

## A STUDY ON ACUTE ILLNESS OBSERVATION SCALE AND ITS EFFICACY IN DIAGNOSING AND MANAGING CHILDREN OF AGE 2–60 MONTHS WITH ACUTE RESPIRATORY ILLNESS

Suresh.G<sup>1</sup>, S.Nanthakumar<sup>2</sup>, R.Vasumathy<sup>3</sup>

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Corresponding Author:

**Dr. Suresh.G.**

Email: aaronjosh.tvmc@gmail.com

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<sup>1</sup>Medical Officer, Department of Paediatrics, Primary Health Centre, Ukkirankottai, Tirunelveli, India.

<sup>2</sup>Senior Resident, Department of Paediatrics, Government Namakkal Medical College, Tamilnadu, India.

<sup>3</sup>Associate Professor, Department of Paediatrics, Government Namakkal Medical College and Hospital, Tamilnadu, India.

### ABSTRACT

**Background:** Acute respiratory illnesses are a leading cause of paediatric morbidity, and early identification of severity remains challenging in resource-limited and busy clinical settings. This study aimed to assess the relationship between demographic factors, clinical features, and AIOS scores at admission and follow-up, and to determine which observable signs best reflected illness severity and recovery. **Materials and Methods:** This prospective observational study was conducted in a tertiary care paediatric unit and included 100 children aged 2–60 months with acute respiratory illness. The AIOS was applied at admission (Day 1) and reassessed on Day 5. Clinical features were recorded and analysed in relation to the AIOS scores. **Results:** Age was not associated with AIOS on day 1 ( $p=0.357$ ) but was significantly associated on day 5 ( $p<0.001$ ), while sex was associated only at admission ( $p=0.011$ ; day 5  $p=0.931$ ). Weight centiles influenced AIOS at presentation ( $p=0.012$ ) but not at follow-up. Fever duration ( $2\pm 1$  days) showed no association with AIOS on day 1 or day 5 ( $p>0.05$ ). Cough duration was associated only on day 1 ( $p=0.037$ ) but not on day 5 ( $p=0.364$ ), whereas breathlessness duration correlated on day 1 ( $p=0.006$ ) and day 5 ( $p<0.001$ ). Respiratory rate correlated with AIOS at admission ( $r=0.324$ ,  $p=0.001$ ) but not on day 5 ( $p=0.112$ ). Retractions ( $p=0.001$ ) and grunting ( $p<0.001$ ). During follow-up, decreased breath sounds ( $p<0.001$ ), cyanosis ( $p=0.002$ ), prolonged capillary refill time ( $p=0.002$ ), and inability to drink ( $p<0.001$ ) remained significantly associated with higher AIOS scores. Lethargy showed no independent association ( $p=0.652$ ). **Conclusion:** The AIOS reliably reflects illness severity and short-term recovery using observable clinical signs. Respiratory effort, perfusion, ventilation, and feeding difficulties were the most consistent indicators of disease severity over time.

## INTRODUCTION

Acute respiratory illnesses (ARI) are responsible for the majority of hospital visits among children younger than five years.<sup>[1]</sup> Infants and toddlers show higher morbidity because of their immature immune function and narrow airway diameter.<sup>[2]</sup> Minor mucosal swelling or airway secretions can reduce airflow and increase breathing effort.<sup>[3]</sup> Clinical evaluation in this age group is difficult because symptoms are often vague and verbal expression is limited. Therefore, bedside decisions depend mainly on observable signs rather than symptom reporting. ARIs involve upper and lower airway conditions, such as the common cold, bronchiolitis, pneumonia, croup, influenza, and bronchitis.<sup>[4]</sup> Clinical

presentation differs with age, infective agent, nutritional status, and associated illnesses. Common features include fever, cough, tachypnoea, nasal flaring, chest retractions, wheezing, and poor feeding.<sup>[5]</sup> Severe illness can progress to hypoxaemia, respiratory failure, or death. Early identification of children who require closer observation or admission is an important part of paediatric emergency and inpatient care.

Routine assessment of children with respiratory illnesses relies on physical examination, respiratory rate, oxygen saturation, and selected investigations, such as chest radiography or laboratory tests.<sup>[6]</sup> These methods require equipment, trained staff, or patient cooperation, which may not always be available. Clinical judgement can differ among observers,

especially in crowded clinical settings. To reduce this variability, structured clinical scoring systems have been developed to standardise the assessment of illness severity in children.

