Atrium Health

Clinical Guidance on Blood Culture Ordering and Utilization for Adults and Pediatrics

S	Situation	In the Wake and Greater Charlotte markets, there is a critical shortage of BD BACTEC bottles used for blood culture collection. This shortage impacts aerobic, anerobic, acid-fast bacilli, and fungal culture bottles for both pediatric and adult patients.
B	Background	Due to a shortage of materials, blood culture bottle production will decrease by 50% over the next few months.
A	Assessment	Conservation of blood cultures bottles now is necessary to ensure adequate supply in the future.
R	Recommendation	In response to the shortage, clinical guidance on blood culture ordering and utilization was developed. It is recommended that facilities and providers align their practices with the recommendations stated below.

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July 2024

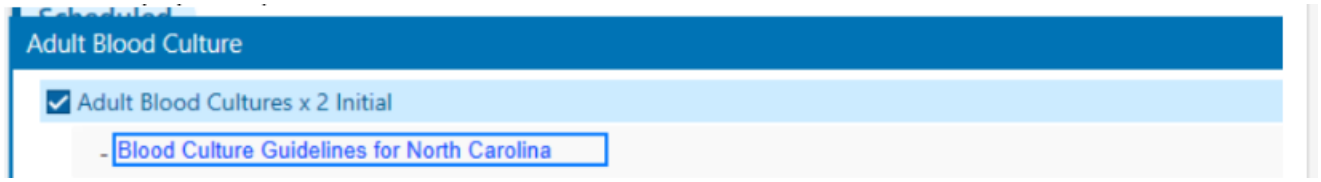
Recommendations for Blood Culture Collection

Due to the shortage of all BD BACTEC bottles, it is critical cultures are drawn appropriately with excellent sterile technique to increase culture yield and reduce risk of culture contamination. Best practices for blood culture collection are listed below.

- **Bacterial Blood Culture Bottle Selection**
    - There are four different types of BD BACTEC bottles. They should be selected according to the type of blood culture being requested.
        - **Adult patients:**
            - Use one (1) aerobic BD BACTEC PLUS and one (1) anaerobic BD BACTEC Lytic bottle
        - **Children 6 years and older:**
            - Use one (1) aerobic BD BACTEC PLUS in most circumstances (see pediatric algorithms for guidance)
        - **Pediatric patients 5 years and younger:**
            - Use one (1) BD BACTEC Peds Plus bottle
        - **For fungal or mycobacterial blood culture:**
            - Use one (1) BD BACTEC Myco/F Lytic bottle. Submit one bottle per culture. Cannot be combined (separate bottles will need to be obtained for fungal cultures and mycobacteria cultures)
            - If there is a clinical concern for candidemia, **avoid** ordering fungal blood cultures in addition to bacterial blood cultures as *Candida* species readily grow in routine blood culture bottles.
    - Body fluids other than blood should **NOT** be inoculated into blood culture bottles.
- **Volume Requirements** - The required volumes per bottle are as follows:
    - **Adults (18+ years):**
        - **8-10 mL** per bottle for the aerobic and anaerobic bottle. 16-20 mL total of blood per venipuncture
    - **Children 6 –17 years**:
        - **8-10 mL** per blood culture bottle (usually aerobic only; see Pediatric algorithms for guidance)
    - **Children ≤ 5 years old:**
        - **1 mL per year of age** (1 to 5 mL of blood per venipuncture) per pediatric bottle. Transfer the entire amount to a BACTEC Peds Plus/F vial (Pink Cap)
    - **If requesting fungal or AFB cultures:**
        - 3-5 mL per Myco/F Lytic bottle
- **Number of Blood Cultures** - The BACTEC FX system, requires the inoculation of blood into two bottles, one aerobic and one anaerobic, from a single collection site. These two bottles drawn together are considered one bacterial blood culture "set". There is no advantage to obtaining cultures in any other

combination than as the set described above. **However, see Pediatric algorithms for additional guidance in that population.**

- **In adults,** to preserve inventory, it is recommended to obtain **two sets** of blood cultures only on the **initial** collection.



For **repeat** collections for appropriate indications, only **one set** of blood cultures should be ordered. Do not repeat blood cultures more often than every 48 hours.

- **In adults**, collection from a peripheral site is preferred to reduce false positive (contaminated) results. If one set is collected from a catheter, a second set should be collected from a peripheral site.
- **In pediatrics**, collection from a catheter is acceptable. Bottles should be labeled with the site of collection.

- **Specimen Collection** - Specimen collection should be done at the bedside by properly trained phlebotomists and nursing/medical staff.
  - Skin disinfection is a critical step to avoid contamination and should be performed in accordance with local protocols.
    - 1. Select vein for venipuncture site.
    - 2. Use a **ChloraPrep** (Medi-Flex Hospital Products, Inc) kit following the instructions recommended by manufacturer.
    - 3. Use repeated back and forth strokes of the applicator for 30 seconds to thoroughly clean the site. Allow to dry for 30 seconds.
  - No need to change needles before injecting the blood into the culture bottle. **DO NOT USE IODINE TO DISINFECT BOTTLE**. Use a 70% alcohol pad.

