Clinical Decision Tool Reviews

Phoenix Sepsis Score

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Abstract

The Phoenix sepsis score defines sepsis for children born full term (37 weeks gestational age or greater) who are hospitalized using lab and vital sign criteria based on the presence of end-organ dysfunction. Septic shock is defined as the presence of cardiovascular dysfunction in the context of sepsis. The Phoenix score is calculated by adding the highest subscores within a 24-hour period (the first 24 hours of hospitalization).

In both derivation and validation testing, the Phoenix criteria outperformed the International Pediatric Sepsis Consensus Conference (IPSCC) criteria. The Phoenix criteria may be more physiologically accurate than SIRS given that many children may meet SIRS criteria (e.g. fever and tachycardia) without truly having sepsis due to viral infections, for example.

I. How to Use

When to Use

- Use in pediatric patients with suspected infection to determine if they meet criteria for sepsis or septic shock within the first 24 hours of hospitalization.
- The score requires information from 4 systems to calculate a result: respiratory, cardiovascular, coagulation, and neurologic. Use the worst total score at a given point in time to estimate a patient's risk & outcomes.

Pearls / Pitfalls

- In patients with suspected sepsis or septic shock, fluids, antibiotics, and other resuscitative interventions should not be delayed.
- An elevated Phoenix score requires a significant degree of end-organ dysfunction. A "normal" score should not delay or negate treatment of suspected sepsis.
- The score does not account for patients who may have chronic organ dysfunction.
- The score should not be used in birth hospitalizations, patients over the age of 18 years, or with a post-conceptional age less than 37 weeks.
- The score is not intended for early detection of sepsis or incipient sepsis.
- High-resource settings included in the study were exclusively from tertiary care centers in the United States.

Why Use

- The Phoenix Sepsis Score is the result of a large retrospective study conducted by the Society of Critical Care Medicine Pediatric Sepsis Definition Task Force, and improves upon criteria that were initially developed in 2005.
- The Phoenix score is best used for prognostication of mortality: A Phoenix score of 2 points or higher is associated with higher in-hospital mortality in settings with both high and low resource availability.
- A clinical database made up of 3.6 million pediatric hospital encounters was used in this study. The database included encounters from both high and low resource settings, leading to improved generalizability of score results.
- This score outperforms the prior International Pediatric Sepsis Consensus Conference (IPSCC) criteria for pediatric sepsis.
- The Phoenix criteria are not validated for patients who developed sepsis after 24 hours of admission (eg healthcare associated infections)

II. Next Steps

Advice

- If early or developing sepsis is suspected, treatment should not be delayed or deferred if the Phoenix score is normal.

- Goal-directed therapy (e.g. setting concrete goals for mean arterial pressure, oxygen saturation, and other physiologic indicators) can help improve survival.
- Antibiotic choice should be tailored to the suspected sources/site of infection (if able to be determined) and the local antibiogram
- Underlying conditions (e.g. malignancy, immunocompromise, cystic fibrosis, history of drug-resistant organisms) should also inform antibiotic choice

Management

- Sepsis: A score of ≥2 in children with suspected infection meets criteria for sepsis.
- Septic shock: ≥2 points plus ≥1 cardiovascular points meets criteria for septic shock.
- Follow your local standard of care for initiating treatment of sepsis and septic shock if supported by the patient's clinical condition. The Society of Critical Care Medicine's Surviving Sepsis Campaign, maintains information on management and treatment of pediatric sepsis.

Critical Actions

- Patients with suspected septic shock should be admitted to a pediatric critical care unit
- Hypotension in children is a late finding and signals impending cardiovascular collapse and cardiac arrest
- Consider vasoactive agents if hypotension or signs of poor perfusion persist after administration of isotonic fluids, and/or if the patient is developing signs of fluid overload (with persistently poor perfusion).
- Vasoactive medications may be safely run through a peripheral line initially if central access is unavailable, so long as the line site is monitored for signs of extravasation.

