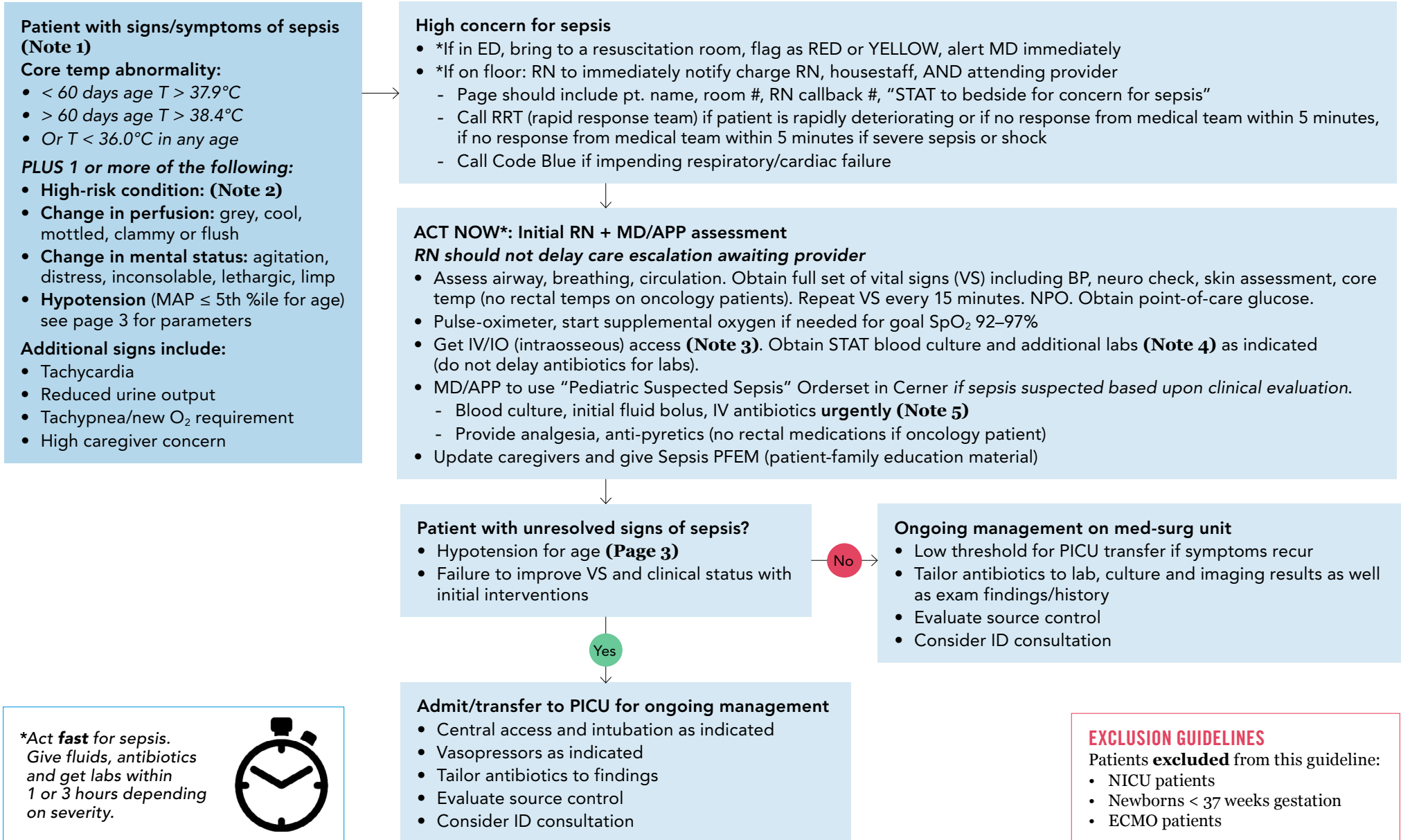


Aim: To standardize initial management of patients with suspected sepsis in order to reduce time to blood culture, fluid bolus and antibiotics.



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NOTE 1: SEPSIS

Sepsis is a systemic inflammatory response to suspected or proven infection. Various definitions for pediatric sepsis have been proposed and most recognize sepsis as a spectrum ranging from SIRS to Septic Shock.

SIRS (Systemic Inflammatory Response Syndrome):

> 1 of (must include either temp/WBC):

- Temp > 38.5 (> 38 if < 2 mo age) or < 36
- Tachycardia (or bradycardia if < 1 yr age)
- Tachypnea
- WBC < 5 or > 15 or > 10% bands

Sepsis: SIRS + suspected infection

Severe Sepsis: Sepsis + CV dysfunction or ARDS or 2+ organ dysfunctions
(Also referred to as Sepsis-Associated acute organ dysfunction)

Septic Shock: Sepsis + CV dysfunction that persists after ≥ 40 mL/kg NS in one hour

NOTE 2. HIGH RISK CONDITIONS INCLUDE:

- Immunodeficiency (chronic steroids, immune suppression, asplenia, Sickle Cell Disease, malignancy, etc.) <https://starnet.childrenshc.org/References/cds/fever-and-neutropenia-treatment-guidelines.pdf>
- In-dwelling devices (central line, urinary catheter, trach, VP shunt, cardiac device, etc.) increasing risk for healthcare associated infection
- Age < 60 days <https://starnet.childrenshc.org/references/CDS/febrile-infant-inpatient-guideline.pdf>
- Severe developmental delay
- Urogenital abnormalities
- Single cardiac ventricle

