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Original Article

Respiratory Distress in the Neonatal Intensive Care Unit: Prevalence and Key Etiological Factors

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ABSTRACT

Background: Respiratory distress in newborns, marked by tachypnoea, grunting, retractions, or cyanosis, is a common cause of urgent NICU admission, especially in South Asia. This study aimed to determine the prevalence of respiratory distress among NICU-admitted patients and to identify key etiological factors and associated other conditions. **Methods & Materials:** This hospital-based observational descriptive analytic study was conducted in the NICU of Uttara Crescent Hospital, Dhaka, Bangladesh, from February 2023 to January 2024, including 169 consecutive neonatal admissions over one year. Respiratory distress was defined by clinician diagnosis, standard signs, or need for respiratory support at admission or during stay. Data were extracted via a structured form; outcomes analyzed in SPSS v26 using unadjusted odds ratios, 95% CIs, p<0.05. **Results:** Among 169 NICU admissions, respiratory distress (RD) was present in 96 neonates, with a prevalence 56.80%. RD cases had a mean age of 6.79±3.81 days, were predominantly male (63.54%), mostly preterm (60.42%), and commonly admitted within ≤3 days of life (83.33%). Common causes included CHD (40.6%), neonatal sepsis (35.4%), TTN (32.3%), and RDS (18.8%). Supportive care was frequent; mean NICU stay was 5.6±4.1 days.On unadjusted analysis, TTN (OR 5.88, p = 0.002), RDS (OR 5.65, p = 0.03), and CHD (OR 2.57, p = 0.033) were significantly associated with RD. **Conclusion:** Respiratory distress affected over half of NICU admissions, mostly within three days, with CHD, EONS/LONS, and TTN as leadin cause. Early evaluation and standardized protocols can optimize oxygen therapy, echocardiography, and antibiotic stewardship.

Keywords: *Respiratory distress; NICU; Congenital heart disease, Neonatal sepsis (EONS/LONS)*

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INTRODUCTION

Respiratory distress in the newborn is best understood as a clinical symptom, not a single disease entity; it represents impaired gas exchange and typically presents with tachypnoea, grunting, nasal flaring, chest retractions, central cyanosis, and, in severe cases, apnea or circulatory compromise [1,2]. Because these signs can develop quickly after birth and overlap across pulmonary and extrapulmonary disorders, safe care depends on early recognition, consistent bedside documentation, and prompt etiological assessment in the NICU, where deterioration can occur within hours [1,3]. To improve comparability across settings with different diagnostic capacity, the Brighton Collaboration has emphasized practical case definitions grounded in clinical observation, with optional supportive measurements such as pulse oximetry when available [3]. In this framework, respiratory distress functions as a symptom complex that should trigger a structured search for the final diagnosis rather than being treated as a diagnosis itself.Globally, respiratory distress remains one of the most common reasons for early neonatal evaluation and NICU admission. Clinical syntheses suggest that roughly 7% of newborns develop some degree of respiratory distress [2]. The burden is tightly linked to prematurity, since preterm infants have structurally and biochemically immature lungs and are at high risk of respiratory distress syndrome (RDS), frequently requiring oxygen or positive pressure support [1,4]. Preterm birth remains a major global problem, with modelling work estimating a worldwide rate of 10.6% in 2014, and a substantial share of the absolute burden occurring in Asia, including Bangladesh, which contributes large numbers of preterm births [5]. These epidemiologic realities make a high RD caseload predictable in South Asian NICUs, with direct implications for staffing, monitoring capacity, and availability of escalation pathways [4,5].

