Indonesian Journal of Global Health Research
Volume 8 Number 1, February 2026
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

PROGNOSTIC SIGNIFICANCE OF INCREASING PSOFA SCORES IN PAEDIATRIC SEPSIS

Nadia Setianingsih[1], Yunnie Trisnawati[1,2], Arlinda Sari Wahyuni[3], Bugis Mardina Lubis[1,2], Hendri Wijaya[1,2], Rosmayanti Syafriani Siregar[1,2]*
[1]Department of Pediatrics, Faculty of Medicine, Universitas Sumatera Utara, Jl. Dr. Mansyur No.5, Padang Bulan, Medan Baru, Medan, Sumatera Utara 20155, Indonesia
[2]Adam Malik Hospital, Jl. Bunga Lau No.17, Kemenangan Tani, Medan Tuntungan, Medan, Sumatera Utara 20136, Indonesia
[3]Department of Public Health and Community Medicine, Faculty of Medicine, Universitas Sumatera Utara, Jl. Dr. Mansyur No.5, Padang Bulan, Medan Baru, Medan, Sumatera Utara 20155, Indonesia
*rosmayanti.syafriani@usu.ac.id

ABSTRACT
Sepsis is a major cause of morbidity and mortality among children worldwide, particularly in low- and middle-income countries. Early identification and continuous monitoring of organ dysfunction are critical components in paediatric sepsis management. The Paediatric Sequential Organ Failure Assessment (pSOFA) score is used to evaluate organ dysfunction and predict the risk of mortality. The aim of the study was to investigate the association between an increase in pSOFA score (ΔpSOFA) and mortality among paediatric sepsis patients. This retrospective cohort study included paediatric patients aged 1 month to 18 years diagnosed with sepsis and treated in the PICU from January to December 2023. Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the predictive value of the pSOFA score for mortality. A total of 87 patients were included in the analysis, with 36 deaths recorded within the first 7 days. Patients with ΔpSOFA ⩾1 had a six-fold higher risk of mortality ($p<0.001$; 95% CI: 3.26–11.02). The day-1 pSOFA score showed poor predictive ability (AUC=0.50), whereas the day-3 score demonstrated good predictive performance (AUC=0.85). An increase in the pSOFA score is significantly associated with a higher risk of mortality in paediatric sepsis patients.

Keywords: child; mortality; organ dysfunction; pSOFA; sepsis

How to cite (in APA style)
Setianingsih, N., Trisnawati, Y., Wahyuni, A. S., Lubis, B. M., Wijaya, H., & Siregar, R. S. (2026). Prognostic Significance of Increasing pSOFA Scores in Paediatric Sepsis. *Indonesian Journal of Global Health Research*, *8*(1), 1079–1084. https://doi.org/10.37287/ijghr.v8i1.238.

INTRODUCTION

Sepsis is one of the leading causes of morbidity and mortality among infants and children worldwide, with an estimated 2.9 million deaths among children under the age of five and approximately 454,000 deaths in children and adolescents aged 5 to 19 years (Rudd et al., 2020). Several factors influence mortality in paediatric sepsis, including host factors, pathogens, early identification, and timely management. Sepsis was originally defined as a systemic inflammatory response triggered by infection. However, this definition has been revised due to its overly broad scope, which could classify nearly all infections as sepsis (Kawasaki, 2017). In 2016, the Society of Critical Care Medicine (SCCM) and the European Society of Intensive Care Medicine (ESICM) introduced the latest definition (Sepsis-3), which characterizes sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection (Singer et al., 2016).

Sepsis may result from bacterial, fungal, viral, or parasitic infections, although bacteria pathogens remain the most common cause. The presence of infection can be confirmed through Gram stain, culture, or Polymerase Chain Reaction (PCR) (Hadinegoro et al., 2016). One factor influencing infection severity is the virulence of the causative microorganism. A study was conducted on microbial profiles in 52 adult ICU patients of at Adam Malik General Hospital, Medan during 2019–2020 using blood cultures taken more than 48 hours after admission. The most frequently isolated organisms were Gram-negative bacilli, with 52.8% being Klebsiella pneumoniae positive

for Extended-Spectrum Beta-Lactamases (ESBL) and 5.5% producing carbapenemase. Among Gram-positive organisms, Staphylococcus aureus was most commonly found (15%), with half suspected to be Methicillin-Resistant Staphylococcus aureus (MRSA) (Haithami, 2020). Early interventions such as fluid resuscitation, antibiotics, oxygen supplementation, and inotropic support via peripheral intravenous access have been shown to improve outcomes in paediatric sepsis patients (Nyirasafari et al., 2017).