NOTE 3. IV ACCESS:

- May use functioning central line
- If central line occluded, place peripheral IV (PIV)
- If unable to place PIV within 15–30 min. consider other access (e.g., intraosseous [IO], intramuscular medication, central line)

NOTE 4. LABS/IMAGING:

- Suggested minimum labs (tailor depending on potential sources, timing of past labs) include: CBC w/ diff, venous blood gas (VBG), lactate, CMP, CRP, Procalcitonin, Blood Culture. If patient has central line, obtain blood culture from **both** central line and peripheral draw. Prefer culture obtained **prior** to antibiotics, however, do not delay antibiotic administration.
- Urinalysis and urine culture unless alternate source apparent (e.g. cellulitis, pneumonia)
- Consider culture of any wound drainage or suspicious skin lesions
- Consider throat culture for Staph aureus and Streptococcus, vaginal culture if concern for toxic shock
- Consider lumbar puncture
- Consider chest radiograph, EKG, other imaging depending on likely sources
- Consider MRSA nasal PCR if concern for pneumonia (**Note 4**)
 - Negative predictive value (NPV) of MRSA PCR is high (~98% based on adult data in uncomplicated CAP), so **negative** result is **good** predictor of **no** MRSA pneumonia
 - Positive predictive value (PPV) is low (~50% based on adult data in uncomplicated CAP), so **positive** result is **poor** predictor of MRSA pneumonia

NOTE 5. KEY INTERVENTIONS EARLY:

Delays of as little as an hour have been shown to increase mortality in septic shock. National sepsis guidelines recommend initial interventions within 1 hour of recognition if patient has septic shock, and within 3 hours if patient has sepsis-associated organ dysfunction but without shock.

- Obtain **blood culture** (and additional labs as indicated). Prefer culture obtained prior to antibiotics, however, do not delay antibiotic administration.
- Give isotonic (lactated ringers [LR]) preferred to normal saline [NS] **fluid bolus**.
 - Recommended fluids for patients in septic shock are up to 40–60 ml/kg over the first hour, divided in 10–20 ml/kg increments at a time (e.g. each 20 ml/kg bolus in over 20 minutes), titrated to cardiac output markers and watching for signs of fluid overload.
 - If hypotension present, administer up to 40 ml/kg in first hour.
 - For patients > 50 kg, goals are aliquots of 500 ml to 1 liter for approximately 2–3 liters in 3 hours if indicated.
 - There are ongoing studies evaluating benefit of LR over NS. Albumin not recommended for initial resuscitation.
- Administer 1st **antibiotic**.
 - Antimicrobial recommendations are available on Star Net (Clinical Guidelines), on the avoMD Children's Minnesota Guideline app, as well as in the Pediatric Suspected Sepsis orderset in Cerner.
 - Consideration should be made for community vs. health care associated infection, for which antimicrobial recommendations differ. <https://starnet.childrenshc.org/References/CDS/sepsis-antibiotic-recommendations.pdf>

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VITAL SIGN PARAMETERS

Age	High Heart Rate	High Respiratory Rate	Low Systolic Blood Pressure	Low Temp, Celsius	High Temp, Celsius
< 1 month	> 205	> 60	< 60	< 36	> 38
≥ 1 to < 3 months	> 205	> 60	< 70	< 36	> 38
≥ 3 mo to < 1 yrs	> 190	> 60	< 70	< 36	> 38.5
≥ 1 yrs to < 2 yrs	> 190	> 40	< 70 + (age x 2)	< 36	> 38.5
≥ 2 yrs to < 4 yrs	> 140	> 40	< 70 + (age x 2)	< 36	> 38.5
≥ 4 yrs to < 6 yrs	> 140	> 34	< 70 + (age x 2)	< 36	> 38.5
≥ 6 yrs to < 10 yrs	> 140	> 30	< 70 + (age x 2)	< 36	> 38.5
≥ 10 yrs to < 13 yrs	> 100	> 30	< 90	< 36	> 38.5
≥ 13 yrs	> 100	> 16	< 90	< 36	> 38.5

PALS (Pediatric Advanced Life Support) Vital Signs Parameters for Age. 2005 American Heart Association (AHA) Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care (ECC) of Pediatric and Neonatal Patients: Pediatric Basic Life Support | American Academy of Pediatrics (aappublications.org)

Age	5th percentile for MAP (Mean Arterial Pressure)	Median MAP (50%ile)
37 weeks post-menstrual age to 30 days	39	56
1–3 months	41	59
3–6 months	44	62
6–12 months	48	67
1–2 year	52	72
2–3 year	53	71
3–4 year	52	69
4–5 year	52	69
5–6 year	53	69
6–7	54	71
7–9 year	55	72
9–16 year	56	73–75
> 16 years	57	75–76

Mean Arterial Pressure (MAP) Table derived from: Roberts JS, Yanay O, Barry D. Age-Based Percentiles of Measured Mean Arterial Pressure in Pediatric Patients in a Hospital Setting. *Pediatr Crit Care Med.* 2020 Sep;21(9):e759-e768. doi: 10.1097/PCC.0000000000002495. PMID: 32740191.

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