The etiological spectrum of neonatal respiratory distress is broad and varies with gestational age, timing of onset, and perinatal context. Pulmonary causes commonly include transient tachypnoea of the newborn, RDS of prematurity, meconium aspiration syndrome, pneumonia, and sepsis-related respiratory failure, while extrapulmonary causes include congenital heart disease, metabolic derangements, anemia, and central nervous system depression [1,2,4]. Mode of delivery can also shape population risk; a meta-analysis reported higher odds of neonatal RDS following cesarean section, particularly elective procedures, supporting efforts to avoid non-medically indicated early cesarean delivery and to strengthen antenatal planning for high-risk pregnancies [6]. In LMIC settings, delayed presentation, limited laboratory and imaging access, and constrained respiratory support infrastructure can blur etiologic classification, potentially contributing to empiric antibiotic overuse or delayed escalation of respiratory care [4,7]. RD is also high-stakes because untreated hypoxemia and fatigue can progress to respiratory failure and serious complications, even when survival is achieved, prolonged oxygen and ventilation can increase morbidity, length of stay, and family and system costs [1,2]. Bangladesh-specific evidence highlights this urgency: in a SCANU cohort, respiratory distress was independently associated with increased in-hospital mortality, and related work emphasizes the value of feasible respiratory support strategies, including bubble CPAP, where conventional equipment is limited [8,9]. Despite its importance, locally grounded data on RD prevalence among NICU admissions and the relative contribution of

key etiologies remain heterogeneous, particularly outside major referral centres. Therefore, the study aimed to determine the prevalence of respiratory distress among NICU admitted patients and to identify key etiological factors and associated other conditions.

METHODS & MATERIALS

This hospital-based observational study was conducted in the Neonatal Intensive Care Unit (NICU) of Uttara Crescent Hospital, Dhaka, Bangladesh. The study used a cross-sectional analytic design, enrolling 169 neonates consecutively admitted during one year, from February 2023 to January 2024. All neonates admitted to the NICU during the period were considered eligible. Neonates were excluded if key admission records were unavailable, if respiratory distress status at presentation could not be ascertained, or if they were readmitted during the same illness episode, in order to avoid duplication. Respiratory distress was defined clinically at admission based on documented features such as tachypnea, chest retractions, nasal flaring, grunting, central cyanosis, or requirement of oxygen support immediately after arrival, as recorded by the attending clinicians. The primary component was the presence or absence of respiratory distress at admission, used to compute prevalence among total NICU admissions. Etiological factors were determined from the final clinical diagnosis recorded in the case sheet after standard NICU evaluation, and included transient tachypnea of the newborn, respiratory distress syndrome, meconium aspiration syndrome, pneumonia, early-onset or late-onset neonatal sepsis, and congenital heart disease, recognizing that more than one diagnosis could be recorded for a single neonate. Baseline variables included neonatal age at admission, sex, gestational age category, birth weight category, Apgar score at 5 minutes, mode of delivery, and need for resuscitation at birth. Admission vital parameters and bedside measurements, including heart rate, respiratory rate, temperature, random blood sugar, and peripheral oxygen saturation, were extracted from triage and first hour notes. Management variables included oxygen therapy,surfactant, mechanical ventilation, incubator care, phototherapy, antibiotics, inotropes, and intravenous fluids. Secondary outcomes included length of NICU stay and discharge weight.Data were collected using a structured data extraction form from admission registers, delivery records, and patient files, with cross-checking between sources for completeness. Statistical analysis was performed using descriptive statistics in SPSS (v. 26.0) for prevalence and distributions. Associations between candidate factors and respiratory distress were explored using odds ratios with 95% confidence intervals, followed by multivariable logistic regression to identify independent predictors, with $p < 0.05$ considered statistically significant. Ethical approval was obtained from the institutional review authority, confidentiality was maintained by de-identifying data, and only aggregated results were reported.