Best Practices for All Patients

- **Initial Blood Cultures**
  - All patients should be evaluated for an appropriate clinical indication prior to obtaining blood cultures. Before ordering blood cultures, assess the patient's clinical history and perform a physical examination to identify infectious and noninfectious sources for the isolated clinical event and review the potential benefit added by blood cultures.[1]
  - Avoid drawing anticipatory blood cultures (i.e. blood cultures drawn before clinical decision making is complete).

- **Follow-up Blood Cultures**
    - Routine, follow-up blood cultures for a single blood culture with skin flora (e.g. typical blood culture contaminant organisms may include coagulase-negative staphylococci, *Corynebacterium* spp., *Bacillus* spp. other than *Bacillus anthracis*, *Micrococcus* spp., and *Cutibacterium acnes* etc.) in an immunocompetent patient is NOT necessary unless bacteremia is suspected or a prosthesis is present.[1,2]
    - Avoid drawing surveillance blood cultures (i.e. routinely monitoring for bacteremia without a clinical indication).
    - Avoid placing standing orders for blood cultures (e.g. after an initial positive culture, placing an order for follow-up blood cultures daily for multiple days).
- Please consider the clinical value of drawing blood cultures in patients requiring comfort care or end-of-life care.

Recommendations for Non-Neutropenic Adults

- Use **Figures 1a & 1b** to determine when blood cultures are indicated in **non-neutropenic, adult patients**. Note, this algorithm should be interpreted in the context of each individual patient's clinical scenario, and it does not substitute for clinical judgement.[1]

Figure 1a. Algorithm for Initial Blood Culture Recommendations in Non-Neutropenic Adults
Adapted from *Fabre V, et al. Clin Infect Dis. 2020 Aug 22;71(5):1339-1347.*[1]

