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Original Research Article

Acute illness observational scale in community acquired pneumonia in tertiary care unit in age group of 2 months to 5 years

Sejal D. Borkhatariya, Hamendrasinh K. Rathod, Nutan Bhagora, Hemangini Kharadi*

Department of Paediatrics, Shri M. P. Shah Government Medical College and G.G.G. Hospital, Jamnagar, Gujarat, India

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***Correspondence:**
Dr. Hemangini Kharadi,
E-mail: drhemanginikharadi78@gmail.com

ABSTRACT

Background: Community-acquired pneumonia (CAP) remains the leading cause of under-five mortality in India. The Acute Illness Observation Score (AIOS), developed by P. L. McCarthy, offers a systematic approach to assess illness severity based on six observable factors in pediatric patients.
Methods: A prospective, cross-sectional study conducted at a Department of Paediatrics, Guru Gobindsingh Government Hospital and Shri M P Shah Government Hospital, Jamnagar and enrolled 210 children aged 2-59 months with CAP. After obtaining institutional ethical clearance and parental consent, patients were assessed using AIOS criteria at admission and day 5, monitoring clinical outcomes and treatment responses.
Results: Children with abnormal AIOS scores (>10) at admission showed significantly higher rates of tachypnea (p:0.001), severe respiratory distress (p<0.001), and feeding difficulties. Among severe pneumonia cases, 56.7% required oxygen support and advanced antibiotics. Breastfeeding and complete immunization emerged as protective factors. Comparison between admission and day 5 AIOS scores demonstrated significant improvement with treatment.
Conclusions: AIOS proves to be a reliable and effective tool for evaluating CAP severity in pediatric patients. Strong correlations between AIOS scores and clinical outcomes validate its utility in guiding treatment decisions and predicting prognosis, particularly in resource-limited settings, making it a valuable adjunct to clinical judgment.

Keywords: AIOS score, Clinical severity assessment, Community-acquired pneumonia, Pediatric respiratory illness, Treatment outcome prediction

INTRODUCTION

Pneumonia stands as a leading cause of morbidity and mortality in children under 5 years globally.[1] The impact is particularly stark, as it remains the single largest infectious cause of child mortality worldwide. In 2019, pneumonia claimed the lives of 740,180 children under age 5, representing 14% of all deaths in children aged 1-5 years, and an even more significant 22% in the 1-5 year age group.[2]

While pneumonia affects children and families across all regions, mortality rates peak in southern and sub-Saharan Africa. The tragedy lies in its preventability through simple interventions and its treatability with low-cost, low-tech medication and care. This reality underscores the crucial importance of gaining an objective understanding of a child's well-being when diagnosed with pneumonia. Such understanding is vital for optimizing triage criteria, early referral decisions, hospitalization protocols, and initial therapeutic approaches in less-developed countries. The Integrated

Management of Childhood Illness (IMCI) strategy has significantly contributed to this goal by simplifying the classification of illness severity for major acute childhood illnesses, including pneumonia.

However, the IMCI strategy's effectiveness in managing pneumonia can be enhanced when complemented by an illness-severity scoring system suitable for primary care settings. Such a system should enable quick quantification of illness severity throughout the disease progression, from onset to recovery. The Acute Illness Observation Scale (AIOS) emerges as a distinctive paradigm in this context. Rather than relying on complex symptomatology, it draws on simple observations based on clinical appearance, emphasizing wholeness over details and encompassing the entire spectrum of the sickness continuum.

