

## Identifying Risk Factors for Readmission to the Neonatal ICU After Discharge

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### Abstract:

**Background:** The frequent readmission of newborns to the Neonatal Intensive Care Unit (NICU) after their initial discharge creates challenges with neonatal care and resource allocation. This study aims to identify and investigate the reasons for early NICU readmissions within 30 days of the initial discharge.

**Methods:** A retrospective examination of 200 neonatal patients at IGIMS, Patna, Bihar was conducted. Collecting population characteristics, medical records, and post-discharge contact information. The method of logistic regression was used to examine associations between risk factors.

**Results:** Low birth weight (OR = 2.65, 95% CI = 1.83 - 3.87), NICU problems (OR = 3.21, 95% CI = 2.17 - 4.75) and a lack of post-discharge medical visits (OR = 1.92, 95% CI = 1.24 - 2.98) were also significant risk factors for readmission. There was a greater chance for mothers younger than 25 (OR = 1.48, 95% CI = 0.96-2.28, p = 0.078).

**Conclusion:** The findings emphasise the importance of thorough discharge and post-discharge follow-up planning, particularly for premature and difficult-to-deliver newborns. Adapting interventions based on recognised risk factors can reduce readmission rates and enhance neonatal care outcomes.

**Keywords:** Discharge planning, Low birth weight, Maternal age, Neonatal care, Neonatal readmission, NICU, Risk factors.

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### Introduction

The NICU is essential because it provides specialised care to newborn delivered prematurely or seriously ill [1]. Despite significant improvements in neonatal outcomes due to technological advances in medicine, readmissions

to the NICU following initial discharge remain a concern [2]. These readmissions place newborns at risk and put an increase in healthcare resources, affecting both the newborns and their families.



Figure 1: Newborn in NICU [3]

Despite efforts to offer adequate care during their initial stay, a few newborns will be readmitted to

the NICU shortly after discharge when it is needed. Repeated hospitalisations are associated with increased healthcare costs and psychological stress

on the patient's family [4, 5]. To design measures and approaches that could decrease the need for readmissions, it is essential to identify the contributing factors.

### Problem Statement

Readmissions of newborns to the NICU serve as a constant reminder of how challenging it is to transition neonatal care to the home. As the demand for efficient use of medical facilities grows, it is more essential than ever to determine why patients continue to come to the hospital. Identifying risk factors that cause neonatal readmissions can lead to more precise discharge planning, improved post-discharge care, and improved outcomes for newborns and their families.

### Objectives

- To identify and evaluate the most significant risk factors related to neonatal readmissions after NICU discharge.
- To estimate the frequency of these threats among the individuals under investigation.
- To learn more about why newborns are readmitted so shortly after discharge and to use this information to guide efforts to improve newborn care and post-hospitalisation transitions.

### Review of Previous Studies

Several studies on neonatal readmissions attempted to identify the root causes of this disturbing trend. [6] found no significant disparities between groups in a large retrospective study of newborns in their first year. According to their research, babies whose births were complicated or delivered to mothers with low birth weights were more inclined to be readmitted to the NICU shortly after being discharged [7, 8]. These findings highlight the significance of medical and obstetric variables in determining the possibility of readmission.

Similarly, [9, 10] conducted a long-term study following a diverse group of newborns from a specific community. The investigators wished to determine how affected readmission rates. Researchers were astonished by finding that had an inverse relationship with readmission probability. This unexpected result raised the possibility that protective factors, such as increased post-discharge support, were at work in this subset of neonates.

In addition, [11] examined the impact of, specifically maternal age, on newborn readmissions. The investigation utilised a sizeable sample of newborns from various socioeconomic backgrounds. The study's conclusion that maternal age alone has no significant effect on readmission rates contradicted previously held beliefs. This intricate study demonstrates that to comprehend the

complexities of neonatal readmissions, it is essential to analyse multiple variables within a broader context.

These studies illustrate the intricate relationship between medical conditions, obstetric complications, specific clinical and demographic characteristics, and neonatal readmissions [12, 13]. However, the current literature emphasises that the interaction of these variables and their combined impact on readmission risk have yet to be adequately studied. Consequently, a more comprehensive study must consider a broader range of variables and their possible interaction.

Although helpful, these studies frequently evaluate risk factors in isolation when an integrated strategy is required to clarify the complex chain of interconnected factors.

For a deeper understanding of the contributing factors and the development of effective intervention strategies, examining the broader ecological context in which neonatal transit from the NICU to the home is necessary.