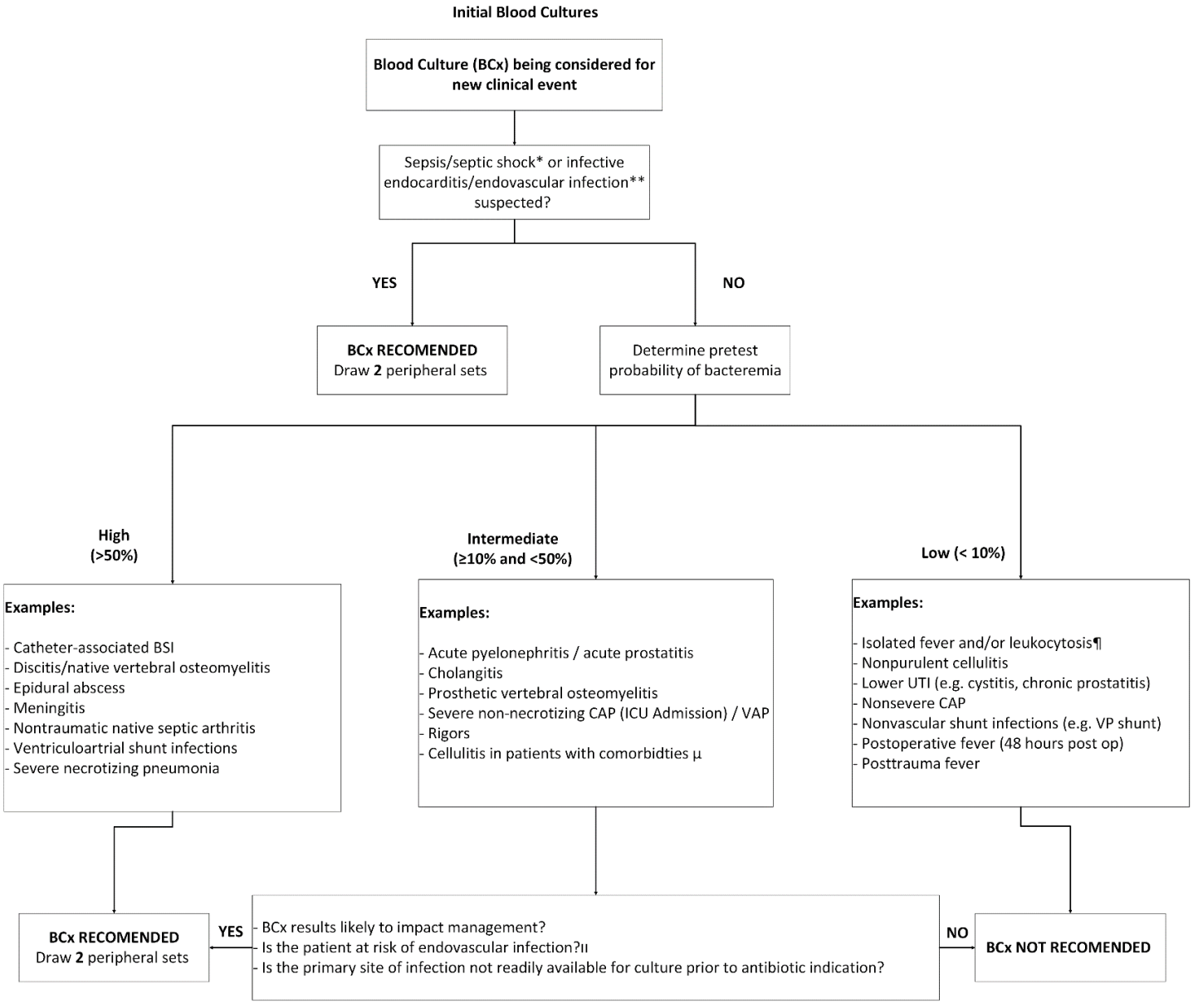


Figure 1b. Algorithm for Follow-up Blood Culture Recommendations in Non-Neutropenic Adults

Adapted from *Fabre V, et al. Clin Infect Dis. 2020 Aug 22;71(5):1339-1347.*[1]

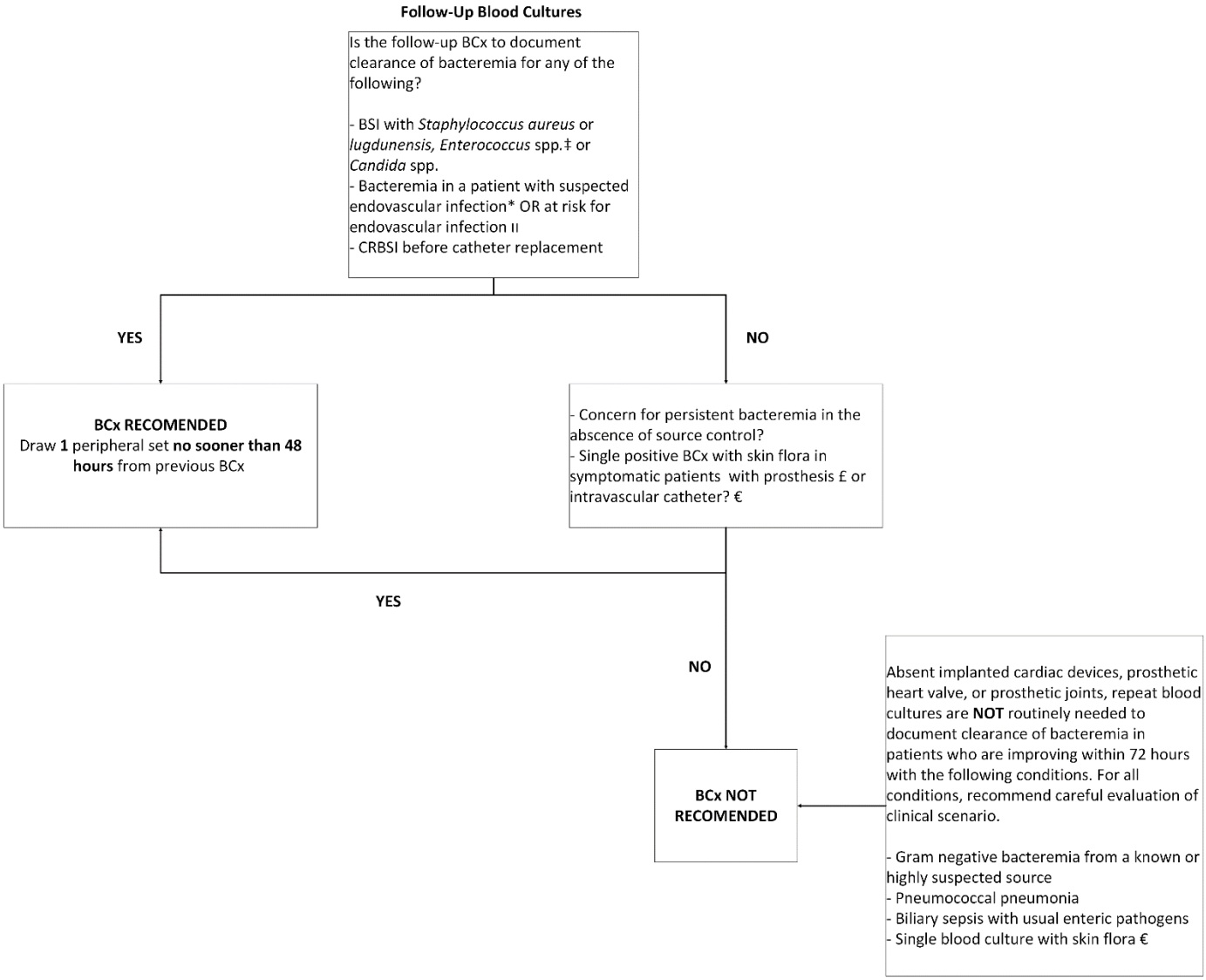


Figure Footnote

***** Sepsis or Septic Shock as defined by CMS/SEP-1 criteria

******Endovascular infection: septic thrombophlebitis, infected endovascular thrombi, implantable cardioverter defibrillator (ICD)/pacemaker lead infections, intravascular catheter infections, vascular graft infections