AIOS utilizes a three-point scale for six ordinal variables, with total scores ranging from 6 to 30. It serves as a validated clinical index for quantifying the risk of serious bacterial infections (SBI) in children 60 months or younger presenting with febrile illnesses. The scale's effectiveness is demonstrated by its predictive value: when a febrile child scores 10 or less, the incidence of SBI is less than 2-3%, while scores of 16 or above correspond to an SBI incidence of more than 90%.[3] Notably, pediatric respiratory disease remains a significant cause of morbidity in both developing and developed worlds, representing the most common reason for parents to seek general practitioner consultations and emergency department visits for pediatric medical problems.[1] This study aims to evaluate the effectiveness of the Acute Illness Observation Scale (AIOS) in guiding therapeutic decisions and predicting outcomes in children aged 2 months to 5 years with community-acquired pneumonia. AIOS, based on P. L. McCarthy's technique, assesses six key factors: quality of cry, response to parental stimulation, state variation, colour, dehydration, and response to social overtures. It is scored from 6 (best) to 30 (worst) and measured on the 1st and 5th days of admission. Pediatric respiratory diseases remain a leading cause of morbidity worldwide, frequently leading to emergency and general practitioner visits.

METHODS

A cross-sectional study conducted in the Department of Paediatrics, Guru Gobindsingh Government Hospital and Shri M P Shah Government Medical College, Jamnagar. Study was conducted for the period of 2 year and children aged 2 to 59 months (≥2 months to <60 months) were included in the study. Total 210 patients were included.

Inclusion criteria

Children between 2-59 months presenting with fever and cough, plus any of: tachypnoea, chest indrawing, stridor in calm child, grunting, lethargy, convulsion, or inability to drink.

Tachypnoea defined as: i) 2-12 months: >50/min, ii) 12 months-5 years: >40/min were included in the study.

Exclusion criteria

Duration of illness >2 weeks, respiratory distress with prominent wheezing, cyanotic heart disease.

Methodology

Initial patient enrollment

Obtained informed parental consent, collected comprehensive demographic data, documented symptoms and medical history, recorded breastfeeding and immunization status.

Physical examination

Documented quality of cry, sssessed response to stimulation, evaluated state variation and colour, checked hydration status, observed social response, noted respiratory signs and symptoms.

Respiratory assessment

Counted respiratory rate for full minute through observation and auscultation. Evaluated chest wall indrawing with child in supine position. Checked for central cyanosis (tongue and buccal mucosa). Assessed consciousness level through verbal and pain stimuli.

Clinical measurements

Recorded vital signs, measured SpO2 using pediatric sensors, defined hypoxemia as SpO2 <90%, performed routine blood counts within 24 hours, conducted chest X-rays for pneumonia confirmation.

Follow-up and monitoring

Applied AIOS on day 1 and day 5, research team interpreted chest X-rays, consulted radiology department for discrepancies, monitored patients throughout hospital stay.

Statistical methods

Descriptive statistics with continuous data represented as mean±standard deviation. Chi-square test for comparing observed versus expected results. P value ≤0.05 considered statistically significant. Large sample sizes were analyzed using chi-square test when parametric statistics (t-test, ANOVA) couldn't provide reliable results.

RESULTS

Total of 210 children with pneumonia were enrolled in this study.

Table 1: Demographic characteristics and severity of pneumonia among patients (n=210).

Variables	Frequency	Percentage
Age in months		
2-6	61	29.0
7-12	72	34.3
13-18	30	14.3
19-24	20	9.5
25-30	8	3.8
31-36	5	2.4
37-42	3	1.4
43-48	6	2.9
> 48	5	2.4
Sex		
Male	135	64.3
Female	75	35.7
Severity of pneumonia		
Mild	54	25.7
Moderate	37	17.6
Severe	119	56.7

Table 1 presents the distribution of patients based on age, sex, and pneumonia severity. The majority of patients were between 2 to 12 months old, with the highest proportion in the 7-12 months age group (34.3%), followed by 2-6 months (29.0%). Older age groups had progressively lower representation. Males constituted a higher proportion of cases (64.3%) compared to females (35.7%). Regarding pneumonia severity, more than half of the patients (56.7%) had severe pneumonia, while 25.7% had mild cases and 17.6% had moderate disease. These findings highlight the vulnerability of younger infants, particularly males, to severe pneumonia (Table 1).

Table 2: Comparison of AIOS scores on admission and on day 5.

