SHC RAPID BLOOD CULTURE IDENTIFICATION RESPONSE GUIDE

(v12.04.25)

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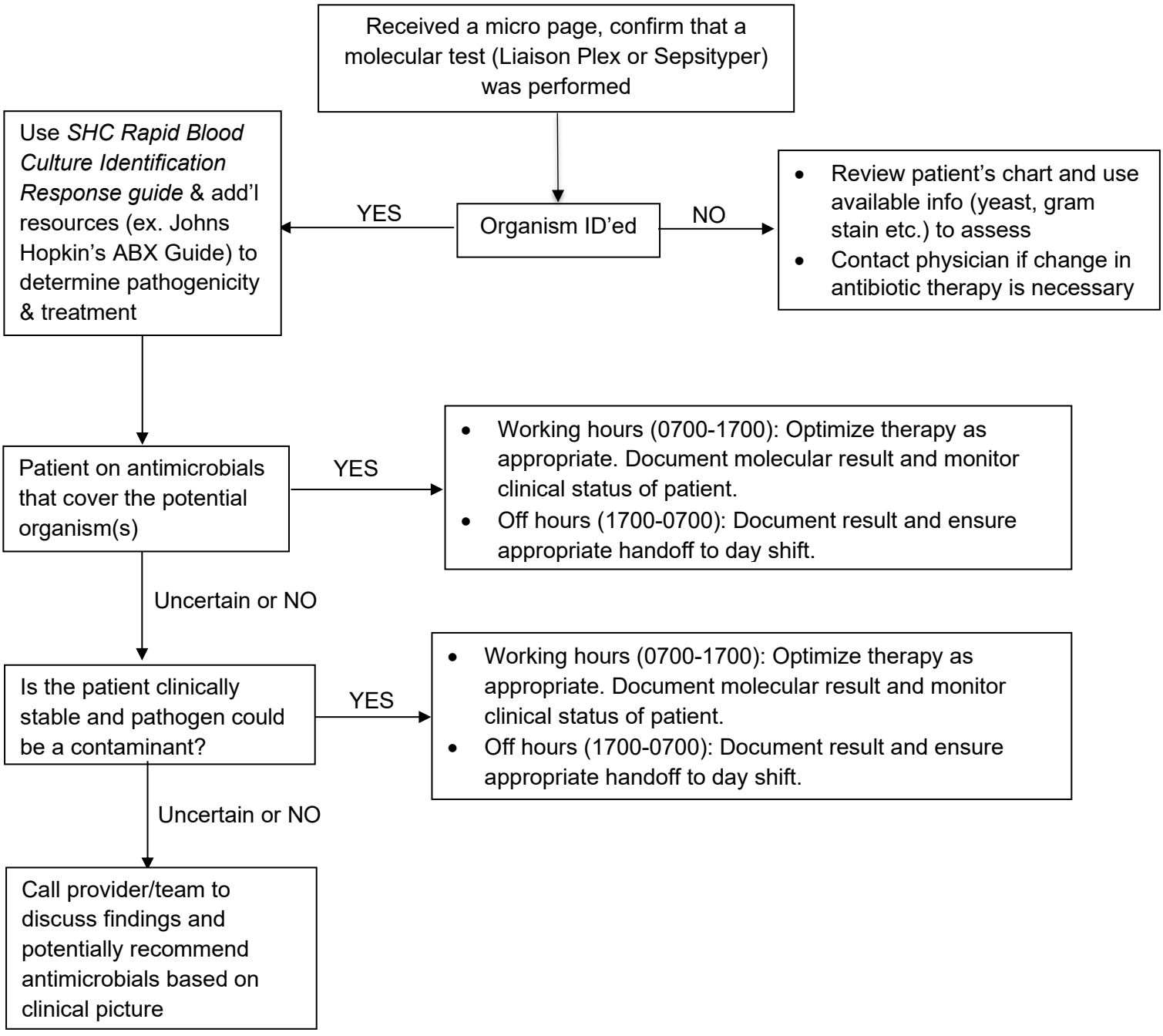
Blood Culture Documentation Requirements

- Decreased time to appropriate antibiotics
- Decreased hospital length of stay
- Decreased mortality
- Reduced costs