RESULTS

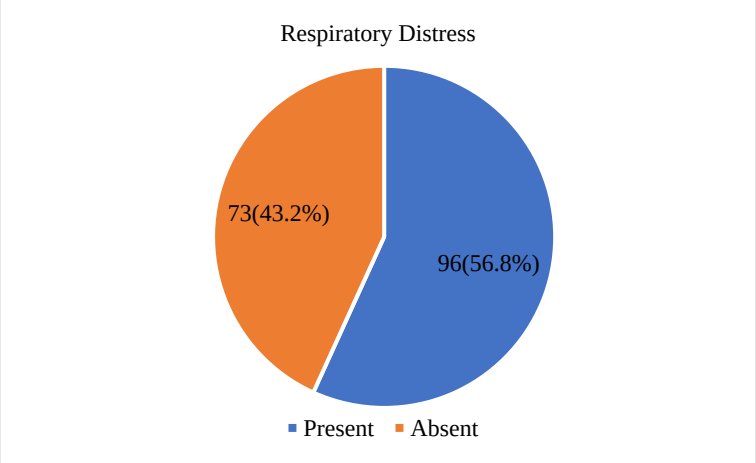


Figure 1 Prevalence of respiratory distress among NICU admissions during the study period (n = 169).

Among 169 neonates admitted to the NICU, respiratory distress was present in 96 cases, giving a prevalence of 56.80%, and the remaining 73(43.20%) neonates did not have respiratory distress (*Figure 1*).

Respiratory distress (RD) cases had a mean age of 6.79 ± 3.81 days, with a clear male predominance, 61 (63.54%) males versus 35 (36.46%) females. Most affected neonates were preterm (≤36 weeks), 58 (60.42%), while 38 (39.58%) were term, and none were post-term. In terms of birth weight, nearly half fell in the 2500–3999 g group, 45 (46.88%), followed by 1500–2499 g, 37 (38.54%). Very low birth weight demonstrates a smaller but important subgroup, <1500 g: 11 (11.46%), and ≥4000 g was uncommon, 3 (3.13%). The Apgar score profile suggests that most were not severely compromised at 5 minutes, ≥7 in 92 (95.83%), with only 4 (4.17%) having an Apgar <7. Admission occurred early for most, with ≤3 days in 80 (83.33%), indicating that RD largely presented in the immediate neonatal period (*Table I*).

Table I
Baseline neonatal demographic and perinatal characteristics of respiratory distress cases (n = 96).

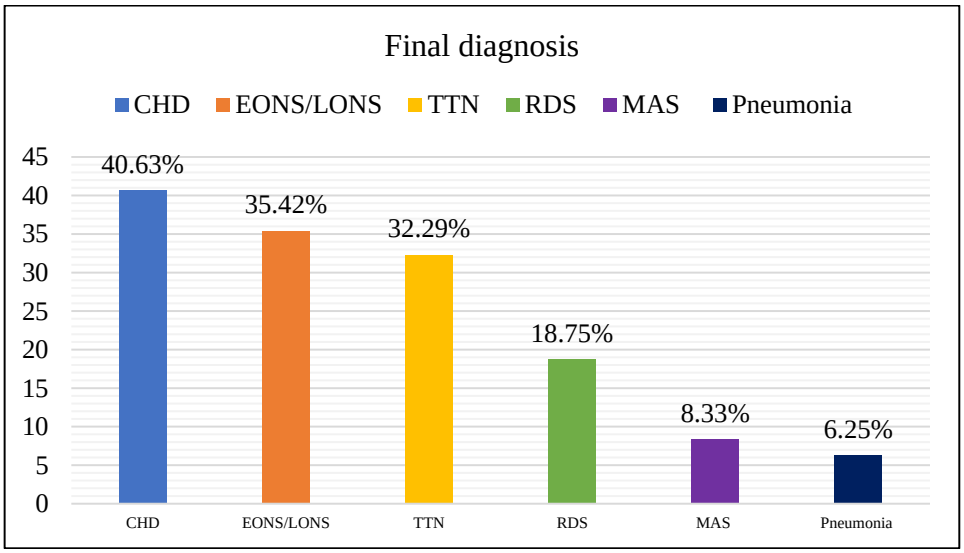
Characteristic	Category	Frequency (n)	Percentage (%)
Age (days)	Mean±SD	6.79±3.805	
Sex	Male	61	63.54
	Female	35	36.46
Gestational age	Preterm (≤36 weeks)	58	60.42