µ Cellulitis in patients with comorbidities: immunocompromised hosts or those at risk of poor outcomes from sequelae from missed *Staphylococcus aureus* bacteremia, patients at risk (e.g. elderly, diabetes, ESRD) of Group B Streptococcus (*Streptococcus agalactiae*) bacteremia either cryptogenic or secondary to non-purulent cellulitis or surgical site infection

¶ Before ordering BCx, assess the patient's clinical history and perform a physical examination to identify infectious and noninfectious sources for the isolated fever episode and review the potential benefit added by BCx

ıı Patients at risk of endovascular infection: ICD/pacemaker, vascular graft, prosthetic valves and prosthetic material used for cardiac valve repair, history of infective endocarditis, valvulopathy in heart transplant recipient, unrepaired congenital heart disease, repaired congenital heart disease with residual shunt or valvular regurgitation, or within the first 6 months postrepair, known or suspected injection drug use

‡ A single set of BCx for Enterococcus in patients without valvular heart disease and no urinary retention/obstruction that would predispose patients to bacteremia may not need repeat BCx

£ Prosthesis: joint or intravascular prosthesis

€ Routine additional follow-up BCx for a single BCx with skin flora (e.g. typical blood culture contaminant organisms may include coagulase-negative staphylococci, *Corynebacterium* spp., *Bacillus* spp. other than *Bacillus anthracis*, *Micrococcus* spp., and *Cutibacterium acnes* etc.) in an immunocompetent patient are not necessary unless bacteremia is suspected, or a prosthesis is present

Definitions: BSI = blood stream infection, CAP = community-acquired pneumonia, VAP = ventilator-associated pneumonia, UTI = urinary tract infection, spp. = species, CRBSI = catheter-related bloodstream infection

Recommendations for High-Risk Immunocompromised Adults

- Use **Figures 2a & 2b** to determine when blood cultures are indicated in **high-risk immunocompromised adults**. Note, this algorithm should be interpreted in the context of each individual patient's clinical scenario, and it does not substitute for clinical judgement.
    - **High-risk immunocompromised adults** may include but are not limited to patients with febrile neutropenia, recent solid organ transplant recipients (<6 months after transplant and/or treatment for acute rejection), hematopoietic stem cell transplant recipients before day + 180 and/or those with graft versus host disease (GVHD) on systemic immunosuppression (e.g. JAK inhibitor, tacrolimus, prednisone >20 mg/day), patients undergoing chimeric antigen receptor (CAR)-T cell therapy etc.

Figure 2a. Algorithm for Initial Blood Culture Recommendations in High-Risk Immunocompromised Adults
Adapted from *Fabre V, et al. Clin Infect Dis. 2020 Aug 22;71(5):1339-1347.*[1]