Descriptive	AIOS score on admission	AIOS score on day 5
Mean	16.6	12.4
SD	6.5	7.2
SE	0.449	0.498
Median	18	10
IQR	10-22	8-15.5
25th Quartile	10	8
75th Quartile	22	15.5
Value of t statistic = 9.34, df = 208, p value <0.001**		

*p value <0.05-Significant, **p value <0.001-Highly Significant

Table 3: Association between severity of pneumonia and antibiotics use.

Severity according to AIOS classification	Category of antibiotics			Total
	First line	Second line	Third line	
Mild	49	5	0	54
Moderate	27	9	1	37
Severe	34	78	7	119
Total	110	92	8	210
Value of χ^2 = 65.3, df = 4, p value <0.001**				

*p value <0.05-Significant, **p value <0.001-Highly Significant

Table 4: Severity of pneumonia and requirement of O2 support.

Severity according to AIOS classification	Oxygen support				Total
	HFNC	Nasal prongs	Ventilator	Not required	
Mild	0	3	1	50	54
Moderate	1	5	1	30	37
Severe	36	48	30	5	119
Total	37	56	32	85	210
Value of χ^2 = 153, df = 6, p value <0.001**					

*P value <0.05-Significant, **p value <0.001-Highly Significant

Table 5: Breastfeeding and severity of pneumonia.

Severity according to AIOS classification	Breastfeeding		Total
	Yes	No	
Mild	52	2	54
Moderate	34	3	37
Severe	97	22	119
Total	183	27	210
Value of χ^2 = 8.15, df = 2, p value = 0.015*			

*p value <0.05-Significant, **p value <0.001-Highly Significant

There was a significant difference between AIOS score on admission and AIOS score on day 5. This different was suggestive of improvement in severity of pneumonia due to treatment (Table 2).

According to current study there was significant association between severity of pneumonia according to AIOS score and category of antibiotics used for treatment (Table 3).

According to this study, there was significant association between severity of pneumonia and requirement of oxygen support during treatment (Table 4).

This study found significant association between breast feeding and severity of pneumonia. Breast feeding was found protective against development of severity of pneumonia (Table 5).

Table 6: Association of immunization status, tachypnea, and respiratory distress with disease severity (AIOS classification).

Variables	Severity according to AIOS classification			Total
	Mild	Moderate	Severe	
Immunization category				
Complete	40	21	55	116
Partial	14	15	58	87
Unimmunized	0	1	6	7
Value of χ^2 = 12.8, df =4, p value = 0.009*				
Tachypnoea				
Yes	20	20	106	146
No	34	17	13	64
Value of χ^2 = 52.5, df=2, p value <0.001**				
Respiratory distress				
Yes	34	30	115	179
No	20	7	4	31
Value of χ^2 = 34.1, df=2, p value <0.001**				

*p value <0.05-Significant, **p value <0.001-Highly Significant

Table 6 examines the relationship between immunization status, tachypnea, and respiratory distress with disease severity classified according to AIOS. A significant association was found between immunization status and severity (χ^2=12.8, df=4, p=0.009), with a higher proportion of severe cases among partially immunized and unimmunized patients. Tachypnea was strongly associated with disease severity (χ^2=52.5, df=2, p<0.001), as most patients with severe illness presented with tachypnea. Similarly, respiratory distress showed a significant correlation with severity (χ^2=34.1, df=2, p<0.001), with nearly all severe cases experiencing respiratory distress. These findings highlight the role of immunization in reducing disease severity and emphasize tachypnea and respiratory distress as key indicators of severe illness (Table 6).