To date, no universally accepted diagnostic criteria for paediatric sepsis exist. Several scoring systems have been developed to assess organ dysfunction in children, including the Paediatric Multiple Organ Dysfunction Score (P-MODS), Paediatric Logistic Organ Dysfunction (PELOD), and PELOD-2 (Raju et al., 2022). The Indonesian Paediatric Society (IDAI) recommends the use of PELOD-2 for diagnosing paediatric sepsis. The Paediatric Sequential Organ Failure Assessment (pSOFA), adapted from the adult SOFA score, is another tool designed to evaluate organ dysfunction in children (Matics and Sanchez-Pinto, 2017). An ideal scoring system for sepsis should be accurate, simple, minimally invasive, and cost-effective. Compared to PELOD-2, pSOFA requires fewer laboratory parameters while maintaining similar predictive performance (Mianling et al., 2019).

A critical component in the management of paediatric sepsis is the continuous assessment of changes in organ dysfunction scores over time. Previous studies have demonstrated that an increase in pSOFA score (ΔpSOFA) from day one to day three is associated with a higher risk of mortality in paediatric intensive care units. Patients with a ΔpSOFA ≥2 points have been reported to have a mortality risk of up to 50% (Lalitha et al., 2021). However, there remains a lack of research specifically evaluating the impact of increasing pSOFA scores on mortality in paediatric sepsis patients. This study aims to investigate the association between increasing pSOFA scores and mortality among children with sepsis admitted to the paediatric intensive care unit of Adam Malik General Hospital, Medan.

METHOD

This was an analytical study with a retrospective cohort design conducted in the Paediatric Intensive Care Unit (PICU) of Adam Malik General Hospital from December 2024 to January 2025. The study population comprised paediatric patients diagnosed with sepsis who were admitted between January and December 2023. The inclusion criteria were patients aged 1 month to 18 years, diagnosed with sepsis based on a PELOD-2 score ≥8 or pSOFA score ≥8, and who received antibiotic therapy. The exclusion criteria were patients who died within the first three days of admission or were discharged against medical advice before completing seven days of treatment. This study was approved by the Ethics Committee of the University of North Sumatra (Approval no: 1361/KEPK/USU/2024, date: 28.11.2024).

The pSOFA and PELOD-2 scores were calculated based on organ system components. The PELOD-2 score includes dysfunction of the cardiovascular, respiratory, haematological, central nervous, and hepatic systems. The pSOFA score encompasses neurological, haematological, hepatic, renal, and haemodynamic parameters. The change in pSOFA score (ΔpSOFA) was defined as the difference between the pSOFA scores on the first and third days of admission. Mortality was assessed within the first seven days of treatment. Patients who died between the third and seventh days were classified as the non-survivor group, while those who survived or died after seven days were included in the survivor group.

This study included 115 paediatric patients with sepsis who were admitted and treated in the PICU of Adam Malik General Hospital during the study period. This study utilised a consecutive sampling method, determined by the predefined inclusion and exclusion criteria. Twenty-eight patients were excluded because they died within the first 72 hours of treatment. Of the 87 children with sepsis, 51 survived up to seven days of treatment and 36 died within the first seven days.

All collected data were processed and analysed. The chi-squared test was used to assess the association between ΔpSOFA and mortality. The relationships between pSOFA and PELOD-2 scores with mortality were analysed using the Mann–Whitney U test. Statistical significance was set at $p < 0.05$. Diagnostic test analysis to evaluate the predictive ability of pSOFA scores for mortality was conducted using Receiver Operating Characteristic (ROC) curve analysis, with calculation of the Area Under the Curve (AUC).

RESULT

This study conducted on 87 paediatric patients with sepsis admitted to the PICU of Adam Malik General Hospital, demonstrated a 41.4% mortality rate within seven days of treatment. Non-survivors were significantly younger than survivors, and pneumonia was the most prevalent infection, followed by bacteraemia. Demographic characteristics of the patients are presented in Table 1.