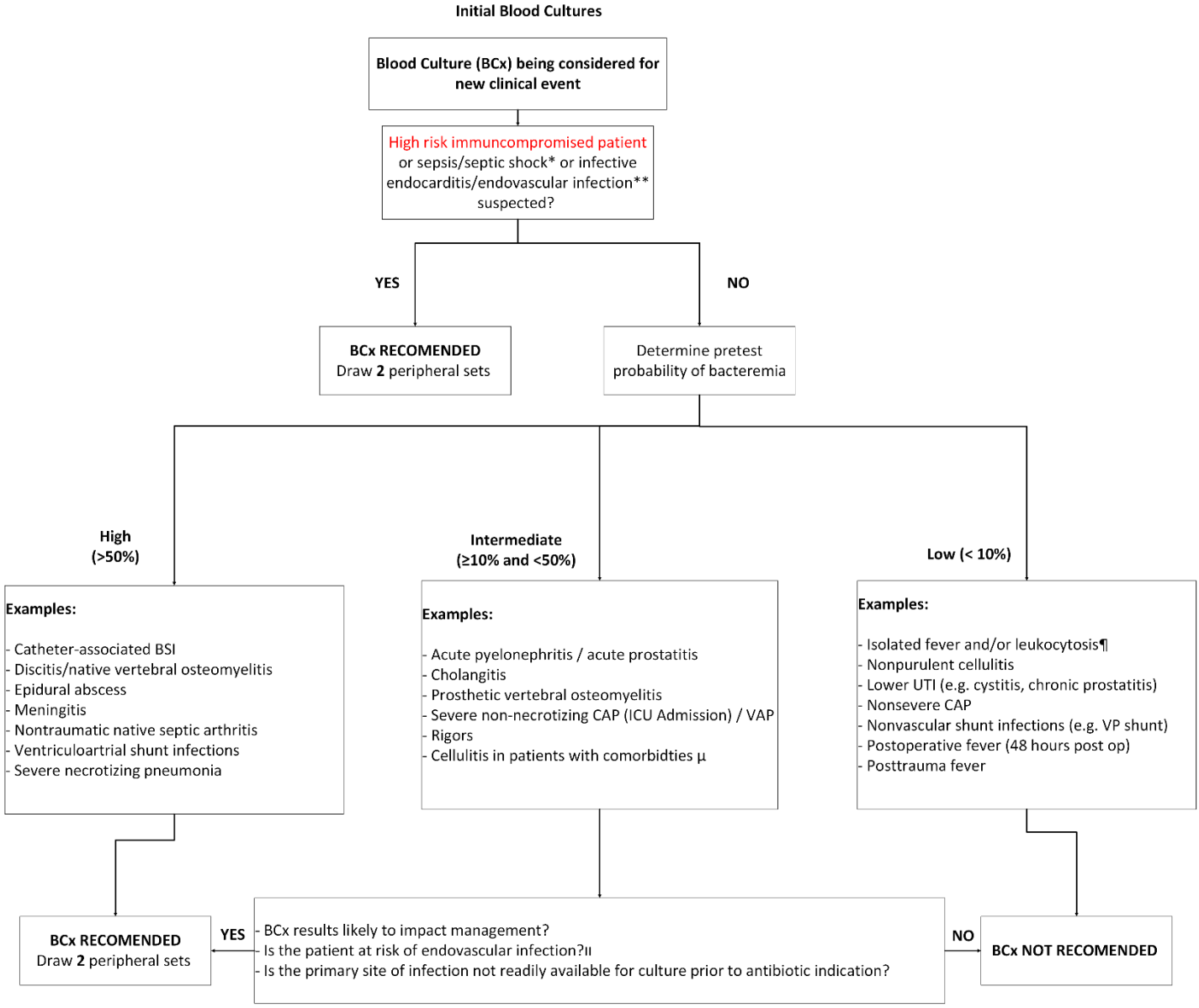
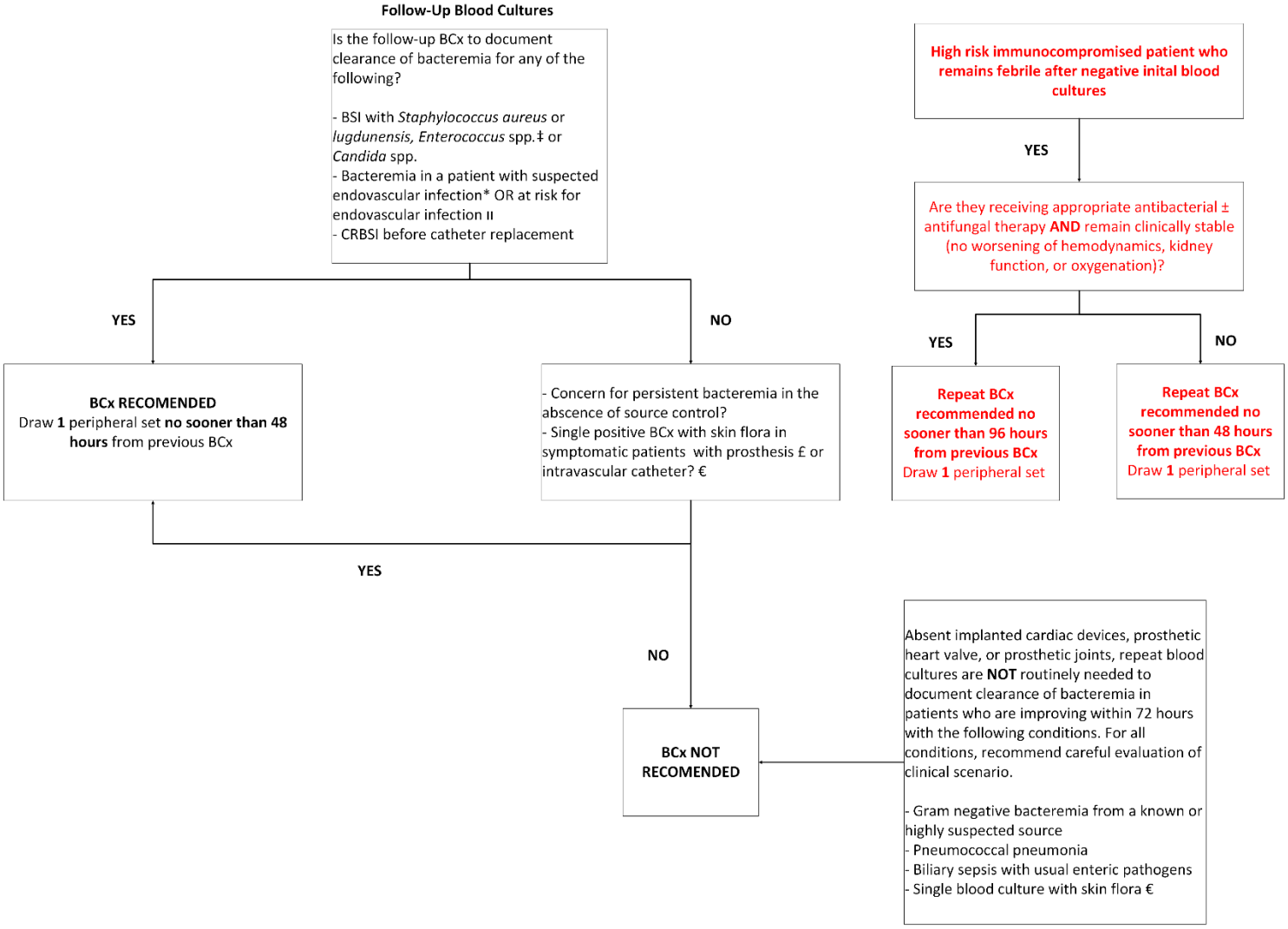


