
- Had complete medical records containing: gestational age, initial bilirubin levels, phototherapy duration, and post-phototherapy bilirubin levels.

Exclusion Criteria

- Infants who received an exchange transfusion at baseline.

- Infants diagnosed with congenital metabolic disorders (e.g., galactosemia) or significant anatomical abnormalities.
- Incomplete or missing clinical records.

Sampling Technique

A total sampling approach was used, with all eligible cases recorded during the study period included. This method enhances external validity and is consistent with observational studies of neonatal outcomes. Independent Variables: Initial bilirubin level (mg/dL), Duration of phototherapy (hours), Gestational age (weeks), Type of phototherapy device (single/double light, LED/fluorescent) if available in records, Dependent Variable. Effectiveness of phototherapy, defined as a clinically significant reduction in serum bilirubin level following treatment, based on WHO and AAP bilirubin thresholds. Control Variables: Neonatal characteristics (sex, birth weight). Clinical risk factors (prematurity, sepsis, birth trauma). Operational Definitions: Pathological jaundice: Jaundice appearing within the first 24 hours, bilirubin rising >5 mg/dL/day, or exceeding age-specific thresholds based on AAP nomograms. Effective phototherapy: ≥2 mg/dL reduction in serum bilirubin or decrease to below treatment threshold within the recommended clinical timeframe. Gestational age categories: Preterm (<37 weeks), term (37–42 weeks).

Data Collection Procedures

Data were extracted from hospital neonatal medical records by trained research personnel. Collected information included: Demographic characteristics (sex, weight, gestational age). Clinical diagnosis and bilirubin measurements (before and after phototherapy). Phototherapy duration and device type. Relevant maternal and neonatal clinical history. To ensure data accuracy, double-entry verification was used, and discrepancies were resolved by rechecking the original medical record.

Data Analysis

Data were processed using SPSS version 26.0. Analysis included: Descriptive Statistics. Frequencies and percentages for categorical variables. Means and standard deviations or medians (IQR) for continuous variables. Inferential Statistics Paired t-test or Wilcoxon signed-rank test to compare pre- and post-phototherapy bilirubin levels. Chi-square test to assess associations between categorical predictors (e.g., gestational age, phototherapy duration categories) and phototherapy effectiveness. Logistic regression analysis to identify independent predictors of phototherapy success, while adjusting for confounding factors. A p-value <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the institutional review board of Tenriawaru Regional General Hospital. As this study used secondary data, informed parental consent was waived in accordance with national ethical regulations. Confidentiality was maintained by anonymizing patient identifiers and securing stored data.

RESULT

A total of 60 pediatric patients with confirmed pulmonary tuberculosis were included in the analysis. Descriptive characteristics of the study population, including NLR categories and chest X-ray severity classifications, are presented to illustrate the distribution of inflammatory status and radiological findings. Subsequent analyses examine the correlation between NLR and chest X-ray severity to determine whether systemic inflammatory response corresponds with the extent of pulmonary involvement.

Table 1. Characteristics of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Gestational Age	< 37 weeks (Preterm)	28	50.9%
	37–42 weeks (Term)	22	41.0%
	> 42 weeks (Post-term/Dismature)	5	9.9%
Sex	Male	35	63.6%
	Female	20	36.4%
Birth Weight	< 2500 g (Low Birth Weight)	36	65.5%
	≥ 2500 g (Normal Birth Weight)	19	34.5%
Type of Phototherapy	LED Phototherapy	55	100%
	Conventional Phototherapy	0	0%
Type of Jaundice	Physiological Jaundice	0	0%
	Pathological Jaundice	55	100%

Gestational Age. Most newborns treated for pathological jaundice were preterm infants (50.9%), followed by term infants (41%). Only a small proportion were post-term (9.9%). This indicates that preterm infants are more vulnerable to pathological jaundice, likely due to immature liver function and reduced bilirubin metabolism. Sex Distribution. The majority of affected infants were male (63.6%), compared to females (36.4%). This pattern is consistent with research indicating that male infants have a slightly higher risk of developing hyperbilirubinemia, potentially due to hormonal and metabolic differences.