### Identified Gaps

Even though previous research findings are beneficial, there still needs to be more in the literature. There is an essential gap in knowledge because there are inadequate studies examining the interplay between various risk factors and readmission rates. Even though numerous studies have examined individual readmission risk factors, little attention has been given to how these factors relate to one another. In addition, the generalizability of findings to diverse neonatal populations is limited by the need for studies focusing on.

Insufficient research has also been conducted on the long-term effects of neonatal readmissions. Even though numerous studies concentrate on short-term readmission rates, minimal is known about how readmissions may influence developmental outcomes, the dynamics of families, and subsequent healthcare utilisation. Accounting for these informational gaps is essential for directing effective intervention and discharge planning.

Ecological Systems Theory functions as the theoretical basis for this investigation. From the microscopic (internal variables) to the macroscopic (societal and cultural effects), the theory emphasises the interaction between the individual and their environment at multiple dimensions. By applying this approach to our research, we aim to learn more about the relationship between medical, family, and social influences on newborn health risk factors.

The complexity of neonatal readmissions necessitates a comprehensive basis, which the Ecological Systems Theory provides. It acknowledges that people's clinical factors are not the only ones influencing the readmission risk; environmental and societal impacts are also significant. We anticipate that by taking this approach, we will be able to identify new ways to combat the complex causes of newborn readmissions.

## Methods

### Study Design

This study employed a retrospective approach to investigate the causes of newborns' readmission to the NICU after their discharge.

When ethical or practical considerations preclude prospective designs, retrospective studies can help analyse the relationships between variables and outcomes.

### Participants

Two hundred newborns who discharged from NICU of Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, between January 1, 2022, and December 31, 2022, were included in the study. Babies born prematurely, with low birth weight, or with other medical complications were all examined for inclusion. We collected information on gestational age, birth weight, gender, mother's age, and socioeconomic background to ensure the sample was representative.

### Data Collection

The Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, hospital electronic medical records were accessed in retrospectively to obtain information about patients. The following factors were taken into account:

- Demographic information: Gestational age, birth weight, gender, maternal age, and socioeconomic indicators.

## Results

### Descriptive Statistics

The key demographic characteristics of the study population are shown in Table 1. This section

**Table 1: Demographic characteristics**

| Characteristic          | Mean ( $\pm$ SD)  | Range       |
|-------------------------|-------------------|-------------|
| Gestational age (weeks) | 32.4 ( $\pm$ 3.2) | 25 - 37     |
| Birth Weight (grams)    | 1500 ( $\pm$ 350) | 1000 - 2200 |
| Maternal age (years)    | 28.7 ( $\pm$ 5.2) | 20 - 40     |

### Risk Factors

The variables enumerated in Table 2 are associated with readmission to the NICU within 30 days of discharge. These factors were identified using multivariate logistic regression testing, which considers potential confounding variables.

- Medical history: Neonatal diagnoses, complications during the NICU stay, and interventions received.
- Post-discharge follow-up: Frequency of post-discharge medical visits, adherence to prescribed medications, and parental support systems.

A group of medical experts reviewed the files and entered the information into a database to ensure accuracy. To safeguard patient confidentiality, all identifying information was removed from the data.

### Data Analysis

The data was analysed using statistical software. Using descriptive statistics, the sample population's demographic characteristics were summarised. Logistic regression was used to determine which factors were significantly associated with NICU readmission. The odds ratios (ORs) and 95% confidence intervals (CIs) were computed to assess the strength of associations between the identified risk factors and readmissions. To account for potential confounding factors, variables with significant correlations in univariate analysis were incorporated into a multivariate logistic regression model. This allowed us to ascertain how each risk factor contributed to the overall possibility of readmission.

A p-value of 0.05 or less was considered statistically significant. In addition, subgroup analyses were conducted to examine potential risk factor variations between groups. Sensitivity analyses were performed to determine the dependability of results and fill any data gaps. Utilising statistical tests, it was determined whether or not the result was an appropriate match for the data.

The Institutional Review Board approved this investigation at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India.

describes the demographic characteristics of the neonatal patients included in the investigation.

