Northwestern Medicine Delnor Hospital
Antimicrobial Stewardship Update:
Biofire Blood Culture Result Interpretation

The Biofire Blood culture PCR panel has been in use in the microbiology lab since 11/17. It is automatically run on all positive blood cultures and does not require an additional order for testing. It allows for rapid identification of organisms growing in the blood. Studies have shown decreased time to narrow spectrum therapy, shorter hospital stays, and improved clinical outcomes when these results are used to tailor treatment. This is a list of organisms and antimicrobial resistance genes that can be detected:

Gram Positive Bacteria	**Gram Negative Bacteria**	**Yeast**
Enterococcus genus	*Acinetobacter baumannii*	*Candida albicans*
Listeria monocytogenes	***Enterobacteriaceae* family**	*Candida glabrata*
***Staphylococcus* genus**	*Enterobacter cloacae* complex	*Candida krusei*
Staphylococcus aureus	*Escherichia coli*	*Candida parapsilosis*
***Streptococcus* genus**	*Klebsiella oxytoca*	*Candida tropicalis*
Streptococcus agalactiae	*Klebsiefia pneumoniae*	
Streptococcus pneumoniae	*Proteus* spp	**Antimicrobial resistance genes**
Streptococcus pyogenes	*Serratia marcescens*	*mecA* — methicillin (nafcillin/oxacillin) resistance
	Haemophilus influenzae	*vanA/B* — vancomycin resistance
	Pseudomonas aeruginosa	KPC — carbapenem resistance
	Neisseria meningitidis	

- The Biofire panel takes about 75 minutes to run. The gram stain and the Biofire result will be phoned together if positive.

- Biofire results show up directly below the gram stain within the blood culture result. Examples of how results are reported in the computer:

  a. Staphylococcus species: detected
  Staph aureus: not detected

  b. Staph aureus: detected
  MRSA (mecA gene): detected

  c. Enterococcus: detected
  VRE (vanA/B gene): not detected

  d. E.coli: detected
  Carbapenemase gene: not detected

- If all organisms in the panel are "not detected", the members will be listed. For example:

  Gram = gram negative rods

  Biofire PCR result:
  Acinetobacter baumanii: not detected
  Enterobacter cloacae: not detected
  E.coli: not detected
  Klebsiella oxytoca: not detected
  Klebsiella pneumoniae: not detected
  Proteus: not detected
  Serratia marcescens: not detected
  Haemophilus influenza: not detected
  Pseudomonas aeruginosa: not detected
  Neisseria meningitides: not detected

- **Some of the limitations listed in the manufacturer's package insert**:

  a. In mixed cultures, the panel may not identify all detectable organisms.
  b. Antimicrobial resistance can occur via multiple mechanisms. A "not detected" result for the antimicrobial resistance genes does not indicate antimicrobial susceptibility. Sub-culturing and standard susceptibility testing of isolates is required.
  c. A negative result does not exclude the possibility of bloodstream infection. Negative test results may occur from sequence variants in the region targeted by the assay, the presence of inhibitors, or an infection caused by an organism not detected by the panel. Test results may be affected by concurrent antibacterial/antifungal therapy or levels of organism in the sample that are below the limit of detection.

- **General interpretation information:**

Caution should be used when interpreting results with multiple organisms reported. In bacteremias with a possible polymicrobial source, narrowing too much may result in undertreatment (e.g., keep anaerobic coverage on in complicated intra-abdominal infections).

Table 1 below provides recommendations for interpretation and empiric therapy based on local susceptibility patterns and the Northwestern Medicine Empiric Treatment Guidelines. When blood culture gram-stain and biofire results are known, current antimicrobial therapy should be evaluated in light of the clinical picture and adjusted to the most appropriate single agent if possible.

In addition, when full susceptibility results become available (usually in 24-72 hours), therapy should be reviewed and adjusted to the most appropriate narrow-spectrum agent.

Table 1: Biofire Results and Recommended Therapy

Use this table to select the most appropriate empiric therapy for treating a blood stream infection. Patients who responded to a narrow spectrum agent do not require escalation, even if this guideline recommends a broader spectrum, and can usually be safely continued on current therapy. Patients who have not clinically responded to initial therapy (persistent fever, lack of improvement, etc.) should have therapy adjusted to a more active regimen based on this guideline. Data on susceptibility for various pathogens was derived from the 2019 institutional antibiogram and included when available.