- **Definitions**
  - **Liaison Plex (formerly Verigene) BC-GP and BC-GN Platforms** provide direct from blood identification of organism and resistance marker targets listed in table 1 below within 2.5-3 hours from culture positivity
  - **Bruker Sepsityper** provides direct from blood organism identification via MALDI-ToF (mass spectrometry) within 30-90 min. The organism library includes >450 species. Platform lacks resistance marker detection. Gram negative organisms not identified by Liaison Plex will reflex to Sepsityper for identification (ID).
- Micro (Copley) will provide the organism and presence of resistance markers if applicable
  - Results will read: “Molecular testing indicates [ORGANISM NAME]”;
  - Testing is only done for one set of blood cultures with the same gram-stain morphology.
  - No ID = target is not included on the panel and Liaison Plex result will read “Organism present but not identified by molecular testing. Additional testing to follow.”
- Expectation is that pharmacy will respond to pages within 15-30 min; this is required for closed loop communication as it is considered a critical result; After two attempts, micro will contact the Main Pharmacy for the respective hospital.

Communication of Blood Culture and Liaison Plex Results **(see link)** (SHL Copley Micro #: 858-262-6900)

SHC Pharmacist Blood Culture Workflow



LIAISON PLEX BLOOD CULTURE – GRAM POSITIVE PLATFORM

Genus	*Staphylococci*	*Streptococci*	*Enterococci*	*Bacillus*	*Listeria*
Species	*S. aureus* *S. epidermidis* *S. lugdunensis* Staphylococcus spp (e..g other CONS)	*S. anginosus* Group *S. agalactiae* (GBS) *S. pneumoniae* *S. pyogenes* (GAS) Streptococcus spp.	*E. faecalis* *E. faecium*	*Bacillus spp*	*L. monocytogenes*
Resistance	Mec A/Mec C (confers methicillin resistance)		Van A/B (confers vancomycin resistance)		

The following recommendations are for EMPIRIC treatment only. Susceptibilities should drive definitive therapy

LIAISON PLEX ACTION TABLE – GRAM POSITIVE

Dosing: Ensure a loading dose has been given; Refer to Dosing Guidelines on SharpNet and err on the side of maximum tolerable doses

Genus	Species	Resistance	DOC	Alternative	Comments
Staphylococcus	*S. aureus*	- MecA/C (MSSA)	Cefazolin or Nafcillin	Daptomycin	***Should never be considered a contaminant*** • Mortality: 15-20% (heart valve involvement in 25% of cases) • Vancomycin is INFERIOR for MSSA bacteremia • **For MSSA:** BL/BLI, also have activity and may be used empirically if concern for polymicrobial source • **For MRSA:** Vanco AUC/MIC Goal: 500-600 • Check levels within the first 24-48 hours to ensure therapeutic (early target attainment = better outcomes) • Do not use Daptomycin if pulmonary source suspected • Avoid linezolid
	S. aureus	+ MecA/C (MRSA)	Vancomycin	Daptomycin Ceftaroline	
	S. epidermidis	+ MecA/C (MRSE)	Vancomycin	Daptomycin	• Commonly a contaminant (if only 1 of 2 blood culture sets) • Concern for nosocomial pathogen when foreign bodies and biofilm is present (i.e. plastic or metal) ○ Most often due to IV lines, artificial valves, joints, pacemakers, CNS shunts, etc. • Recommend repeat blood cultures prior to treatment if vanco is indicated • Vancomycin AUC 400-600 and trough ≥10 mg/dL
	S. epidermidis	- MecA/C (MSSE)	Vancomycin	Daptomycin	• Commonly a contaminant (see row above) • Liaison Plex has lower sensitivity for detection of mecA+ in S epi and the majority of isolates are mecA+ so wait to de-escalate until final susceptibilities are available
	S. lugdunensis		Vancomycin	Daptomycin	**Usually not a contaminant;** Majority are susceptible to cefazolin • More virulent than other CoNS; may cause abscess or endocarditis like *S. aureus* • 2nd leading cause of CoNS endocarditis
	Staphylococcus spp. (other CoNS)		Vancomycin	Daptomycin	• Represents another type of CoNS • Commonly a contaminant. See S. epidermidis above • Target vanco AUC 400-600 and trough ≥10 mg/dL
Streptococcus	*S. anginosus* Group		Ampicillin Cefazolin	Ceftriaxone Vancomycin	• Subgroup of *Streptococcus viridans* • Includes: *S. intermedius, S. anginosus, S. constellatus (previously S. milleri)* • Associated with head & neck infections, IAI, abscess
	S. pyogenes (GAS)		Ampicillin Cefazolin	Ceftriaxone Vancomycin	**ALL strains are universally susceptible to PCN** • Associated with pharyngitis, cellulitis, and rare but devastating toxic shock syndrome or necrotizing fasciitis • Virulence dependent on toxin production • **If severely ill, SIRS, shock, or cellulitis/necrotizing fasciitis → Recommend linezolid or clindamycin (for toxin inhibition), IVIG (for toxin neutralization in necrotizing fasciitis or toxic shock only) +/- ID consult**
	S. agalactiae (GBS)		Ampicillin Cefazolin	Ceftriaxone Vancomycin	**ALL strains are universally susceptible to PCN** • Commonly found in GI/GU tracts or skin • Associated with neonatal sepsis and cellulitis in elderly and younger non-pregnant patients • Can be primary bacteremia (aka without a source) in elderly patients • Clindamycin resistance increasing