The Canadian ARI and Flu Scale measures symptom severity, functional limitation, and caregiver impact using a parental questionnaire.<sup>[7]</sup> The Paediatric Respiratory Severity Score evaluates tachypnoea, wheeze, accessory muscle use, oxygen saturation, and feeding difficulty.<sup>[8]</sup> The Modified Tal Score and Wang Respiratory Score focus on wheeze, retractions, and respiratory effort.<sup>[9]</sup> The Paediatric Respiratory Assessment Measure is commonly used for asthma to assess severity and response to bronchodilator therapy. The ReSVinet Score combines clinical findings with caregiver input and is available in paper and digital formats.<sup>[10]</sup> Many of these tools are disease-specific or depend on physiological measures that may change after treatment.

The Acute Illness Observation Scale (AIOS) differs from respiratory-focused scoring. It is a short observational tool based on six appearance domains, including cry quality, caregiver interaction, hydration, colour, and state variation. Scoring depends only on observation and does not require equipment.<sup>[3]</sup> Although the AIOS was designed for early illness recognition, evidence supporting its use in children with ARI is limited. Data examining its association with routine clinical signs and need for hospitalisation in children aged 2 to 60 months is rare.<sup>[11]</sup>

This gap is relevant because children with respiratory illnesses may present early with subtle changes. A simple observational scale may assist in triage, support admission decisions, and complement routine examinations in clinical practice.

#### **Aim**

A study on acute illness observation scale and its efficacy in diagnosing and managing children of age 2–60 months with acute respiratory illness.

## **MATERIALS AND METHODS**

This prospective observational study was conducted on 100 children at Namakkal Headquarters Hospital, Tamil Nadu, from July 2023 to July 2024. The study was approved by the Institutional Ethics Committee. Written informed consent was obtained from the parents or legal guardians, and participant confidentiality was maintained throughout the study.

#### **Inclusion Criteria**

Children between 2 and 60 months of age who presented with a fever of <three days' duration associated with cough or difficulty in breathing. Eligibility required the presence of at least one clinical sign, namely fast breathing according to age-

specific criteria, chest indrawing, stridor in a calm child, grunting, lethargy, convulsions, or inability to drink.

#### **Exclusion Criteria**

Children, if symptoms were present for > two weeks. Patients with a known history of asthma, heart disease, chronic lung disease, inborn metabolic disorders, or neurological conditions, such as developmental delay or degenerative disorders.

#### **Methods**

The eligible patients presenting with suspected pneumonia to the outpatient department. Decisions regarding treatment or hospital admission were made based on Integrated Management of Neonatal and Childhood Illness (IMNCI) classification or the attending physician's clinical assessment. After obtaining informed parental consent, clinical data were recorded using a structured proforma, including respiratory signs, temperature measured with a digital thermometer, respiratory rate counted over one full minute, heart rate, capillary refill time, and oxygen saturation measured by pulse oximetry. Diagnostic investigations, including chest radiography and complete blood count, were performed within 24 hours of admission and were used for clinical correlation rather than statistical comparison.

The Acute Illness Observation Score (AIOS) was assessed by two independent observers on Days 1, 2, and 5, with scoring performed when the child was calm. Day 2 AIOS scoring was used for clinical monitoring but was excluded from statistical analysis, while Days 1 and 5 scores were included. Details of all investigations, treatments administered, and the clinical course during hospital stay or outpatient follow-up were systematically documented using a standardised data collection form.

#### **Statistical Analysis**

The data were analysed using SPSS version 29. Comparisons were performed using the unpaired t-test or Mann–Whitney U test, as appropriate. Statistical significance was set at  $p < 0.05$ .

## **RESULTS**

The study included 100 children with a median age of 18 months (IQR: 17 months). Age showed no significant association with AIOS on Day 1 ( $p = 0.357$ ) but was significantly associated with AIOS on Day 5 ( $p < 0.001$ ). 59 children were males (59%), and 41 children were females (41%). Sex was significantly associated with AIOS on Day 1 ( $p = 0.011$ ), but not on Day 5 ( $p = 0.931$ ). Weights were distributed across all centile categories (<3rd, 3–15th, 15–95th, > and >95th). Weight centiles were significantly associated with AIOS on Day 1 ( $p = 0.012$ ) but not on Day 5 ( $p = 0.101$ ). [Table 1]

**Table 1: Distribution of demographic variables and their association with AIOS scores on day 1 and day 5**

Variable		Measure	AIOS Day 1	AIOS Day 5
Age		Median 18 months (IQR 17 months)	p = 0.357	p < 0.001
Sex	Male	59%	p = 0.011	p = 0.931
	Female	41%		
Weight centiles		<3 <sup>rd</sup> , 3–15 <sup>th</sup> , 15–95 <sup>th</sup> , >95 <sup>th</sup>	p = 0.012	p = 0.101