Pathogen/PCR Target	Result	Interpretation	Recommendation (% Susceptibility)
Staphylococcus *S.aureus* *mecA*	Detected Not detected Not detected	Methicillin-susceptible coagulase-negative *Staphylococcus*	Consider withholding treatment unless severely ill or more than one positive blood culture (nafcillin or cefazolin if treatment required)
Staphylococcus *S.aureus* *mecA*	Detected Not detected Detected	Methicillin-resistant coagulase-negative *Staphylococcus*	Consider withholding treatment unless severely ill or more than one positive blood culture (vancomycin if treatment required)
Staphylococcus *S.aureus* *mecA*	Detected Detected Not detected	Methicillin-susceptible S.aureus (MSSA)	Nafcillin (100%) or Cefazolin (100%)
Staphylococcus *S.aureus* *mecA*	Detected Detected Detected	Methicillin-resistant S.aureus (MRSA)	Vancomycin (100%)
Enterococcus genus *van A/B*	Detected Not detected	*Enterococcus* sp.	Ampicillin (98%) or Piperacillin/tazobactam (~98%) or vancomycin (100%) depending on clinical status and other coverage required
Enterococcus genus *van A/B*	Detected Detected	Vancomycin-resistant *Enterococcus* (VRE)	Linezolid or daptomycin pending further data
Streptococcus pyogenes (group A strep)	Detected		Penicillin G Ampicillin Cefazolin Vancomycin (severe pcn allergy)
Streptococcus agalactiae (Group B strep)	Detected		Penicillin G Ampicillin Cefazolin Vancomycin (severe pcn allergy)
Streptococcus pneumoniae	Detected		Pneumonia: Penicillin or ampicillin CNS infection: Ceftriaxone + vancomycin (d/c after susceptibilities return if susc to ctriax)

Streptococcus genus	Detected		Cefazolin or ceftriaxone (consider holding treatment if 1 of 2 blood cultures positive and patient not severely ill)
Enterobacteriaceae *E.coli*	Detected Detected	*E.coli**	Community onset: Cefazolin (90%) Risk of resistance: Ceftriaxone (98%)
Enterobacteriaceae *Klebsiella pneumoniae*	Detected Detected	*K.pneumoniae**	Community onset : Cefazolin (95%) Risk of resistance: Ceftriaxone (100%)
Enterobacteriaceae *Klebsiella oxytoca*	Detected Detected	*K.oxytoca**	Community onset or risk of resistance: Ceftriaxone (93%)
Enterobacteriaceae *Enterobacter cloacae*	Detected Detected	*E.cloacae**	Cefepime (93%) or TMP/SMX (93%)
Enterobacteriacea No other species detected	Detected	*Enterobacteriaceae* species not included in the panel	Zosyn or cefepime pending further data
Enterobacteriaceae *Any organism* *kpc* gene	Detected Detected	Indicates ESBL resistant to carbapenems	Consult ID
Haemophilus influenzae	Detected		Ceftriaxone
Listeria monocytogenes	Detected		Ampicillin or TMP/SMZ (beta-lactam allergy)
Neisseria meningitidis	Detected		Penicillin or ceftriaxone
Proteus sp.	Detected		Community onset: Cefazolin (92%) Risk of resistance: Ceftriaxone (100%)
Pseudomonas aeruginosa	Detected		Piperacillin/tazobactam (94%) +/- tobramycin (99%) Cefepime (88%) or Aztreonam (77%) in place of pip/tazo if allergy

*There is a small chance that both the specific pathogen and another *Enterobacteriaceae* which cannot be detected specifically by the Biofire test is present, but the therapies recommended should generally cover these pathogens as well.

**Adapted from Nebraska Medicine's "Recommendations Regarding Use of Rapid Blood Pathogen Identification Panel Data," updated in July 2017; accessed on 1/7/2020 at: https://www.nebraskamed.com/sites/default/files/documents/for-providers/asp/biofire-recs.pdf and Nebraska Medicine's "Misinterpretation of Results from Rapid Blood Culture Identification Panel" shared by authors in February 2018.