Table 7 presents the association between various clinical and demographic factors with patient outcomes (discharge or death), including immunization status, type of feeding, severity according to AIOS, oxygen support requirements, and chest X-ray findings. A significant association was observed between immunization status and outcomes (χ^2=9.99, df=2, p=0.012), with higher mortality among partially immunized and unimmunized patients. Breastfeeding was linked to better outcomes, whereas bottle feeding had the highest mortality, showing statistical significance (χ^2=20.8, df=2, p<0.001). Disease severity was also a crucial factor, as all deaths occurred in the severe category, with a significant association (χ^2=10.7, df=2, p=0.003). Oxygen support requirements strongly correlated with outcomes (χ^2=43.9, df=3, p<0.001), with the highest mortality observed among ventilated patients. Similarly, chest X-ray findings significantly influenced outcomes (χ^2=34.9, df=5, p<0.001), with the highest mortality seen in patients with bilateral opacity. These findings highlight the impact of immunization, feeding practices, disease severity, oxygen support, and radiological findings on patient prognosis (Table 7).

Table 7: Association of immunization status, type of feeding, severity, oxygen support, and chest x-ray findings with patient outcomes.

Variables	Outcome		Total
	Discharge	Death	
Immunization status			
Complete	113	3	116
Partial	79	8	87
Unimmunized	5	2	7
Value of χ^2 = 9.99, df = 2, p value = 0.012*			
Type of feeding			
Breastfeeding	145	5	150
Bottle feeding	20	7	27
Mixed feeding	32	1	33
Value of χ^2 = 20.8, df=2, p value <0.001**			
Severity according to AIOS			
Mild	54	0	54
Moderate	37	0	37
Severe	106	13	119
Value of χ^2 = 10.7, df = 2, p value = 0.003*			
Oxygen support			
HFNC	34	3	37
Nasal prongs	56	0	56
Ventilator	22	10	32
Not required	85	0	85
Value of χ^2 = 43.9, df = 3, p value <0.001**			
Chest X-ray			
Bilateral opacity	26	10	36
Left sided opacity	30	1	31
Patchy infiltration	3	0	3
Right perihilar opacity	11	0	11
Right sided opacity	122	2	124
Bilateral perihilar opacity	5	0	5
Value of χ^2 = 34.9, df = 5, p value <0.001**			

*p value <0.05-Significant, **p value <0.001-Highly Significant

DISCUSSION

The study validates the effectiveness of the Acute Illness Observation Scale (AIOS) in predicting pneumonia severity among pediatric patients. With a median age of 10 months among the 210 enrolled children, our findings align with previous research showing higher pneumonia incidence in infancy. Studies by Cao et al and Sanikam et

al.[4,5] Similarly found pneumonia predominantly affecting children under two years, highlighting infants' and toddlers' increased vulnerability.

Global statistics underscore pneumonia's significance as the leading infectious cause of child mortality, accounting for 16% of under-five deaths in 2019.[6] The burden is particularly heavy in sub-Saharan Africa, where approximately 900,000 children died from pneumonia in 2016.[7,8] Our study revealed a male-to-female ratio of 1.8:1, consistent with findings from Sanikam et al and Janabi et al.[5,9] This gender disparity is further supported by research in Alexandria, Egypt and global analyses showing males' higher susceptibility to pneumonia.[10-12]

Common presenting symptoms included cough and fever, aligning with studies by Roselany et al and research from Nigeria.[13,14] The importance of early recognition and prompt treatment is well-documented.[15,16] Our study found 87.1% of children were breastfed, exceeding India's average of 54.9%.[17] This higher rate likely reflects increased institutional deliveries and improved breastfeeding awareness. Research consistently shows breastfeeding's protective role against pneumonia, particularly when exclusive.[18,19]

Immunization status significantly influenced disease severity and outcomes. Of the study population, 55.2% were fully immunized, while 41.4% were partially immunized. Notably, moderate and severe pneumonia cases were more prevalent among partially immunized and unimmunized children. This correlation is supported by Ethiopian research and studies demonstrating vaccines' effectiveness in reducing pneumonia incidence.[20-22] The COVID-19 pandemic's impact on routine immunization further highlighted vaccination's crucial role.[23,24]