All enrolled children presented with fever, cough, and breathlessness (100% each). The mean duration of fever was 2 days (IQR 1) and showed no association with AIOS on Day 1 (p = 0.885) or Day 5 (p = 0.657). The mean duration of cough was also 2 days (IQR 1) and showed a significant association

with AIOS on Day 1 (p = 0.0372) but not on Day 5 (p = 0.364). Breathlessness had a mean duration of 2 days (IQR 1) and was significantly associated with AIOS on Day 1 (p = 0.006), with a stronger association persisting on day 5 (p < 0.001). [Table 2]

**Table 2: Distribution of symptom duration and its association with AIOS scores on day 1 and day 5**

Symptom	Measure	AIOS Day 1	AIOS Day 5
Duration of fever	Mean 2 days (IQR 1)	p = 0.885	p = 0.657
Duration of cough	Mean 2 days (IQR 1)	p = 0.0372	p = 0.364
Duration of breathlessness	Mean 2 days (IQR 1)	p = 0.006	p < 0.001

Body temperature was not meaningfully associated with AIOS on Day 1 (r = 0.03, p = 0.768) or Day 5 (r = 0.004, p = 0.967). Respiratory rate showed a significant positive correlation with AIOS on Day 1 (r = 0.324, p = 0.001); however, this association was

not present on Day 5 (r = 0.16, p = 0.112). All children presented with tachypnoea (100%). Tachypnoea severity decreased from Day 1 (14.66 ± 4.86) to Day 5 (6.66 ± 1.17). [Table 3]

**Table 3: Association of vital parameters with AIOS scores on day 1 and day 5**

Parameter	AIOS Day 1 (r/p value/Mean ± SD)	AIOS Day 5 (r/p value/Mean ± SD)
Temperature	r = 0.03, p = 0.768	r = 0.004, p = 0.967
Respiratory rate	r = 0.324, p = 0.001	r = 0.16, p = 0.112
Tachypnoea	14.66±4.86	6.66±1.17

Chest retraction was significantly associated with AIOS on Day 1 (p = 0.001), but not on Day 5 (p = 0.110). Grunting was present in 20 children (20%), in which AIOS decreased from Day 1 (20.38±3.96) to Day 5 (7.10±1.52) and was strongly associated with higher AIOS scores at presentation (p < 0.001) and persistently higher scores on follow-up. Wheezing was not associated with AIOS on Day 1 (p = 0.898)

but showed a significant association on Day 5 (p < 0.001). Crepitations were not associated with AIOS on Day 1 (p = 0.178) but were significantly associated on Day 5 (p < 0.001). Decreased breath sounds were significantly associated with AIOS on both Day 1 (p = 0.0001) and Day 5 (p < 0.001). [Table 4]

**Table 4: Association of respiratory clinical signs with AIOS scores on day 1 and day 5**

Clinical Sign	AIOS Day 1	AIOS Day 5
Retractions	p = 0.001	p = 0.110
Grunting	p < 0.001	Persistently higher scores
Wheeze	p = 0.898	p < 0.001
Crepitations	p = 0.178	p < 0.001
Decreased breath sounds	p = 0.0001	p < 0.001

Cyanosis was significantly associated with AIOS scores on both Day 1 (p = 0.014) and Day 5 (p = 0.002). Prolonged capillary refill time was significantly associated with AIOS on Day 1 (p = 0.014) and Day 5 (p = 0.002). Lethargy was noted in 47 children (47%), and the mean AIOS was lower on

Day 1 compared to Day 1 (6.93±1.49 vs 14.93±5, p = 0.652). Inability to drink was present in 18 children (18%), the AIOS significantly decreased from (21.13±2.73) at Day 1 to Day 5, (7.5±1.55, p < 0.001). [Table 5]

**Table 5: Association of systemic and perfusion-related clinical features with AIOS scores on day 1 and day 5**

Clinical Feature	AIOS Day 1	AIOS Day 5
Cyanosis	p = 0.014	p = 0.002
Capillary refill time	p = 0.014	p = 0.002
Lethargy	p = 0.652	-
Inability to drink	p < 0.001	Persistently higher scores

## DISCUSSION

This study shows that the AIOS reflects early severity and recovery in childhood respiratory illness. Respiratory distress, perfusion, and feeding difficulty best tracked severity, whereas fever, lethargy, and isolated vital signs had limited value during follow-up.