Figure 2b. Algorithm for Follow-up Blood Culture Recommendations in High-Risk Immunocompromised Adults
Adapted from *Fabre V, et al. Clin Infect Dis. 2020 Aug 22;71(5):1339-1347.*[1]



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Definitions: BSI = blood stream infection, CAP = community-acquired pneumonia, VAP = ventilator-associated pneumonia, UTI = urinary tract infection, spp. = species, CRBSI = catheter-related bloodstream infection

Recommendations for Non-Immunocompromised Pediatric Patients

- Use **Figures 3a & 3b** to determine when blood cultures are indicated in **non-immunocompromised pediatric patients**. Note, this algorithm should be interpreted in the context of each individual patient's clinical scenario, and it does not substitute for clinical judgement.

Figure 3a. Algorithm for Initial Blood Culture Recommendations in Non-Immunocompromised Pediatric Patients

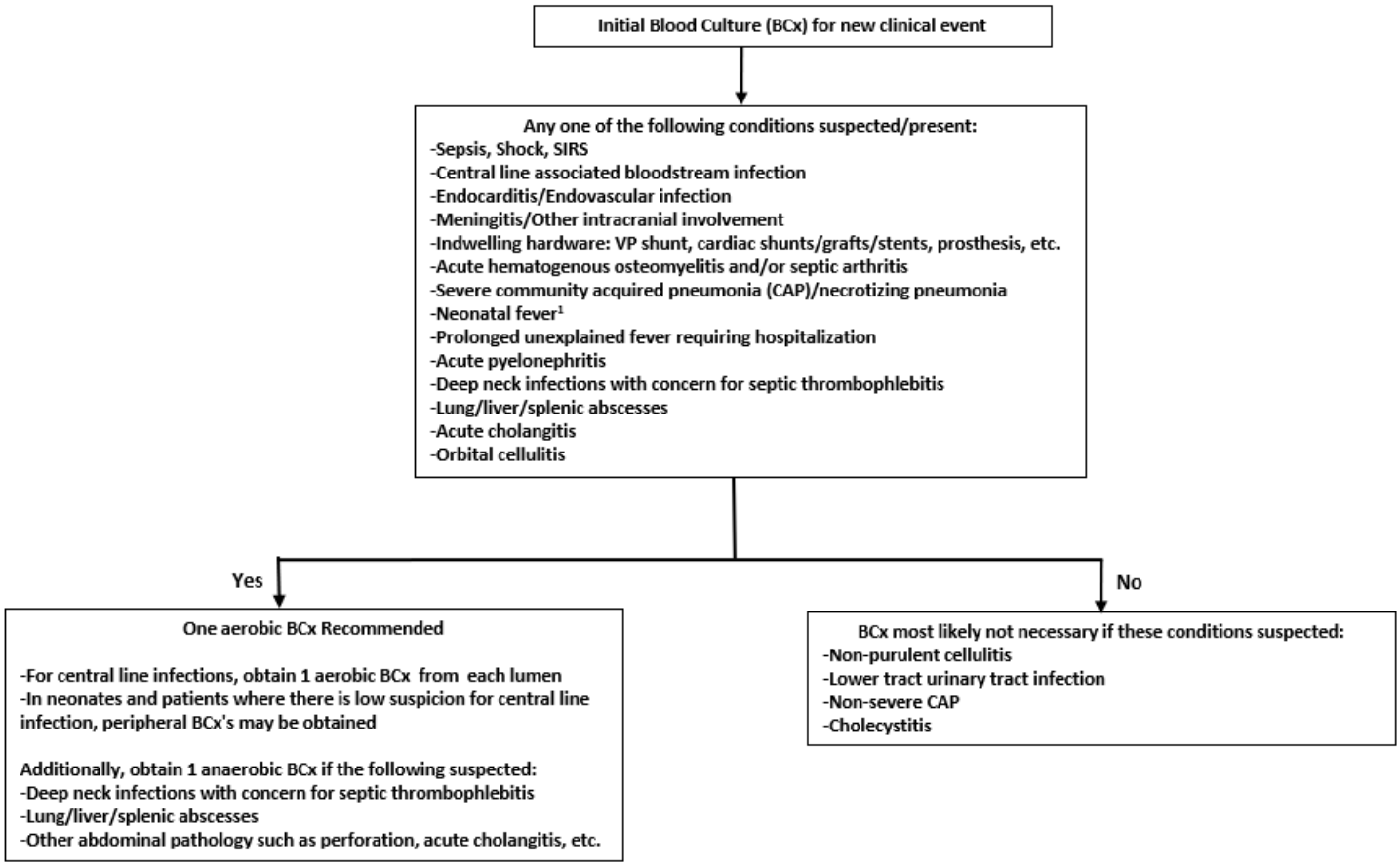

Figure 3b. Algorithm for Follow-up Blood Culture Recommendations in Non-Immunocompromised Pediatric Patients