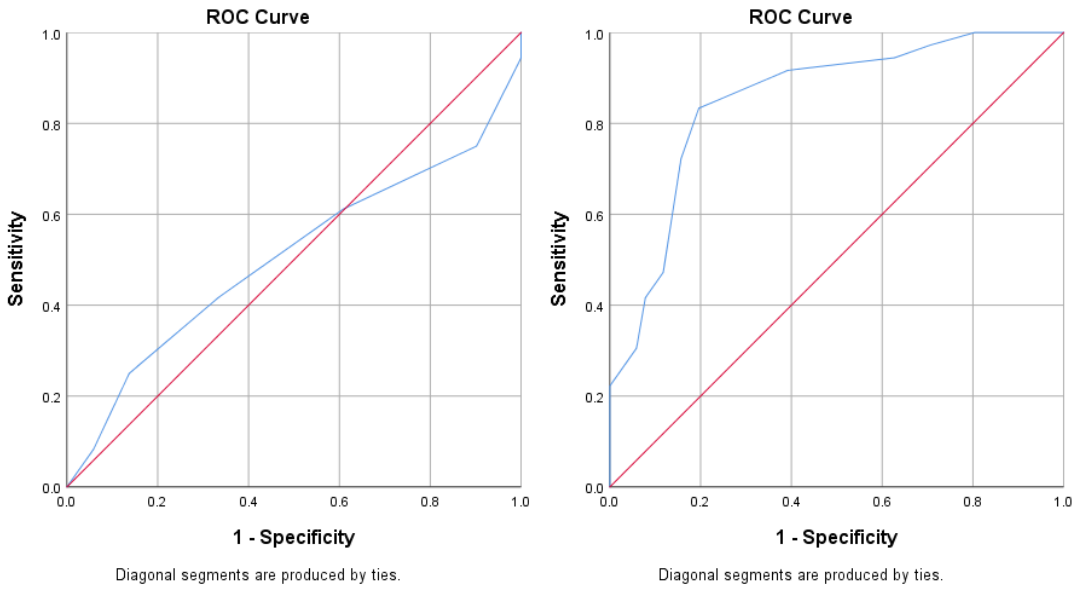
Table 1. Demographic Characteristics of Patient

Characteristic	Total (n=87)	*Non-Survivors* (n=36)	*Survivors* (n=51)	*p-value*
Age (Mean ± SD)	7.61±6.76	7.60±6.76	9.18±6.67	0.008
Sex (%)				0.081
Male	42 (48.3)	13 (31.0)	29 (69.0)	
Female	45 (51.72)	23 (51.1)	22 (48.9)	
Diagnosis of Infection (%)				0.958
Pneumonia	45 (51.7)	18 (40.0)	27 (60.0)	
Bacteraemia	11 (12.6)	5 (45.5)	6 (54.5)	
Urinary Tracy Infection	7 (8.0)	3 (42.9)	4 (57.1)	
Central Nervous System (CNS) Infection	9 (10.3)	5 (55.6)	4 (44.4)	
Pulmonary Tuberculosis	2 (2.3)	1 (50.0)	1 (50.0)	
Skin infection	1 (1.1)	0 (0)	1 (100.0)	
Others	12 (13.8)	4 (33.3)	8 (66.7)	

The proportion of pSOFA and ΔpSOFA score of the patients are presented in Table 2. The analysis revealed that day-1 pSOFA scores were not significantly predictive of mortality, whereas day-3 pSOFA scores demonstrated strong prognostic utility. A ΔpSOFA ≥1 was independently associated with a six-fold increased risk of death. Furthermore, a day-3 pSOFA threshold of ≥11 yielded high sensitivity, specificity, and overall predictive accuracy, underscoring its clinical utility in early risk stratification of paediatric sepsis. The ROC curve of pSOFA score of day-1 and day-3 are presented in Figure 1.