	S. pneumoniae		Ceftriaxone	Vancomycin	• Associated with PNA, meningitis • If treating meningitis: combination with vancomycin for double coverage
	Strep spp.		Ceftriaxone	Vancomycin	• Other type of Strep (from what is listed above) • Certain Strep (e.g. Strep viridans e.g. mitis/oralis) in 1 set only could represent contamination
Enterococcus	*E. faecalis*	- Van A/B	Ampicillin	Vancomycin	**98-100% ampicillin susceptible at SHC** • Associated with IAI, catheter-related infection, UTI • *E. gallinarum* and *E. casseliflavus* (neither identified via Liaison Plex) are intrinsically resistant to vancomycin but susceptible to ampicillin
		+ Van A/B (VRE)	Ampicillin	Daptomycin Linezolid	
	E. faecium	- Van A/B	Vancomycin	Daptomycin Linezolid	< 50% ampicillin susceptible at SHC • Associated with IAI, catheter-related infection, urosepsis • VRE: high-dose daptomycin (10 mg/kg) • Daptomycin (cidal) preferred over linezolid (static)
		+ Van A/B (VRE)	Daptomycin	Linezolid	
Bacillus	*Bacillus spp.*		Vancomycin	Daptomycin	• Commonly a contaminant (if only 1 of 2 sets) • Concern for nosocomial pathogen when foreign bodies and biofilm is present (i.e. plastic or metal) or immunocompromised
Listeria	*L. monocytogenes*		Ampicillin	SMX/TMP Meropenem	• GI source or meningitis in immunocompromised patients and age > 50

BC-GN PLATFORM

NOTE: Gram-Negative target Interpretation: Below is how the panel reports out family, genus and species targets. Example: *Serratia marcescens* will be reported as positive for the Enterobacteriaceae/Morganellaceae family as well as the *Serratia marcescens* species. *Stenotrophomonas maltophilia* would be reported out as a species by itself.