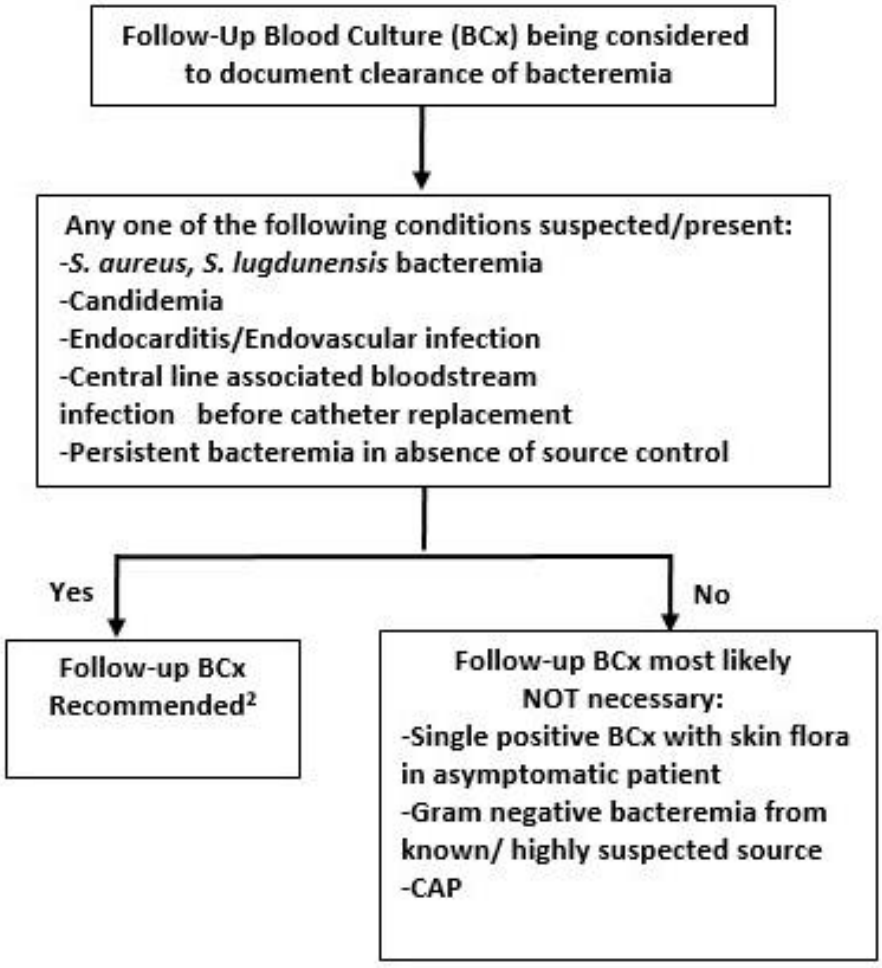

Figure Footnote

[1] Refer to practice guidelines for the evaluation and management of well-appearing febrile infants 8 to 60 days old: Pediatrics. 2021; 148(2):e2021052228.

[2] Follow-up BCx's:

-For central line associated infections, repeat 1 culture daily from central line until 2 consecutive negatives (each negative 48 hours), then stop. There is no need to obtain a BCx sooner than 24 hours after the initial positive BCx.

-For endocarditis concerns, it is reasonable to obtain a total of 3 blood cultures on the first day, and if there is no growth by the second day of incubation, to obtain 2 or 3 additional cultures.

-If neither central line associated infection nor endocarditis suspected, draw follow-up BCx no sooner than 48 hours after initial BCx

Recommendations for Immunocompromised Pediatric Patients

- Use **Figure 4** to determine when blood cultures are indicated in **immunocompromised pediatric patients**. Note, this algorithm should be interpreted in the context of each individual patient's clinical scenario, and it does not substitute for clinical judgement.
    - **Immunocompromised pediatric patients** may include but are not limited to patients with primary immunodeficiencies, febrile neutropenia, solid organ transplant recipients including those with acute rejection, hematopoietic stem cell transplant recipients including those with severe graft versus host disease (GVHD), patients undergoing chimeric antigen receptor (CAR)-T cell therapy etc.