Table 2. Patient mortality in relation to pSOFA and ΔpSOFA score

Score	Total	*Non- survivor*	*Survivor*	p-value	RR (95%CI)
pSOFA Day-1 (Mean ± SD)	10.22±1.85	10.28±2.13	10.38±1.65		
≥12		9 (56.3)	7 (43.8)	0.146	1.48 (0.88-2.50)
<12		27 (38.0)	44 (62.0)		
pSOFA Day-3 (Mean ± SD)	10.62±3.23	12.86±2.57	9.25±2.65		
≥11		30 (75.0)	10 (25.0)	<0.001	5.88 (2.72-12.67)
<11		6 (12.8)	41 (87.2)		
ΔpSOFA					
≤0 (No Deterioration)	58 (66.7)	9 (15.5)	49 (84.5)	<0.001	6.00 (3.27-11.03)
≥1 (Deterioration)	29 (33.3)	27 (93.1)	2 (6.9)		



A B

Figure 1. ROC Curve of pSOFA Score in Predicting Mortality
(A) pSOFA Day-1 (B) pSOFA Day-3

DISCUSSION

Sepsis remains a leading cause of paediatric mortality globally—particularly in low and middle income countries—where child mortality due to sepsis exceeds 50%. 46, 26 In the present study, mortality among paediatric patients with sepsis in the PICU reached 55%, consistent with prior investigations at Adam Malik Hospital (55.7%) and RSCM (54%) (Lubis et al., 2020; Hadinegoro et al., 2016). This elevated mortality is closely related to limited access to care, infrastructure, and specialist personnel in developing settings. Consequently, integrated training for healthcare providers in these regions is essential for sepsis recognition, prevention, and management (Watson et al., 2024).

The Non Survivor cohort had a significantly lower mean age than Survivors, indicating a higher mortality risk among younger children. This aligns with a meta analysis reporting a reduction in mortality odds with each additional year of age (adjusted OR = 0.95; 95% CI: 0.94–0.96) (Tan et al., 2019). In this study, pneumonia was the most frequent infection, followed by bacteremia—consistent with Gupta et al., who identified pneumonia as the predominant infection in an Indian paediatric ICU, followed by bacteremia and UTI (Wattal and Oberoi, 2012). These findings also in accordance with SPROUT data, which reported respiratory tract infections in 40% and bloodstream infections in 19% of paediatric sepsis cases (Weiss et al., 2015).

Mortality progressively increased with higher pSOFA scores. The admission pSOFA score predicted PICU mortality with greater accuracy than SIRS (Malik et al., 2024). Respiratory, neurologic, and cardiovascular subscores contributed most to the overall pSOFA score. In our cohort, day 3 pSOFA was significantly higher in Non Survivors compared to Survivors, whereas day 1 pSOFA did not differ significantly—possibly due to exclusion of subjects who died before day 3, potentially biasing early pSOFA analysis. This contrasts with findings from Karachi, where mean day 1 pSOFA scores were significantly higher in deceased patients (8 vs. 4) (Baloch et al., 2022). Lalitha et al. similarly reported significantly elevated day 1 and day 3 pSOFA scores in non survivors (means 10 and 13) versus survivors (both mean 6) (Lalitha et al., 2021).

In this study, mortality was higher in the ΔpSOFA ≥1 group than in the ΔpSOFA ≤0 group. Mortality risk was approximately six fold greater in the ΔpSOFA ≥1 group compared to ΔpSOFA ≤0, consistent with findings from a paediatric ICU in India, where mean ΔSOFA was 2.65 ± 2.34 in non

survivors versus 1.6 ± 1.79 in survivors (Lois and Save, 2023). A parallel study in South India by Lalitha AV et al. demonstrated a significant association between increasing pSOFA and mortality ($p < 0.05$). The mortality rate was 7.1% at ΔpSOFA = 0, 18.5% at ΔpSOFA = 1, and up to 50% for ΔpSOFA ≥2, with no fatalities among those whose score decreased (Lalitha et al., 2021).