	Term (37–40 weeks)	38	39.58
	Post-term (>40 weeks)	0	0.00
Birth weight	<1500 g	11	11.46
	1500–2499 g	37	38.54
	2500–3999 g	45	46.88
	≥4000 g	3	3.13
Apgar at 5 minutes	<7	4	4.17
	≥7	92	95.83
Age at admission	≤3 days	80	83.33
	4-7 days	10	10.42
	>7 days	6	6.25

On presentation, the mean heart rate was 143.2±3.4/min, and the mean respiratory rate was elevated at 59.6 ± 18.5/min, consistent with tachypnea in this cohort. Mean SpO_2 was 92±3.7%, suggesting mild-to-moderate hypoxemia overall in many cases at first assessment. Mean random blood sugar was 3.3 ± 0.8, which is relatively low and clinically relevant in neonates, and temperature is reported as 98 ± 0, implying no variability in documentation (*Table II*).

Table II
Vital parameters and bedside measurements at presentation among respiratory distress cases.

Parameter	Mean±SD
Heart rate (/min)	143.2±3.4
Respiratory rate (/min)	59.6±18.5
Temperature (recorded unit)	98±0
Random blood sugar	3.3±0.8
SpO_2 (%)	92±3.7



Note: Overlapping etiologies or multiple concurrent diagnoses

Figure 2 Distribution of final etiological diagnoses among neonates with respiratory distress (*n* = 96).

The figure shows that CHD was the most frequent final diagnosis, 40.63% (39/96), followed by EONS/LONS, 35.42% (34/96), and TTN, 32.29% (31/96). RDS accounted for 18.75% (18/96), indicating a smaller but still clinically meaningful share of cases with surfactant-deficiency type pathology. Less common diagnoses were MAS, 8.33% (8/96), and pneumonia, 6.25% (6/96) (*Figure 2*).

Most neonates required stabilization, IV fluids were given to 94 (97.92%) and oxygen to 84 (87.50%). Phototherapy was common, 58 (60.42%), while escalation therapies were less frequent: surfactant 18 (18.75%) and mechanical ventilation 5 (5.21%); incubator care was used in 31 (32.29%). Antibiotic use was high, mainly cefotaxime 72 (75.00%) and meropenem 30 (31.25%), with smaller use of amikacin and vancomycin (each 13.54%), and dopamine was required in 24 (25.00%) indicating notable hemodynamic compromise (*Table III*).

Table III Management modalities and supportive treatments provided to respiratory distress cases (*n* = 96).

Management modality	Frequency (n)	Percentage (%)
IV fluid given	94	97.92
Oxygen therapy	84	87.50
Phototherapy	58	60.42
Surfactant therapy	18	18.75

Incubator care	31	32.29
Mechanical ventilation	5	5.21
Inj.Cefotaxime	72	75.00
Inj. Meropenem	30	31.25
Inj. Dopamine (inotrope)	24	25.00
Inj. Amikacin	13	13.54
Inj. Vancomycin	13	13.54
InjCotson	12	12.50
Inj. Kacin	10	10.42
Inj k-one	17	17.71
Drop. Omidon	14	14.58
Drop. Motigut	30	31.25

The mean duration of hospital stay was 5.6 ± 4.1 days, with most neonates staying 4–7 days: 45 (46.87%), followed by ≤3 days: 30 (31.25%), while >7 days accounted for 21 (21.87%), indicating that about one-fifth required prolonged admission. Mean discharge weight was 2275 ± 634 g, which is below 2500 g on average (*Table IV*).

Table IV
Length of NICU stay and discharge weight outcomes among respiratory distress cases.