Birth Weight. Most infants had low birth weight (65.5%), while only 34.5% had normal birth weight. Low birth weight is a known risk factor because these infants often have reduced hepatic maturity, which can impair bilirubin clearance. Type of Phototherapy. All infants received LED phototherapy (100%), with no use of conventional units. LED devices are widely preferred because they are more energy-efficient, produce less heat, and provide a more stable light intensity, which improves treatment effectiveness and safety. Types of Jaundice. All 55 infants (100%) were diagnosed with pathological jaundice, and no physiological jaundice cases were recorded. This shows that only infants requiring medical intervention were included and that pathological jaundice accounted for 1.84% of total births at the hospital (based on file data). These infants require phototherapy or NICU-level monitoring to prevent severe complications such as kernicterus.

Table 2. Research Univariate Analysis

Variable	Category	Frequency (n)	Percentage (%)
Gestational Age	Term	56	66.7
	Preterm	28	33.3
Infant Sex	Male	48	57.1
	Female	36	42.9
Birth Weight	Normal (≥2500 g)	60	71.4
	Low birth weight (<2500 g)	24	28.6
Type of Phototherapy	Single Phototherapy	62	73.8
	Double Phototherapy	22	26.2
Number of Newborns with Jaundice	Total Cases	84	100
Duration of Phototherapy	<24 hours	19	22.6
	24–48 hours	49	58.3
	>48 hours	16	19.1
Initial Bilirubin Level	<15 mg/dL	34	40.5
	≥15 mg/dL	50	59.5
Post-phototherapy Bilirubin	Decreased	79	94.0
	Not decreased	5	6.0
Phototherapy Effectiveness	Effective	78	92.9
	Not Effective	6	7.1

Gestational Age: Most newborns were term (66.7%), indicating that pathological jaundice in this study was not limited to preterm infants. However, the presence of 33.3% preterm infants highlights prematurity as a significant contributing factor. Infant Sex: More than half of the infants were male (57.1%). This aligns with existing evidence that male infants have a slightly higher risk of hyperbilirubinemia. Birth Weight: Most infants (71.4%) had a normal birth weight, while 28.6% were born with low birth weight. Low birth weight is known to reduce bilirubin metabolism efficiency, supporting its association with jaundice severity. Type of Phototherapy: Single phototherapy was the most frequently used method (73.8%), suggesting that most cases were moderate and manageable without intensive double phototherapy. Duration of Phototherapy: The majority (58.3%) required 24–48 hours of treatment, indicating a typical response pattern for pathological jaundice. Only 19.1% required more than 48 hours, which is usually associated with higher initial bilirubin levels. Initial Bilirubin Level: More than half (59.5%) of infants presented with bilirubin ≥15 mg/dL, confirming the pathological nature of jaundice in this cohort. Post-phototherapy Bilirubin: Phototherapy successfully reduced bilirubin levels in 94% of cases, showing a strong therapeutic effect. Phototherapy Effectiveness: Overall effectiveness was very high (92.9%), confirming its effectiveness as a first-line treatment for pathological jaundice in this study setting.

Table 3. Bivariate analysis of factors associated with phototherapy effectiveness

Independent Variable	Category	Effective n (%)	Not Effective n (%)	Total	p-value
Duration of Phototherapy	<24 hours	12 (21.8%)	0 (0%)	12	**0.000**
	24–48 hours	25 (45.5%)	0 (0%)	25	
	>48 hours	11 (20.0%)	7 (12.7%)	18	
Initial Bilirubin Level	<10 mg/dL	25 (45.45%)	0 (0%)	25	**0.000**
	10–15 mg/dL	20 (36.36%)	0 (0%)	20	
	>15 mg/dL	3 (5.45%)	7 (12.7%)	10	
Gestational Age	<37 weeks	24 (43.6%)	0 (0%)	24	**0.013**
	≥37 weeks	24 (43.6%)	7 (12.8%)	31	

Total sample = 55 newborns

Duration of Phototherapy. The statistical test demonstrated a significant association between phototherapy duration and treatment effectiveness (p = 0.000). Infants who received phototherapy for less than 24 hours or 24–48 hours had a 100% effectiveness rate, whereas those with longer durations (>48 hours) were more likely to experience treatment failure. This finding suggests that timely, appropriately dosed phototherapy is more effective in reducing bilirubin levels. Longer therapy durations tend to occur in more severe cases, which may explain the higher proportion of non-effective outcomes.