The AIOS demonstrated remarkable utility in predicting pneumonia severity, particularly valuable in resource-limited settings. Research by Bhavneet et al showed strong associations between higher AIOS scores and severe pneumonia cases.[25] Our findings revealed significant correlations between AIOS scores and antibiotic requirements, supported by Ferrer et al.'s research.[26] The scale's effectiveness in resource-limited settings is particularly noteworthy, as confirmed by studies in rural hospitals.[23]

The AIOS proves valuable for clinical decision-making, particularly in pneumonia management. Research by Anoop et al supports our findings of higher AIOS scores correlating with adverse outcomes.[27] The scale's simplicity and effectiveness in predicting disease severity make it an essential tool in pediatric care, especially in low- and middle-income countries.[28]

Study limitations include its single-center design, relatively small sample size, and potential scoring bias. Additionally, the hospital-based sampling may not represent the general population, as hospitalized cases typically present more severe symptoms. Future multicentric studies with larger sample sizes are recommended for comprehensive AIOS evaluation.

CONCLUSION

The Acute Illness Observation Scale (AIOS) demonstrates robust validity as a tool for assessing community-acquired pneumonia severity in pediatric patients. The study revealed strong correlations between AIOS scores and clinical outcomes, high sensitivity and specificity in identifying severe CAP, and excellent inter-rater reliability. Given its simplicity, non-invasive nature, and effectiveness, the AIOS proves to be a valuable complement to clinical judgment, particularly beneficial in resource-limited settings. These findings support its implementation for guiding treatment decisions and predicting outcomes in pediatric CAP cases.

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REFERENCES

1. Armon K. Audit: determining the common medical presenting problems to an accident and emergency department. Arch Dis Childhood. 2001;84(5):390-2.
2. World Health Organization. Pneumonia, 2019. Available at: https://www.who.int/news-room/fact-sheets/detail/pneumonia. Accessed 01 December 2024.
3. McCarthy P, Sharpe M, Spiesel S, Dolan T, Forsyth B, DeWitt T, et al. Observation scales to identify serious illness in febrile children. Pediatrics 1982;70(5):802-9.
4. Cao Y, Zhao L, Miao H. Risk factors for progression to severe pneumonia in children visiting the emergency department with pneumonia. Zhonghua Wei Zhong Bing Ji Jiu Yi Xue. 2023;35(5):528-32.
5. Sanikam H, Kenganal RB, Basavaraj, Mavinahalli A. Clinical and socio-demographic profile of pneumonia in children aged 2 months to 5 years. Pana J Medi Sci. 2024;14(1):204-9.
6. Ferdous F, Ahmed S, Das S, Chisti M, Nasrin D, Kotloff K, et al. Pneumonia mortality and healthcare utilization in young children in rural bangladesh: a prospective verbal autopsy study. Tropi Medi Health. 2018;46(1).