Outcome metric	Category	Value
Total hospital stays (days)	Mean ± SD	5.6 ± 4.1
	≤3 days	30 (31.25)
	4–7 days	45 (46.87)
	>7 days	21 (21.87)
Discharge weight (g)	Mean ± SD	2275 ± 634

TTN, RDS, and CHD showed significant unadjusted associations with RD: TTN 33.33% vs 8.22% (OR 5.88, 95% CI 1.91–18.15; p = 0.002), RDS 18.75% vs 4.11% (OR 5.65, 1.23–26.01; p = 0.03), and CHD 40.63% vs 20.55% (OR 2.57, 1.15–5.76; p = 0.033). Pneumonia occurred only in RD cases (6.25% vs 0) but was not statistically significant (p = 0.08) due to low counts. EONS/LONS and MAS, as well as perinatal factors (prematurity, low birth weight, LUCS) and resuscitation, were not significantly associated with RD in this dataset (*Table V*).

Table V
Association of etiological and perinatal factors with respiratory distress among NICU admissions: unadjusted odds ratios (*n* = 169).

Etiological factor	RD yes (n=96) n (%)	RD no (n=73) n (%)	OR (95% CI)	p-value
TTN	32 (33.33)	6 (8.22)	5.88 (1.91-18.15)	0.002
RDS	18 (18.75)	3 (4.11)	5.65 (1.23-26.01)	0.03
CHD	39 (40.63)	15 (20.55)	2.57 (1.15-5.76)	0.033
Pneumonia	6 (6.25)	0 (0.00)	7.32 (0.39-137.03)	0.08
EONS/LONS	34 (35.42)	22 (30.14)	1.24 (0.58-2.63)	0.712
MAS	7 (7.29)	11 (15.07)	0.47 (0.15-1.45)	0.296
Preterm, GA <37 weeks	54 (56.25)	36 (49.32)	1.34 (0.63-2.86)	0.568
Low birth weight, <2500 g	42 (43.75)	34 (46.58)	0.88 (0.42-1.87)	0.893
Caesarean delivery (LUCS)	72 (75.00)	58 (79.45)	0.78 (0.32-1.92)	0.752
Resuscitation required	23 (23.96)	8 (10.96)	2.62 (0.79-8.71)	0.178

DISCUSSION

Respiratory distress (RD) accounted for 56.8% of all NICU admissions in this cohort, underscoring that RD represents a high-frequency presenting symptom encompassing multiple underlying cardiopulmonary and infectious conditions, rather than a discrete diagnosis. This prevalence is consistent with other South Asian, hospital-based NICU series, where RD constitutes a major proportion of admissions. However, reported proportions vary according to case-mix, referral patterns, and the operational definition of "RD." For instance, both prospective and retrospective NICU studies from Bangladesh and neighboring regions have documented similarly high burdens, while some Ethiopian NICU cohorts have reported lower proportions [10-15]. The early presentation pattern observed, with 83.3% admitted by day 3, corresponds with the pathophysiology of common early neonatal etiologies such as transient tachypnea of the newborn (TTN) and respiratory distress syndrome (RDS), as well as early-onset infection pathways. In contrast, later presentations in other cohorts are often associated with late-onset sepsis, progressive pneumonia, and delayed recognition of congenital heart disease (CHD) [16-18]. The observed male predominance is consistent with multiple neonatal RD datasets and is commonly attributed to sex-related differences in lung maturation and susceptibility to respiratory morbidity, particularly among preterm and late-preterm infants [10,14,15].From an etiological perspective, the most clinically significant finding is the prominence of congenital heart disease (CHD), accounting for 40.6% of final diagnoses among RD cases, surpassing early- and late-onset sepsis (EONS/LONS, 35.4%) and transient tachypnea of the newborn (TTN, 32.3%), with overlapping diagnoses explicitly documented. In many published NICU RD profiles, pulmonary causes predominate, with TTN frequently identified as the most common diagnosis, RDS contributing substantially among preterm infants, and meconium aspiration syndrome (MAS) and pneumonia representing smaller proportions. This distribution is evident in hospital-based observational series, where TTN is the leading cause and CHD constitutes a minority of cases [16,15,19,20]. The higher proportion of CHD in this cohort likely reflects local referral patterns, limited prenatal detection, and the