Among 100 children (median age, 18 months), age and sex influenced AIOS at presentation, while age also affected recovery. Weight centiles affected initial AIOS scores but did not influence follow-up severity. Similarly, Rodríguez-Martínez et al. found that in a bronchiolitis cohort of 303 infants, age differed by recovery course: those with prolonged hospitalisation were younger (median 2 vs. 4 months,  $p = 0.003$ ), and each additional month reduced prolonged stay odds (OR 0.92; 95% CI 0.84–0.99).<sup>[12]</sup> Tan et al., in a large study of children with febrile respiratory illness, found that boys accounted for 54% of cases and more often had tachypnoea (16% vs. 15%,  $p = 0.002$ ) and increased work of breathing (12% vs. 8%,  $p < 0.001$ ) at presentation. Admission and oxygen use were similar in both sexes.<sup>[13]</sup>

Masarweh et al. showed in a large study of infants with bronchiolitis that lower birth weight was associated with higher care level at presentation (3000 g in PICU vs. 3144 g in ER;  $p = 0.041$ ), while birth weight showed only a weak correlation with length of stay ( $r = -0.117$ ) and did not predict recovery after adjustment.<sup>[14]</sup> These studies show that age, sex, and weight mainly influence early clinical severity, while recovery depends less on baseline characteristics, supporting our finding that demographic effects are stronger at presentation than during follow-up.

In our study, fever duration did not influence severity, cough duration showed initial illness only, and breathlessness duration indicated both early severity and recovery. Similarly, Elshout et al. found, from a primary care cohort of 480 children (median age 21 months), that the median fever duration before consultation was 2 days (IQR 1–3). Fever duration showed no association with prolonged fever in multivariate analysis (OR 0.93, 95% CI 0.79–1.10), supporting the lack of association between fever duration and illness severity.<sup>[15]</sup> Masarweh et al. showed that duration of respiratory symptoms before presentation did not predict length of stay or hospitalisation after adjustment (all  $p > 0.19$ ), while outcomes were driven by oxygen saturation, fever, gestational age, and birth weight.<sup>[14]</sup>

Justicia-Grande et al. found in the ReSVinet cohort that respiratory difficulty scores were higher at admission in PICU versus ward patients ( $15.7 \pm 2.6$  vs.  $10.2 \pm 2.5$ ;  $p < 0.001$ ) and showed a stronger association with follow-up, correlating with length of stay ( $r = 0.48–0.60$ ).<sup>[16]</sup> These findings show that respiratory difficulty reflects ongoing illness severity, whereas fever and cough mainly affect early

presentation and have limited value in tracking recovery.

In this study, tachypnoea, chest retraction, and grunting were noted, whereas grunting's severity had reduced from admission to day 5. Respiratory rate and temperature had limited value during recovery. De Rose et al. reported in a group of 96 infants, admission scores including respiratory rate, distinguished need for respiratory support (AUC 0.903–0.945;  $p < 0.001$ ), while follow-up outcomes were driven by oxygen saturation rather than respiratory rate alone.<sup>[17]</sup> Similarly, Freire et al. found in a large study of infants with bronchiolitis that body temperature did not predict severity, while chest retractions (OR 3) and nasal flaring or grunting (OR 3.8) were strong admission predictors of escalated care, with grunting contributing to persistent risk classification.<sup>18</sup> These studies support our findings by showing that visible respiratory distress signs predict early severity, while grunting reflects ongoing illness, and temperature or respiratory rate alone do not reliably indicate recovery.

Our study shows that auscultatory signs became relevant later, while reduced breath sounds, cyanosis, poor perfusion, and feeding difficulty severity have reduced from admission to day 5; lethargy was frequent but did not indicate illness severity. Similarly, Tewary et al. found in an LRTI cohort that wheezing showed no association with prolonged hospitalisation ( $p > 0.98$ ), while hypoxaemia (OR 81) and radiographic consolidation (OR 33) predicted sustained severity. Refusal of feeds was common (29.8%) and strongly associated with higher initial severity (OR 6.2), with a prolonged clinical course.<sup>19</sup> Tamene et al. found in a 386-child cohort, wheeze (AOR 2.14,  $p = 0.131$ ) and crackles ( $p = 0.72$ ) lacked independent admission association, while chest indrawing (AOR 3.08), cyanosis (OR 21.07), and inability to feed (AOR 0.13) showed persistent severity links; lethargy was non-independent.<sup>20</sup> These studies support our findings by showing that feeding difficulty, hypoxaemia, and reduced ventilation reflect true severity, while wheeze, crackles, and lethargy are common but unreliable indicators of disease progression.

### Limitations

This single-centre study had a small sample size and a short follow-up period. Observer-based scoring may vary. Objective investigations were not uniformly included, and treatment differences were not controlled, which may have influenced the severity assessment and recovery interpretation.

## CONCLUSION

AIOS effectively shows both the initial severity and short-term recovery in children with ARI. Observable signs of respiratory effort, perfusion, ventilation, and feeding difficulties were more informative than fever or isolated vital signs. The AIOS allows for reliable bedside assessment without reliance on

investigations. Its use may support early clinical decisions and recovery monitoring. Future studies should include larger multicentre cohorts with longer follow-up. The inclusion of AIOS with objective measures may further improve its clinical application.

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