III. EVIDENCE

Evidence Appraisal

Derivation study: Sanchez-Pinto LN, Bennett TD, DeWitt PE, Russell S, Rebull MN, Martin B, Akech S, Albers DJ, Alpern ER, Balamuth F, Bembea M, Chisti MJ, Evans I, Horvat CM, Jaramillo-Bustamante JC, Kissoon N, Menon K, Scott HF, Weiss SL, Wiens MO, Zimmerman JJ, Argent AC, Sorce LR, Schlapbach LJ, Watson RS; Society of Critical Care Medicine Pediatric Sepsis Definition Task Force; Biban P, Carrol E, Chiotos K, Flauzino De Oliveira C, Hall MW, Inwald D, Ishimine P, Levin M, Lodha R, Nadel S, Nakagawa S, Peters MJ, Randolph AG, Ranjit S, Souza DC, Tissieres P, Wynn JL. Development and Validation of the Phoenix Criteria for Pediatric Sepsis and Septic Shock. JAMA. 2024 Feb 27;331(8):675-686. doi: 10.1001/jama.2024.0196. PMID: 38245897; PMCID: PMC10900964.

The Phoenix sepsis score was derived from a retrospective cohort of 172,984 children admitted to 10 hospitals across 5 countries (in the US, Bangladesh, Colombia, China, and Kenya). Children (age < 18) presenting with suspected infection were included. Cases managed in the emergency department, inpatient wards, and intensive care units were included. Children were excluded if they were within their birth hospitalization or if they were born before 37 weeks gestational age.

The primary end point was in-hospital mortality. Secondary end points were death within 72 hours of hospitalization or need for ECMO. The Phoenix score was found to have an AUROC of 0.82 for the outcome of mortality. The positive predictive values for in-hospital mortality, 72 hour mortality, and need for ECMO were higher than those for the prior International Pediatric Sepsis Consensus Conference (IPSCC) criteria for sepsis as well as compared to the SIRS crtieria-based definition of sepsis.

The strengths of the derivation include that their population was derived from a broad range of settings, both high- and low-resource. Additionally, the score is a better predictor of poor outcomes and a more specific definition of sepsis when compared to prior definitions (eg SIRS criteria). Sepsis criteria using vital signs only tend to over-estimate the likelihood of sepsis in children. For example, children presenting for evaluation of fever tend to be tachycardic and often tachypneic when febrile only, but the majority of them will be well appearing and not actually manifesting the severe systemic inflammatory response that occurs in sepsis.

The main weakness of this tool is that its higher specificity depends on lab-based diagnosis of end-organ system dysfunction. Overall its positive predictive value is low, despite being higher than the PPV of other sepsis definitions.

Validation study: Long E, Borland ML, George S, Jani S, Tan E, Phillips N, Kochar A, Craig S, Lithgow A, Rao A, Dalziel S, Oakley E, Hearps S, Gelbart B, McNab S, Balamuth F, Weiss SL, Kuppermann N, Brad C, Williams A, Babl FE; Paediatric Research in Emergency Departments International Collaborative (PREDICT) Network. External Validation of the Phoenix Sepsis Score in Children With Suspected Community-Acquired Sepsis. JAMA Netw Open. 2025 Mar 3;8(3):e251412. doi: 10.1001/jamanetworkopen.2025.1412. PMID: 40116825; PMCID: PMC11929021

This prospective cohort study conducted at multiple centers in Australia and New Zealand included 6232 pediatric patients (age < 18 years) with suspected sepsis from 2021-2023. Sepsis in this study was defined as admission to the hospital for parental antibiotics and either

an admission diagnosis of sepsis or treatment of sepsis with one or more fluid boluses of 20 mL per kilo over less than 30 minutes.

Patients not admitted through the ED, patients who were previously admitted to a hospital prior to transfer to a study center, and patients presenting with trauma were excluded.