**Table 2: Risk Factor**

| Risk Factor                           | Odds Ratio | 95% CI      | p-value |
|---------------------------------------|------------|-------------|---------|
| Low Birth Weight                      | 2.65       | 1.83 - 3.87 | <0.001  |
| Maternal Age < 25 years               | 1.48       | 0.96 - 2.28 | 0.078   |
| Complications During NICU Stay        | 3.21       | 2.17 - 4.75 | <0.001  |
| Lack of Post-Discharge Medical Visits | 1.92       | 1.24 - 2.98 | 0.004   |

### Statistical Findings

Using logistic regression analysis, several significant risk variables for readmission within the first 30 days after NICU discharge were identified. Readmission risk factors encompassed low birth weight (OR = 2.65, 95% CI = 1.83 - 3.87), NICU-related issues (OR = 3.21, 95% CI = 2.17 - 4.75) and a lack of post-discharge medical visits (OR = 1.92, 95% CI = 1.24 - 2.98). There was a trend towards relevance for maternal age less than 25 (OR = 1.48, 95% CI = 0.96 - 2.28, p = 0.078).

These findings suggest that neonatal delivered prematurely, those who experienced difficulties in the NICU, and those who weren't given routine follow-up treatment after discharge were more inclined to be readmitted. There was a possible rise in risk related to younger than 25-year-old mothers.

### Discussion

The findings of this study focus on the complex nature of neonatal readmissions during the first 30 days following discharge from the NICU. Low birth weight, NICU-related issues, a shortage of post-discharge medical visits, and an increased risk of readmission are all indicators of the complication of neonatal care transition. This study highlights the importance of considering the intricate network of medical, clinical, and post-discharge factors that impact neonatal health to reduce readmissions.

### Comparison with Previous Studies

Previous research, [14] and [15] agrees with our findings that low birth weight and complications are major causes of neonatal readmissions.

However, a more nuanced view is introduced by the recent rise in risk when a mother is younger than 25.

This could be due to differences in healthcare availability, socioeconomic status, or any other unobserved characteristic within the population under investigation.

### Clinical Implications

The discovered risk factors have significant clinical implications for neonatal care. The significance of post-discharge visits becomes more apparent, particularly for premature neonatal and those who encountered complications during their time in the

NICU. It is possible to stop health complications and reduce the chance of readmission within the crucial 30-day timeframe through early management and cautious monitoring. To further improve neonatal outcomes and reduce readmission risks, it is essential to acknowledge the impact of maternal age below 25 years, which necessitates individualised support and training programmes for younger mothers.

### Limitations

As with any investigation, this study has limitations that must be considered. There is a possibility of bias and missing data due to the retrospective aspect of our method. In addition, the fact that we only examined one hospital in Patna, Bihar, may limit the applicability of our findings to other populations and settings. The complexity of neonatal readmissions may be affected by factors beyond the scope of this research, such as family support systems and social conditions; these need to be explored in depth.

### Future Research

The identified risk factors and possible confounding factors require additional research in the future. Using a large, multi-centre dataset can significantly enhance a study's statistical power and generalisation.

Studies with longer than 30-day follow-up periods can illuminate the long-term effects of readmissions on newborn outcomes, family connections, and healthcare utilisation.

More research into the efficacy of customised discharge plans and targeted interventions for high-risk neonates can enhance the effectiveness of readmission prevention techniques.

### Conclusion

This study contributes to our understanding of neonatal readmissions by determining and analysing significant risk factors associated with readmission to the NICU within 30 days of discharge. Our findings highlight the complexity of neonatal care transitions and the requirement to consider a wide range of clinical, medical, and post-discharge factors when determining the probability of readmission. Clinical practice and discharge planning must be revised in light of the significant correlations between low birth weight, problems during NICU stay, a lack of post-

discharge medical visits, and an increased chance of readmission. By utilising this information, medical professionals can better assist parents of high-risk neonates and schedule more frequent post-discharge visits. Further research is required to determine the causes and effects of the observed increase in risk when the maternal age is less than 25 years.

Our study has limits due to its retrospective approach and the fact that it was conducted in an isolated hospital in Patna, Bihar. Variations in healthcare infrastructure and economic status may affect the generalizability of findings to other populations and locations. Further research is required to determine what previously identified risk factors and possible confounding variables that may affect readmissions over time. The potential for improved neonatal care outcomes and lower readmission rates can be realised by investigating individualised discharge plans and specialised treatments. This study provides valuable information for doctors, policymakers, and academics who wish to improve newborn care and reduce unnecessary readmissions.

By treating the identified risk factors and implementing these findings into clinical practice, we may make progress towards improving the well-being of neonatal and their families during the crucial time following NICU discharge.

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