Day 1 pSOFA demonstrated poor predictive value for 7 day mortality. In contrast, day 3 pSOFA with a cut-off ≥11 achieved sensitivity of 83.3% and specificity of 80.4% (AUC = 0.85) in mortality prediction. Zamir et al. reported that pSOFA predictive accuracy improved over time—from 81.6% on day 1 to 90.8% on day 3, reaching 97.4% on day 7. (Zamir et al., 2023). This contrasts slightly with Baloch SH et al., who found first day pSOFA predictive performance to be strong (AUC = 0.81; 95% CI: 0.76–0.86; $p = 0.001$), with cut-off >2 yielding sensitivity 93.87%, specificity 38.21%, and accuracy 69.93% for 30 day mortality (Baloch et al., 2022). Based on our findings, day 3 pSOFA ≥11 demonstrates adequate predictive utility and may be applied in prognostication among paediatric sepsis patients at Adam Malik Hospital. Similar results from India identified the optimal 72 hour SOFA cut-off at 10.5, with 76.47% sensitivity and 96.50% specificity (Lois and Save, 2023). A lower threshold (pSOFA ≥8) was found predictive in South India, where mortality risk was significantly higher with odds ratios of 8.65 (95% CI: 3.48–21.52) and 16.77 (95% CI: 4.7–59.89) on day 1 and day 3, respectively (Lalitha et al., 2021). Overall, these data underscore that pSOFA's predictive performance improves with longer monitoring, highlighting the importance of daily assessment to determine the most prognostically meaningful time point.

This study has limitations. As a retrospective cohort, some supporting laboratory data were incomplete. Despite assuming normal values when tests were not performed within 24 hours, this may have influenced pSOFA calculation. Furthermore, patients who died before day-3 were excluded, and these individuals may have had higher initial pSOFA scores—potentially biasing our analysis of day-1 scores and explaining the lack of significant predictive power of pSOFA.

CONCLUSION

An increase in the pSOFA score on day three was significantly associated with a higher risk of mortality in paediatric patients with sepsis, with the day-3 pSOFA score demonstrating greater accuracy in predicting mortality compared to the day-1 score. Routine 24-hourly pSOFA assessment is recommended to to enable dynamic monitoring of patients' clinical status. A rising pSOFA score should serve as an indicator for clinicians to re-evaluate the current treatment strategy. Future studies should include patients who died before day three to identify a more accurate day-1 pSOFA cut-off and incorporate daily pSOFA evaluations to determine the optimal time point for mortality prediction.

ACKNOWLEDGEMENTS

REFERENCES

Baloch, S.H., Shaikh, I., Gowa, M.A., Lohano, P.D. and Ibrahim, M.N. (2022), "Comparison of Pediatric Sequential Organ Failure Assessment and Pediatric Risk of Mortality III Score as Mortality Prediction in Pediatric Intensive Care Unit.", Cureus, United States, Vol. 14 No. 1, p. e21055, doi: 10.7759/cureus.21055.

Hadinegoro, S.R.S., Chairulfatah, A., Latief, A., H.Pudjiadi, A., Malisie, R.F. and Alam, A. (2016), "Diagnosis dan tatalaksana sepsis pada anak", Pedoman Nasional Pelayanan Kedokteran Ikatan Dokter Anak Indonesia, pp. 1–47.

Haithami, A. (2020), Analisis Profil Kultur Darah Dan Faktor – Faktor Yang Berhubungan Dengan Pola Kuman Di Icu Rsup Ham, Universitas Sumatera Utara.

Kawasaki, T. (2017), "Update on pediatric sepsis: A review", Journal of Intensive Care, Journal of Intensive Care, Vol. 5 No. 1, pp. 1–12, doi: 10.1186/s40560-017-0240-1.

Lalitha, A. V, Satish, J.K., Reddy, M., Ghosh, S., George, J. and Pujari, C. (2021), "Sequential Organ Failure Assessment Score As a Predictor of Outcome in Sepsis in Pediatric Intensive

Care Unit.", Journal of Pediatric Intensive Care, Germany, Vol. 10 No. 2, pp. 110–117, doi: 10.1055/s-0040-1714705.

Lois, A. and Save, S. (2023), "Serial Evaluation of Sequential Organ Failure Assessment Score (SOFA) as a Predictor of Outcome in Children Admitted in Pediatric Intensive Care Unit (PICU) at Tertiary Care Hospital.", Indian Journal of Critical Care Medicine : Peer-Reviewed, Official Publication of Indian Society of Critical Care Medicine, India, August, doi: 10.5005/jp-journals-10071-24509.

Lubis, M., Lubis, A.D. and Nasution, B.B. (2020), "The Usefulness of C-Reactive Protein, Procalcitonin, and PELOD-2 Score as a Predictive Factor of Mortality in Sepsis", The Indonesian Biomedical Journal.