diagnostic utility of echocardiography among symptomatic neonates, particularly when oxygen saturation is only mildly reduced at presentation, as indicated by the mean SpO_2 of 92%. In such cases, a cardiac etiology may be overlooked if evaluation is limited to pulmonary disease. This observation aligns with evidence supporting pulse oximetry as a highly specific screening tool for critical CHD and suggests a practical implication for NICU workflows in similar contexts: RD algorithms should prioritize cardiac assessment alongside pulmonary and sepsis evaluations, rather than considering CHD as a rare alternative [19,21]. The substantial proportion of cases labeled EONS/LONS, together with high antibiotic use, reflects the global reality that neonatal sepsis often presents with nonspecific respiratory symptoms and that clinicians frequently initiate empiric therapy for RD while awaiting diagnostic results. However, this practice also raises concerns regarding antimicrobial stewardship in settings with limited culture capacity and constrained de-escalation pathways [17,18].The association analysis in this study reinforces the symptom-based approach: diagnoses with direct respiratory pathophysiology, such as TTN and RDS, demonstrated the strongest unadjusted associations with RD (odds ratios of 5.88 and 5.65, respectively), while CHD also remained significantly associated (odds ratio 2.57) [10,19,20]. The absence of significant associations for broader perinatal variables, including prematurity, low birth weight, and lower uterine cesarean section (LUCS), does not diminish their biological importance. Instead, this likely reflects limited statistical power, the use of other NICU admissions rather than healthy newborns as the comparator group, and etiologic overlap that reduces the impact of single factors when multiple diagnoses coexist. Comparable NICU studies employing time-to-recovery models or multivariable hazard analyses often identify gestational age, birth weight, and perinatal complications as predictors when case-mix and competing risks are more explicitly addressed [10,11,14].The management patterns observed in this cohort, including nearly universal intravenous fluid administration, frequent oxygen therapy, selective surfactant use (18.8%), and low rates of mechanical ventilation (5.2%), are consistent with stepped-care approaches recommended for neonatal respiratory disease. These approaches emphasize early stabilization, noninvasive support, and selective surfactant administration for RDS [19,20]. The relatively low proportions of MAS and pneumonia align with recent reviews indicating that MAS is less common in many settings, though it remains clinically significant when present. Pneumonia continues to be an important but variably classified contributor, often conflated with "sepsis" in routine NICU documentation [18,22,23].

LIMITATIONS

The primary limitations of this study are its single-center design, limited sample size, and dependence on routine clinical records, which contain documentation gaps such as temperature measurements lacking variability. Additionally, overlapping etiologies were not addressed using multivariable adjustment, which may result in unmeasured confounding and diagnostic misclassification, especially among sepsis, pneumonia, and mixed cardiac-pulmonary causes. These factors could affect the observed associations.

CONCLUSION

Respiratory distress affected over half of NICU admissions, mostly within the first three days of life, and was more common in male, preterm, and lower-birth-weight neonates. CHD, neonatal sepsis (EONS/LONS), and TTN were the leading final diagnoses. As CHD ,TTN, RDS showed the strongest associations with RD, it highlightens the need for early, parallel evaluation for cardiac, infectious diseases as primary causes of respiratory distress. High oxygen and antibiotic use underscore the importance of standardized RD protocols that strengthen early echocardiography, sepsis confirmation, and antimicrobial stewardship in resource-limited NICU settings.

RECOMMENDATION

A standardized respiratory distress (RD) pathway should be implemented, incorporating rapid stabilization, concurrent evaluation for congenital heart disease (CHD), sepsis, and primary lung disease. This approach should include early pulse oximetry and echocardiography when feasible, as well as culture-guided, time-limited antibiotic therapy with subsequent de-escalation to enhance clinical outcomes and promote antimicrobial stewardship.

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CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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