Initial Bilirubin Level. A statistically significant relationship was found between the initial bilirubin level and the effectiveness of phototherapy (p = 0.000). Infants with mild to moderate bilirubin levels (<10 mg/dL or 10–15 mg/dL) achieved 100% effectiveness, whereas those with levels greater than 15 mg/dL had the highest treatment failure rate (12.7%). This suggests that lower initial bilirubin levels are associated with better phototherapy outcomes, whereas very high initial bilirubin levels may require more intensive treatment or adjunctive management.

Gestational Age. Gestational age also showed a significant association with the effectiveness of phototherapy (p = 0.013). All preterm infants (<37 weeks) responded effectively (100%), whereas infants ≥37 weeks included all cases of non-effectiveness (12.8%). This pattern may reflect differences in bilirubin metabolism, clinical severity, or variability in treatment response between preterm and term infants. Nonetheless, the results indicate that gestational maturity influences phototherapy outcomes.

All three variables, duration of phototherapy, initial bilirubin level, and gestational age, exhibited statistically significant associations with the effectiveness of phototherapy. Early therapy, lower bilirubin levels, and preterm gestational age were associated with better therapeutic response.

DISCUSSION

This study examined the effectiveness of phototherapy in reducing bilirubin levels among newborns with pathological jaundice at RSUD Tenriawaru Bone. It analyzed several factors associated with treatment outcomes, including phototherapy duration, initial bilirubin levels, and gestational age at birth. The findings demonstrated that phototherapy was generally effective, with 87.3% of newborns showing adequate reduction in bilirubin levels. Only a small proportion (12.7%) experienced ineffective outcomes. These results reinforce the widely accepted clinical role of phototherapy as the first-line, non-invasive treatment for neonatal hyperbilirubinemia.

The analysis revealed a significant relationship between phototherapy duration and treatment effectiveness. Infants who underwent phototherapy for less than 24 hours or between 24 and 48 hours achieved a 100% rate of successful bilirubin reduction. In contrast, those treated for more than 48 hours had a higher proportion of ineffective outcomes. This supports the idea that early initiation and appropriately dosed phototherapy can achieve rapid bilirubin decline, consistent with the physiological mechanisms of phototherapy, which involve photoisomerization and increased bilirubin excretion. A longer treatment duration is often associated with higher initial bilirubin levels, delayed therapy initiation, or underlying clinical complications, which may account for the reduced effectiveness in the group with treatment duration greater than 48 hours. Previous studies have similarly emphasized the importance of early phototherapy in preventing bilirubin accumulation and reducing the need for escalated interventions, such as exchange transfusion (Putri, Bachtiar). Therefore, the current findings provide further evidence that timely phototherapy administration remains crucial for optimizing treatment outcomes (Moguilevitch and Fitz-james, 2024).

A significant association was also identified between initial bilirubin levels and the effectiveness of phototherapy. Infants who began treatment with bilirubin levels below 15 mg/dL achieved complete therapeutic success, whereas those with levels above 15 mg/dL were more likely to have an ineffective outcome (Salami *et al.*, 2025). Elevated bilirubin levels at admission indicate more severe hyperbilirubinemia, which may progress rapidly and may not respond as effectively to standard phototherapy protocols. This finding aligns with the existing literature, which suggests that higher baseline bilirubin levels require extended treatment, more intense phototherapy, or a combination of therapeutic strategies to reach safe bilirubin thresholds (Sharma *et al.*, 2024). Additionally, infants presenting late for treatment may already have bilirubin levels close to the threshold for severe complications such as acute bilirubin encephalopathy, making treatment more challenging. These data highlight the importance of early detection and monitoring of jaundice, particularly within the first 48 hours of life when bilirubin levels can rise abruptly (Sarker *et al.*, 2025).

The study also found a significant relationship between gestational age and the effectiveness of phototherapy. Interestingly, all preterm infants (<37 weeks) responded effectively to phototherapy, whereas term infants accounted for all non-effective cases. While this result may initially appear counterintuitive, given that preterm infants typically have a higher risk of hyperbilirubinemia and are more vulnerable to bilirubin toxicity, it may be partly explained by clinical management differences (Vaivada *et al.*, 2022). Preterm infants in clinical settings often receive closer monitoring and earlier initiation of phototherapy due to their known vulnerability (Fairless, Dunn and Ulloa, 2022). As a result, their treatment may begin at lower bilirubin levels, allowing for a more favorable response to phototherapy (Shen *et al.*, 2024).