Detected Organism	Reported Targets			
	Family	Genus [a, b]	Species [a]	Resistance Marker [c, d, e]
Genera and Species				
Citrobacter spp.	*Enterobacteriaceae / Morganellaceae*	*Citrobacter* spp.	-	-
Enterobacter spp.	*Enterobacteriaceae / Morganellaceae*	*Enterobacter* spp. [f]	-	-
Proteus spp.	*Enterobacteriaceae / Morganellaceae*	*Proteus* spp.	-	-
Salmonella spp.	*Enterobacteriaceae / Morganellaceae*	*Salmonella* spp.	-	-
Escherichia coli	*Enterobacteriaceae / Morganellaceae*	-	*Escherichia coli* [g]	-
Klebsiella oxytoca	*Enterobacteriaceae / Morganellaceae*	-	*Klebsiella oxytoca*	-
Klebsiella pneumoniae	*Enterobacteriaceae / Morganellaceae*	-	*Klebsiella pneumoniae*	-
Klebsiella variicola	*Enterobacteriaceae / Morganellaceae*	-	*Klebsiella variicola*	-
Morganella morganii	*Enterobacteriaceae / Morganellaceae*	-	*Morganella morganii*	-
Serratia marcescens	*Enterobacteriaceae / Morganellaceae*	-	*Serratia marcescens*	-
Acinetobacter spp.	-	*Acinetobacter* spp.	-	-
Acinetobacter baumannii	-	*Acinetobacter* spp.	*Acinetobacter baumannii*	-
Pseudomonas spp.	-	*Pseudomonas* spp.	-	-
Pseudomonas aeruginosa	-	*Pseudomonas* spp.	*Pseudomonas aeruginosa*	-
Haemophilus influenzae	-	-	*Haemophilus influenzae*	-
Neisseria meningitidis	-	-	*Neisseria meningitidis*	-
Stenotrophomonas maltophilia	-	-	*Stenotrophomonas maltophilia*	-
	Enterobacteriaceae / Morganellaceae [h]	-	-	-

Liason PLEX Gram-Negative Blood Culture Assay (Preliminary result)

	Value	Range
Acinetobacter baumannii	Not Detected	Not Detected
Acinetobacter species	Not Detected	Not Detected
Citrobacter species	Not Detected	Not Detected
Enterobacteriaceae/Morganellaceae	**Positive (A)**	Not Detected
Enterobacter species	Not Detected	Not Detected
Escherichia coli	Not Detected	Not Detected
Haemophilus influenzae	Not Detected	Not Detected
Klebsiella oxytoca	Not Detected	Not Detected
Klebsiella pneumoniae	Not Detected	Not Detected
Klebsiella variicola	Not Detected	Not Detected
Morganella morganii	Not Detected	Not Detected
Neisseria meningitidis	Not Detected	Not Detected
Proteus species	Not Detected	Not Detected
Pseudomonas aeruginosa	Not Detected	Not Detected
Pseudomonas species	Not Detected	Not Detected
Salmonella species	Not Detected	Not Detected
Serratia marcescens	**Positive (A)**	Not Detected
Stenotrophomonas maltophilia	Not Detected	Not Detected

Gram-Negative Resistance Markers [c, d, e]		
CTX-M	Any *Citrobacter* spp., *Enterobacter* spp., *Enterobacteriaceae/Morganellaceae*, *E. coli*, *K. oxytoca*, *K. pneumoniae*, *K. variicola*, *M. morganii*, *Proteus* spp., *Salmonella* spp., *S. marcescens*, *Acinetobacter* spp., *Pseudomonas* spp., *S. maltophilia*	CTX-M
IMP		IMP
NDM		NDM
VIM		VIM
KPC	Any *Citrobacter* spp., *Enterobacter* spp., *Enterobacteriaceae/Morganellaceae*, *E. coli*, *K. oxytoca*, *K. pneumoniae*, *K. variicola*, *M. morganii*, *Proteus* spp., *Salmonella* spp., *S. marcescens*, *Acinetobacter* spp., *Pseudomonas* spp.	KPC
OXA		OXA
MCR	Any *Citrobacter* spp., *Enterobacter* spp., *Enterobacteriaceae/Morganellaceae*, *E. coli*, *K. oxytoca*, *K. pneumoniae*, *K. variicola*, *M. morganii*, *Proteus* spp., *Salmonella* spp., *S. marcescens*, *Pseudomonas* spp.	MCR
SME	*Serratia marcescens*	SME

LIAISON PLEX ACTION TABLE - GRAM NEGATIVE

"**No resistance markers detected**" refers to the broad-spectrum resistance markers listed above. Resistance can arise via other mechanisms (e.g. AMP-C or non-beta lactamase mechanisms)

***DISCLAIMER*: AMP-C is NOT detected by Liaison Plex**

Dosing: Ensure a loading dose has been given; Refer to Dosing Guidelines on SharpNet and err on the side of maximum tolerable doses