This validation study found a similar AUROC (0.81) for predicting in-hospital mortality as compared to the derivation study. Their data set was also noted to have fewer missing data points and lab values than in the derivation study. The inclusion criteria, however, were not identical to the derivation study, and overall the validation study's findings had a lower accuracy in predicting any in-hospital mortality. Prediction of death within 24 hours of admission and need for ECMO within 24 hours of admission were similar to analogous end-points in the derivation study.

In both the derivation and validation studies, outcome events were overall very infrequent, and missing lab data were presumed to be normal, which may limit its validity, although the large sample sizes in these studies may negate these concerns somewhat.

In light of the findings of the Phoenix derivation and validation studies, the Society of Critical Care Medicine adopted the Phoenix score in its consensus criteria for pediatric sepsis and septic shock. doi: 10.1001/jama.2024.0179.

Formula

Variable		Points
Respiratory (max 3 points)		
PaO_2/FiO_2, SpO_2/FiO_2[1]	PaO_2/FiO_2 ≥400 or SpO_2/FiO_2 ≥292	0
	PaO_2/FiO_2 <400 on any respiratory support or SpO_2/FiO_2 <292 on any respiratory support	1
	PaO_2/FiO_2 100-200 and IMV or SpO_2/FiO_2 148-220 and IMV	2
	PaO_2/FiO_2 <100 and IMV or SpO_2/FiO_2 <148 and IMV	3
Cardiovascular (max 6 points)		
Vasoactive medications[2]	None	0
	1	1
	≥2	2
Lactate[3]	<5 mmol/L	0
	5-10.9 mmol/L	1
	>10.9 mmol/L	2
Age	**MAP, mm Hg**	
<1 month	>30	0
<1 month	17-30	1
<1 month	<17	2
1 to 11 months	>38	0
1 to 11 months	25-38	1
1 to 11 months	<25	2
1 to <2 years	>43	0
1 to <2 years	31-43	1
1 to <2 years	<31	2
2 to <5 years	>44	0
2 to <5 years	32-44	1
2 to <5 years	<32	2
5 to <12 years	>48	0
5 to <12 years	36-48	1
5 to <12 years	<36	2
12 to 17 years	>51	0
12 to 17 years	38-51	1
12 to 17 years	<38	2
Coagulation (max 2 points)		
Platelets	≥100 x 10^3 μL	0
	<100 x 10^3 μL	1
INR	≤1.3	0
	>1.3	1
D-dimer	≤2 mg/L FEU	0
	>2 mg/L FEU	1
Fibrinogen	≥100 mg/dL	0
	<100 mg/dL	1
Neurological (max 2 points)		
GCS	GCS >10; pupils reactive	0
	GCS ≤10	1
	Fixed pupils bilaterally	2

Note: Subscores with no data are assigned a score of zero (expected to be normal)

[1]SpO_2/FiO_2 ratio is only calculated if SpO_2 ≤97%. PaO2/SpO2 should be recorded at the same time as FiO2 or after FiO2 and mean airway pressure. Maximum respiratory point for patients who are not on invasive mechanical ventilation=1.

[2]Vasoactive medications include any dose of epinephrine, norepinephrine, dopamine, dobutamine, milrinone, and/or vasopressin (for shock).

[3]Lactate can be arterial or venous.

Facts & Figures

Sepsis	Suspected infection and score ≥2 points
Septic shock	Sepsis with ≥1 cardiovascular point

Literature

Original/Primary

https://pubmed.ncbi.nlm.nih.gov/38245889/

Schlapbach LJ, Watson RS, Sorce LR, et al. International consensus criteria for pediatric sepsis and septic shock. JAMA. 2024;331(8):665-674.

https://pubmed.ncbi.nlm.nih.gov/38245897/

Sanchez-Pinto LN, Bennett TD, DeWitt PE, et al. Development and validation of the phoenix criteria for pediatric sepsis and septic shock. JAMA. 2024;331(8):675-686.

Validation

https://pubmed.ncbi.nlm.nih.gov/40116825/

Long E, Borland ML, George S, et al. External validation of the phoenix sepsis score in children with suspected community-acquired sepsis. JAMA Netw Open. 2025;8(3):e251412.