Meanwhile, term infants may be brought to care at more advanced stages of hyperbilirubinemia, making treatment less effective. Another explanation is biological: preterm infants often have thinner skin, allowing greater light penetration and potentially enhancing the efficiency of phototherapy. These findings underscore the need for continued vigilance in both preterm and term infants, as gestational age alone does not fully determine treatment response (Uslu and Ulu, 2024).

Overall, the results from this study strongly support phototherapy as an effective intervention for managing pathological jaundice. However, variations in treatment response across different clinical factors highlight the need for individualized treatment. Early identification of jaundice, appropriate monitoring of bilirubin trajectories, and rapid initiation of therapy are essential in preventing complications (Wang *et al.*, 2025). Moreover, infants with high initial bilirubin levels or prolonged phototherapy needs should be closely evaluated for possible underlying causes such as hemolysis, dehydration, sepsis, or breastfeeding difficulties. Integrating standardized protocols, routine bilirubin screening, and parent education may help reduce delayed presentation and improve clinical outcomes. The findings of this research are consistent with numerous international studies reporting significant reductions in bilirubin levels following phototherapy. They also align with evidence emphasizing the importance of early intervention and the predictive value of initial bilirubin levels for treatment success. Nonetheless, the study's results also highlight the complexity of phototherapy response and the necessity to consider multiple clinical variables when assessing treatment effectiveness (Chawla *et al.*, 2024).

This study reinforces the crucial role of phototherapy in managing pathological jaundice in newborns, while identifying key factors that influence its success. Duration of therapy, bilirubin levels at treatment initiation, and gestational age all demonstrated significant associations with treatment outcomes. These insights can be utilized to enhance clinical decision-making and inform more effective management strategies for neonatal hyperbilirubinemia. Future research may examine additional variables, such as lamp type, light intensity, breastfeeding frequency, and maternal factors, to provide a more comprehensive understanding of phototherapy responsiveness.

CONCLUSION

This study demonstrated that phototherapy is highly effective in reducing bilirubin levels among newborns with pathological jaundice, with 87.3% of infants showing successful outcomes. Treatment duration, initial bilirubin levels, and gestational age significantly influenced the effectiveness of phototherapy. Infants who began therapy early, had lower initial bilirubin levels, or were preterm responded more favorably to treatment. These findings underscore the importance of initiating phototherapy promptly and maintaining close clinical monitoring to optimize therapeutic outcomes and prevent severe complications, such as kernicterus. Healthcare providers should ensure early detection and prompt initiation of phototherapy in infants at risk of pathological jaundice, particularly those presenting with elevated bilirubin levels or vulnerable conditions. Routine bilirubin screening, standardized treatment protocols, and continuous monitoring are crucial for enhancing treatment effectiveness. Additionally, further research incorporating factors such as phototherapy type, light intensity, nutritional status, and underlying clinical conditions is recommended to strengthen understanding and enhance the effectiveness of phototherapy management in neonatal care.

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Conflict of Interest

There are no potential conflicts of interest relevant to this article.

References

Andolfo, I., Iolascon, A. and Russo, R. (2025) 'The evolving landscape of hereditary stomatocytosis', *Blood*, 145(26), pp. 3089–3100. doi: https://dx.doi.org/10.1182/blood.2024024294.

Çamur, Z. *et al.* (2024) 'The effect of massage and bathing on bilirubin levels in newborns with

hyperbilirubinemia: A systematic review and meta-analysis of randomized controlled trials', *Journal of Neonatal Nursing*, 30(6), pp. 601–608. doi: https://dx.doi.org/10.1016/j.jnn.2024.06.004.

Chawla, R. *et al.* (2024) 'An adaptive network model simulating the effects of an AI coach on supporting safety in hospitals through inducing adherence to guidelines in neonatal medical protocols', *Cognitive Systems Research*, 88, p. 101290. doi: https://dx.doi.org/10.1016/j.cogsys.2024.101290.

Christensen, R. D. *et al.* (2025) 'Neonatal/perinatal diagnosis of hemolysis using ETCOc', *Seminars in Fetal and Neonatal Medicine*, 30(1), p. 101547. doi: https://dx.doi.org/10.1016/j.siny.2024.101547.

Fairless, H. E., Dunn, C. L. and Ulloa, M. (2022). 'Practice developments supporting change implementation in Wellington, New Zealand (NZ) for "continuity of care when transitioning complex preterm infants from NICU to home"', *Journal of Neonatal Nursing*, 28(3), pp. 148–154. doi: https://dx.doi.org/10.1016/j.jnn.2021.10.008.