Malik, A., Taksande, A. and Meshram, R. (2024), "Pediatric Sequential Organ Assessment Score: A Comprehensive Review of the Prognostic Marker in the Pediatric Intensive Care Unit.", Cureus, United States, Vol. 16 No. 5, p. e60034, doi: 10.7759/cureus.60034.

Matics, T.J. and Sanchez-Pinto, L.N. (2017), "Adaptation and validation of a pediatric sequential organ failure assessment score and evaluation of the Sepsis-3 definitions in critically ill children", JAMA Pediatrics, Vol. 171 No. 10, pp. 1–9, doi: 10.1001/jamapediatrics.2017.2352.

Mianling, Z., Yuge, H., Tufeng, L., Lu, X., Ting, T., Miaofen, L. and Dongqiang, H. (2019), "Performance of the Pediatric Sequential Organ Failure Assessment Score in Assessing the Prognosis of Children with Sepsis in A PICU of A Developing Country : A Single-Center Retrospective Observational Study", Vol. 29 No. 5, doi: 10.5812/ijp.89024.Research.

Nyirasafari, R., Corden, M.H., Karambizi, A.C., Kabayiza, J.C., Makuza, J.D., Wong, R. and Canarie, M.F. (2017), "Predictors of mortality in a paediatric intensive care unit in Kigali, Rwanda.", Paediatrics and International Child Health, England, Vol. 37 No. 2, pp. 109–115, doi: 10.1080/20469047.2016.1250031.

Raju, K., Sanjeev, S. and Kumar, G.B. (2022), "Utility of Sequential Organ Failure Assessment Score in Prognosticating sick Children in Paediatric Intensive care Unit", Journal of Nepal Paediatric Society, Vol. 42 No. 1, pp. 134–139, doi: 10.3126/jnps.v42i1.41178.

Rudd, K.E., Johnson, S.C., Agesa, K.M., Shackelford, K.A., Tsoi, D., Kievlan, D.R., Colombara, D. V, et al. (2020), "Global, regional, and national sepsis incidence and mortality, 1990-2017: analysis for the Global Burden of Disease Study.", Lancet (London, England), England, Vol. 395 No. 10219, pp. 200–211, doi: 10.1016/S0140-6736(19)32989-7.

Singer, M., Deutschman, C.S., Seymour, C.W., Shankar-Hari, M., Annane, D., Bauer, M., Bellomo, R., et al. (2016), "The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)", JAMA, Vol. 315 No. 8, pp. 801–810, doi: 10.1001/jama.2016.0287.

Tan, B., Wong, J.J.-M., Sultana, R., Koh, J.C.J.W., Jit, M., Mok, Y.H. and Lee, J.H. (2019), "Global Case-Fatality Rates in Pediatric Severe Sepsis and Septic Shock: A Systematic Review and Meta-analysis.", JAMA Pediatrics, United States, Vol. 173 No. 4, pp. 352–362, doi: 10.1001/jamapediatrics.2018.4839.

Watson, R.S., Carrol, E.D., Carter, M.J., Kissoon, N., Ranjit, S. and Schlapbach, L.J. (2024), "The burden and contemporary epidemiology of sepsis in children.", The Lancet. Child & Adolescent Health, England, Vol. 8 No. 9, pp. 670–681, doi: 10.1016/S2352-4642(24)00140-8.

Wattal, C. and Oberoi, J.K. (2012), "Infections in Pediatric Intensive Care Units (PICU).", Indian Journal of Pediatrics, India, Vol. 79 No. 5, pp. 647–649, doi: 10.1007/s12098-012-0696-x.

Weiss, S.L., Fitzgerald, J.C., Pappachan, J., Wheeler, D., Jaramillo-Bustamante, J.C., Salloo, A., Singhi, S.C., et al. (2015), "Global epidemiology of pediatric severe sepsis: the sepsis prevalence, outcomes, and therapies study.", American Journal of Respiratory and Critical Care Medicine, United States, Vol. 191 No. 10, pp. 1147–1157, doi: 10.1164/rccm.201412-2323OC.

Zamir, S., Nadeem, M. and Tabussam, S. (2023), "Accuracy of pSOFA Score in Predicting Outcomes in Critically Ill Children", Pakistan Armed Forces Medical Journal, Vol. 73, pp. 523–526, doi: 10.51253/pafmj.v73i2.8990.