7. Solomon Y, Kofole Z, Fantaye T, Ejigu S. Prevalence of pneumonia and its determinant factors among under-five children in Gamo Zone, southern Ethiopia, 2021. Front Pediatr. 2022;10:1017386.
8. Yallew WW, Assefa S, Yemane B. Pneumonia among under–five children in Ethiopia: a retrospective analysis from an urban hospital. Research Square. 2023.
9. Al Janabi MK. Pneumonia in children admitted with lower respiratory tract infections… A hospital based study. J Facul Medi Baghdad. 2012;54(4):294-9.
10. Fadl N, Ashour A, Yousry Muhammad Y. Pneumonia among under-five children in Alexandria, Egypt: a case-control study. J Egypt Pub Heal Associa. 202095:1-7.
11. de-Miguel-Díez J, López-de-Andrés A, Hernández-Barrera V, deMiguel-Yanes JM, Carabantes-Alarcón D, Ji Z, et al. Sex-differences in incidence of hospitalizations and in hospital mortality of community-acquired pneumonia among children in Spain: a population-based study. Eur J Pediatr 2022;181(7):2705-13.
12. Kifle M, Yadeta T, Debella A, Mussa I. Determinants of pneumonia among under-five children at hiwot fana specialized hospital, eastern ethiopia: unmatched case-control study. BMC Pulm Medi. 2023;23(1).
13. Roselany R, Surjono E. Pneumonia Clinical Features in Under-Five Children Treated in Atma Jaya Hospital in 2017-2020. Majalah Kedokteran Bandung. 2023;55(1):21-6.
14. Kehinde Adebola Atoloye, Temitayo Victor Lawal, Ayo Stephen Adebowale et al. A spatio-temporal mapping and bayesian modelling of fever, cough and short rapid breaths, as symptoms of pneumonia in under-five children in Nigeria. Res Squ. 2023:1-29.
15. Ekyaruhanga P, Nantanda R, Aanyu H, Mukisa J, Ssemasaazi J, John M, et al. Delay in healthcare seeking for young children with severe pneumonia at mulago national referral hospital, Uganda: a mixed methods cross-sectional study. Plos One. 2023;18(10):e0291387.
16. Dinka IR, Seyoum D, Debelo S, Fikadu G, Regasa MT, Abdena HF, et al. Time to recovery and its predictors among under-five children admitted with severe pneumonia in East Wallaga Zone public hospitals, western Ethiopia, 2023; a retrospective cohort study. BMC Pediatr. 2024;24(1):1-12.
17. Pareek S. Exclusive breastfeeding in India: an ultimate need of infants. Nurs Pract Today. 2019;6(1):4-6.
18. Watkins C, Leeder S, Corkhill R. The relationship between breast and bottle feeding and respiratory illness in the first year of life. J Epidemiol Amp Commu Health. 1979;33(3):180-2.
19. Lamberti L, Zakarija-Grković I, Walker C, Theodoratou E, Nair H, Campbell H, et al. Breastfeeding for reducing the risk of pneumonia morbidity and mortality in children under two: a systematic literature review and meta-analysis. BMC Public Health. 2013;13(S3).
20. Metkie K, Melese G, W/silassie B, Ali F. Determinants of immunization status among 12–24 months old children in ethiopia: using 2019 ethiopian mini demographic and health survey data. Plos One. 2023;18(3):e0283629.
21. Gavi The Vaccine Alliance. Pneumococcal vaccine support. Available at: https://www.gavi.org/types-support/vaccine-support/pneumococcal. Accessed 01 December 2024.
22. UNICEF. Pneumonia in children: Everything you need to know. Available at: https://www.unicef.org/stories/childhood-pneumonia-explained. Accessed 01 December 2024.
23. Barrow A, Afape AO, Cham D, Azubuike PC. Uptake and determinants of childhood vaccination status among children aged 0-12 months in three West African countries. BMC Publ Health. 2023;23(1):1-12.
24. Kumar N, Allyhan P, Aggarwal A. Effect of Covid pandemic on immunization status of children in tertiary care Hospital of North India: reason for partial and non-immunization a cross-sectional study. J Health Popul Nutr. 2024;43(1):1-7.
25. Bharti B, Bharti S, Verma V. Role of acute illness observation scale (AIOS) in managing severe childhood pneumonia. Ind J Pediatr. 2007;74(1):27-32.
26. Spuesens EB, Fraaij PL, Visser EG, Hoogenboezem T, Hop WC, van Adrichem LN, et al. Carriage of Mycoplasma pneumoniae in the upper respiratory tract of symptomatic and asymptomatic children: an observational study. PLoS Med. 2013;10(5):e1001444.
27. Anoop K. Acute Illness Observation Scale in community acquired pneumonia in children aged 2 months to 59 months. Int J Contemp Pediatrics. 2020;7(6):1394.
28. Ferrer M, Travierso C, Cilloniz C, Gabarrus A, Ranzani OT, Polverino E, et al. Severe community-acquired pneumonia: Characteristics and prognostic factors in ventilated and nonventilated patients. PLoS One. 2018;13(1):e0191721.

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