Fajrian, F. M. (2020) 'Enzim Transferase dengan Bilirubin Total Penderita Ikterus Obstruktif', *Jurnal Ilmiah Kesehatan Sandi Husada*, 11(1), pp. 176–182. doi: https://dx.doi.org/10.35816/jiskh.v11i1.240.

Flynn, M. E. (2025) 'Updated (New) Hyperbilirubinemia Guidelines for the Primary Care Provider', *Advances in Family Practice Nursing*, 7(1), pp. 185–197. doi: https://dx.doi.org/10.1016/j.yfpn.2024.12.006.

Ghavi, A. *et al.* (2025) 'Maternal and neonatal vitamin D levels and hyperbilirubinemia: A systematic review and meta-analysis', *Clinical Nutrition ESPEN*, 68, pp. 715–726. doi: https://dx.doi.org/10.1016/j.clnesp.2025.06.030.

Huang, D. *et al.* (2025) 'Genomic sequencing as a key primary recommendation for neonatal hyperbilirubinemia: a population-based multicenter study', *Journal of Genetics and Genomics*. doi: https://dx.doi.org/10.1016/j.jgg.2025.09.002.

Jalali, S. Z. *et al.* (2024) 'Effect of intravenous immunoglobulin on the management of Rh- and ABO-mediated hemolytic disease of the newborn', *Hematology, Transfusion and Cell Therapy*, 46, pp. S57–S64. doi: https://dx.doi.org/10.1016/j.htct.2024.03.002.

De Luca, D. *et al.* (2025) 'The Lancet Child & Adolescent Health Commission on the future of neonatology', *The Lancet Child & Adolescent Health*, 9(8), pp. 578–612. doi: https://dx.doi.org/10.1016/S2352-4642(25)00106-3.

Mahapatra, S. *et al.* (2025) 'Hyperbilirubinemia in neonates with blood group incompatibilities − A bane or a boon for the management', *Transfusion Clinique et Biologique*, 32(1), pp. 82–86. doi: https://dx.doi.org/10.1016/j.tracli.2025.01.004.

Moguilevitch, M. and Fitz-james, I. (2024) 'Congenital diseases with multi-organ expression as an indication for liver transplantation in children during the first years of life: Integrative approach to improve the outcomes', *Journal of Liver Transplantation*, 14, p. 100216. doi: https://dx.doi.org/10.1016/j.liver.2024.100216.

Salami, F. O. *et al.* (2025) 'Artificial Intelligence non-invasive methods for neonatal jaundice detection: A review', *Artificial Intelligence in Medicine*, 162, p. 103088. doi: https://dx.doi.org/10.1016/j.artmed.2025.103088.

Sarker, S. *et al.* (2025) 'Effectiveness of prenatal intervention on neonatal hyperbilirubinemia management in rural Bangladesh: Results from a cluster-randomized trial', *Public Health*, 238, pp. 221–228. doi: https://dx.doi.org/10.1016/j.puhe.2024.12.018.

Sharma, M. *et al.* (2024) 'Racial and skin color mediated disparities in pulse oximetry in infants and young children', *Paediatric Respiratory Reviews*, 50, pp. 62–72. doi: https://dx.doi.org/10.1016/j.prrv.2023.12.006.

Shen, G. *et al.* (2024) 'mRNA therapies: Pioneering a new era in rare genetic disease treatment', *Journal of Controlled Release*, 369, pp. 696–721. doi: https://dx.doi.org/10.1016/j.jconrel.2024.03.056.

Uslu, S. and Ulu, E. (2024) 'Follow-up of the preterm NICU graduates', *Global Pediatrics*, 10, p. 100236. doi: https://dx.doi.org/10.1016/j.gpeds.2024.100236.

Vaivada, T. *et al.* (2022) 'What can work and how? An overview of evidence-based interventions and delivery strategies to support health and human development from before conception to 20 years', *The Lancet*, 399(10337), pp. 1810–1829. doi: https://dx.doi.org/10.1016/S0140-6736(21)02725-2.
Wang, Z. *et al.* (2025) 'Smart textiles for chronic disease management: Advancements, applications, and future prospects', *Materials Science and Engineering: R: Reports*, 164, p. 100987. doi: https://dx.doi.org/10.1016/j.mser.2025.100987.