Genus/ Species	Resistance	DOC	Alternative	Comments
Acinetobacter species (non-baumannii)		Amp-Sulbactam or Ceftriaxone	Cefepime Pip/tazo	• Non-baumannii species are usually susceptible to recommended beta-lactams if no resistance marker reported
	+ OXA	Sulbactam-durlobactam + meropenem	Contact ID on call	• OXA resistance marker confers carbapenem resistance but studies show possible synergy
Acinetobacter baumannii		If not in ICU: Amp-Sulbactam (18g) + minocycline	Meropenem + minocycline	
	+ OXA or Septic Shock	Sulbactam-durlobactam + meropenem	Contact ID on call	• Resistance is common and multifactorial • OXA resistance marker confers carbapenem resistance but studies show possible synergy
Citrobacter species *Enterobacter* species		Cefepime	Erta/Mero Levofloxacin	• Liaison Plex does not differentiate between *C.koseri* (more susceptible) and *C. freundii* (potentially harbors amp-C) • *C. freundii* and Enterobacter spp.** can produce inducible **AmpC beta-lactamase** (NOT DETECTED BY LIAISON PLEX) ○ Amp-C producing organisms are resistant to ALL PCN & cephalosporins EXCEPT Cefepime, Carbapenems ****Note**: *E. aerogenes* has been renamed *K. aerogenes* but Liaison Plex will still be reported as Enterobacter spp. and it should be treated as Enterobacter
Enterobacteriaceae /Morganellaceae		Cefepime	Pip/tazo or Erta if h/o ESBL/MDRO	• This includes members of the Enterobacteriaceae and Morganellaceae family (Morganella, Proteus, Providencia) that do NOT otherwise have targets on the panel (e.g. Proteus should also be identified by Proteus spp target whereas Providencia, Shigella or Yersinia may fall under this target).
E. coli *K. pneumoniae* & *K. oxytoca* *K. variicola*		Ceftriaxone	Cefepime Zosyn	○ Note: Caution empiric de-escalation in the absence of CTX-M if patient has a recent history of ESBL
	+ CTX-M (ESBL)	Ertapenem	Meropenem	

P. mirabilis	+ KPC (carbapenemase)	Ceftazidime/avibactam	Imi/relebactam Mero/vabor-bactam	
	Other Carbapenemases: NDM, VIM, IMP, OXA	CONTACT ID/ASP STAT Aztreonam/avibactam Cefiderocol		
Haemophilus influenzae		Ceftriaxone	Amp/sulbactam	
Morganella morganii		Cefepime	Pip/Tazo, Ertapenem if h/o ESBL/MDRO	
Neisseria meningitidis		Ceftriaxone	Cefepime	• Utilize higher dosing if there is a concern for CNS involvement
P. aeruginosa vs other Pseudomonas spp.		Cefepime Zosyn	Meropenem, Ceftolozane/ tazobactam	• Multifactorial resistance, review prior culture history as well as recent antibiotic exposure • Quinolones do not provide reliable empiric coverage
	+ OXA	Ceftolozane/ tazobactam	Ceftazidime/ avibactam	
Salmonella spp.		Ceftriaxone	Ciprofloxacin	
Serratia marcescens		Cefepime	Pip/Tazo, Ertapenem if h/o ESBL/MDRO	
	+ SME	Ceftazidime/ avibactam	Cefiderocol	
Stenotrophomonas maltophilia		SMX/TMP+ minocycline	Aztreonam-Avibactam +/- mino or SMX-TMP if ICU	

Resistance Mechanism	Organism	DOC	Alternative	Comments
CTX-M (ESBL)	Enterobacterales	Ertapenem	Meropenem	Use meropenem for mixed infections or in the setting of albumin <2.5 or septic shock given the better PK/PD exposures
KPC (CRE)	Predominantly Enterobacterales	Ceftazidime/ avibactam	Imi/relebactam	
SME (CRE)	Predominantly Enterobacterales	Ceftazidime/ avibactam	Cefiderocol	Carbapenemase mostly produced by Serratia marcescens → suspect CRE
NDM, VIM, IMP (MBLs)	Predominantly Enterobacterales	Aztreonam-avibactam and call ID	Cefiderocol and call ID	
OXA	Acinetobacter, Pseudomonas	See prior section in table, Call ID	n/a	
MCR				Mobilized Colistin Resistance: Presence infers resistance to colistin, making organism usually highly resistance. Does not automatically infer other resistance mechanisms