Figure 4. Algorithm for Bacterial Blood Culture Recommendations in Immunocompromised Pediatric Patients

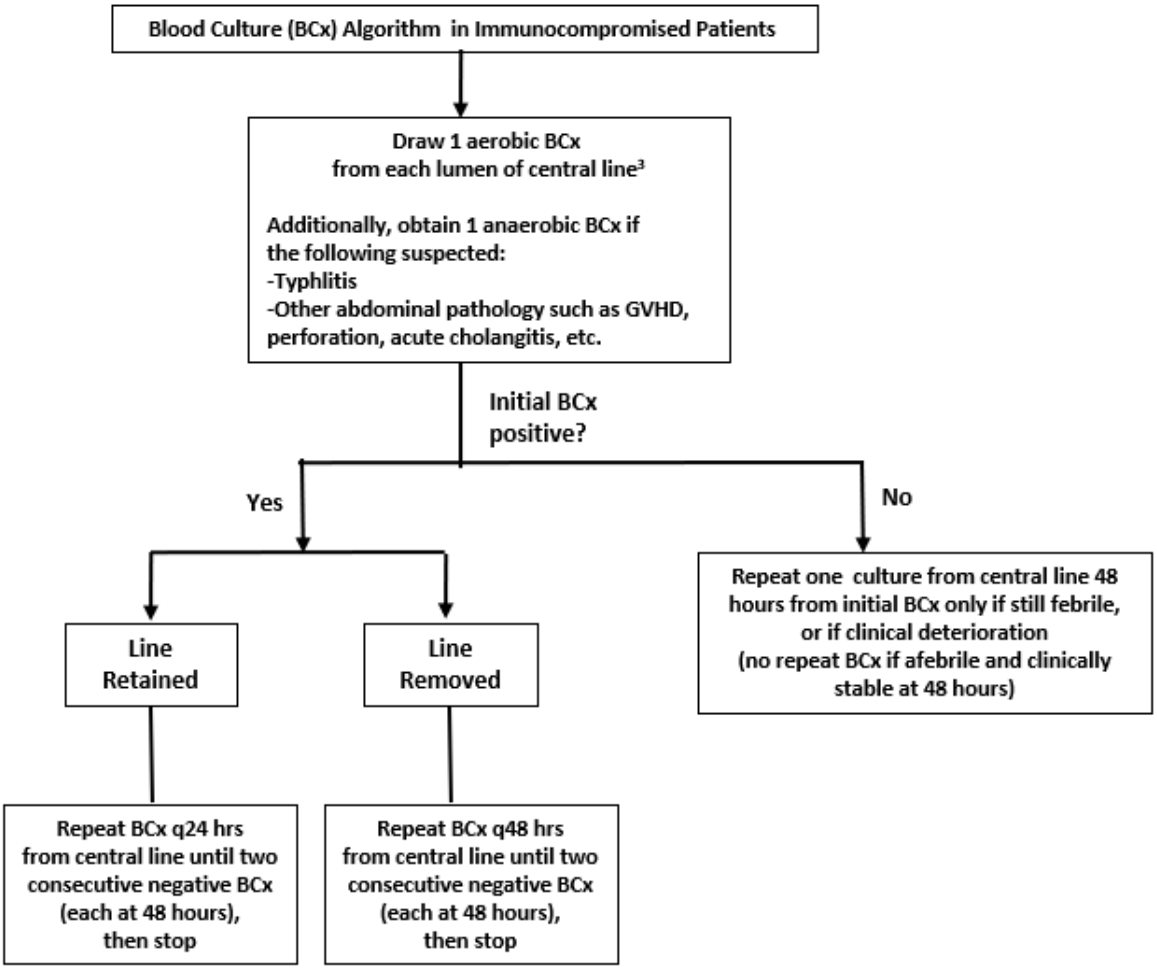

Figure Footnote

[3]In pediatric patients, it is acceptable to obtain blood through central line only (foregoing peripheral stick)

References

1. Fabre V, Sharara SL, Salinas AB, Carroll KC, Desai S, Cosgrove SE. Does This Patient Need Blood Cultures? A Scoping Review of Indications for Blood Cultures in Adult Nonneutropenic Inpatients. Clin Infect Dis. 2020 Aug 22;71(5):1339-1347. doi: 10.1093/cid/ciaa039. PMID: 31942949.
2. Doern GV, Carroll KC, Diekema DJ, Garey KW, Rupp ME, Weinstein MP, Sexton DJ. Practical Guidance for Clinical Microbiology Laboratories: A Comprehensive Update on the Problem of Blood Culture Contamination and a Discussion of Methods for Addressing the Problem. Clin Microbiol Rev. 2019 Oct 30;33(1):e00009-19. doi: 10.1128/CMR.00009-19. PMID: 31666280; PMCID: PMC6822992.
3. Pantell RH, Roberts KB, Adams WG, et al. Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old. *Pediatrics*. 2021 Aug;148(2):e2021052228. DOI: 10.1542/peds.2021-052228. PMID: 34281996
4. Baltimore RS, Gewitz M, Baddour LM, et al. Infective Endocarditis in Childhood: 2015 Update: A Scientific Statement From the American Heart Association. *Circulation*. 2015 Oct 13;132(15):1487-515. DOI: 10.1161/CIR.0000000000000298. PMID: 26373317