Blood culture contamination is defined as one of two blood cultures sets with the following organisms:

- Coagulase negative Staphylococcus spp other than *S. lugdunensis*
- Viridans *Streptococcus*
- Micrococcus species
- Corynebacterium species
- Peptostreptococcus species
- Cutibacterium (previously Propionibacterium) species
- Saprophytic Neisseria
- Bacillus species
- Paenibacillus species(GS variable - GNR or GPR)

Other considerations for deeming blood culture results to be contaminants versus pathogens:

- Slow-growing gram-positive organisms are likely a contaminant (e.g., GPR) unless the host is immunocompromised
- Consider risk factors (e.g., central line, dialysis catheter or hardware) that will increase the likelihood of the organism being a pathogen

Sepsityper - No ID on Liaison Plex = Most Common Other Negative Organisms

SHC Blood Culture Recommendations			
Genus/Species	**Empiric DOC**	**Alternative**	**Comments**
No molecular ID			
No molecular ID or "No targets detected" for either GNR and/or GPC	Empiric treatment based on likely pathogens given clinical picture SHC Infectious Disease Therapeutic Guidelines: Pneumonia guidelines SSTI guidelines UTI guidelines Intra-abdominal guidelines Gastroenteritis guidelines Sepsis empiric guidelines		
GNR in ONLY in anaerobic bottles after 24h-48h	Add metronidazole if not already on anaerobic coverage	Consider combination BL-BLIs that have anaerobic coverage (e.g. piperacillin/tazobactam)	Evaluate clinical picture and potential source(s) of infection: Anaerobic GNR will only grow in anaerobic bottles, but aerobic GNR can also grow in anaerobic bottles. In addition, anaerobic GNR has slow growth, thus early preliminary growth (<24-48h) of GNR in anaerobic bottles may be from an aerobic GNR.
Gram Negative Rods			
Aeromonas hydrophila	Ceftriaxone	Cefepime, Levofloxacin	Patients may have GI symptoms (e.g. abdominal pain, nausea, vomiting and diarrhea)
Bacteroides species (GNR, anaerobe)	Add metronidazole if not already on anaerobic coverage	Consider combination BL-BLIs that have anaerobic coverage (e.g. piperacillin/tazobactam)	
Fusobacterium nucleatum (GNR, anaerobe)	Ampicillin/sulbactam	Metronidazole +/- Ceftriaxone	Often part of polymicrobial infection, hence the need for other Gram-negative coverage
Moraxella catarrhalis (GNR)	Ceftriaxone	Ampicillin/Sulbactam, Cefepime Levofloxacin	
Providencia species (GNR)	Cefepime	Piperacillin/Tazobactam Ertapenem if h/o ESBL/MDRO	
Prevotella buccae (GNR, anaerobe)	Ampicillin/sulbactam	Metronidazole +/- Ceftriaxone	Often part of polymicrobial infection, hence the need for other Gram-negative coverage

Veillonella parvula (GN rod/cocci, anaerobe)	Ampicillin/Sulbactam	Metronidazole +/- Ceftriaxone	May be a contaminant. Usually resistant to vancomycin

LIAISON PLEX ACTION TABLE - YEAST (should never be considered a contaminant)

Genus	Empiric Drug of Choice	Comments
Candida albicans	Fluconazole	
Candida auris	Micafungin with de-escalation based on susceptibility results	CONTACT ID/ASP Note: must use 150mg dose
Candida dubliniensis		
Candida famata		
Candida glabrata		Susceptible dose dependent to fluconazole
Candida guilliermondii		
Candida kefyr		
Candida krusei		Intrinsic resistance to fluconazole
Candida lipolytica		
Candida lusitaniae		Intrinsic resistance to amphotericin B
Candida parapsilosis		Higher micafungin MICs relative to fluconazole but comparable clinical outcomes
Candida tropicalis		
Candida haemulonii/duobushaemulonii		Related to C auris, often multi-drug resistant
Cryptococcus neoformans/gattii	Amphotericin + flucytosine	CONTACT ID/ASP

Liaison PLEX/Sepsityper DOCUMENTATION requirements: Refer to site-specific requirements