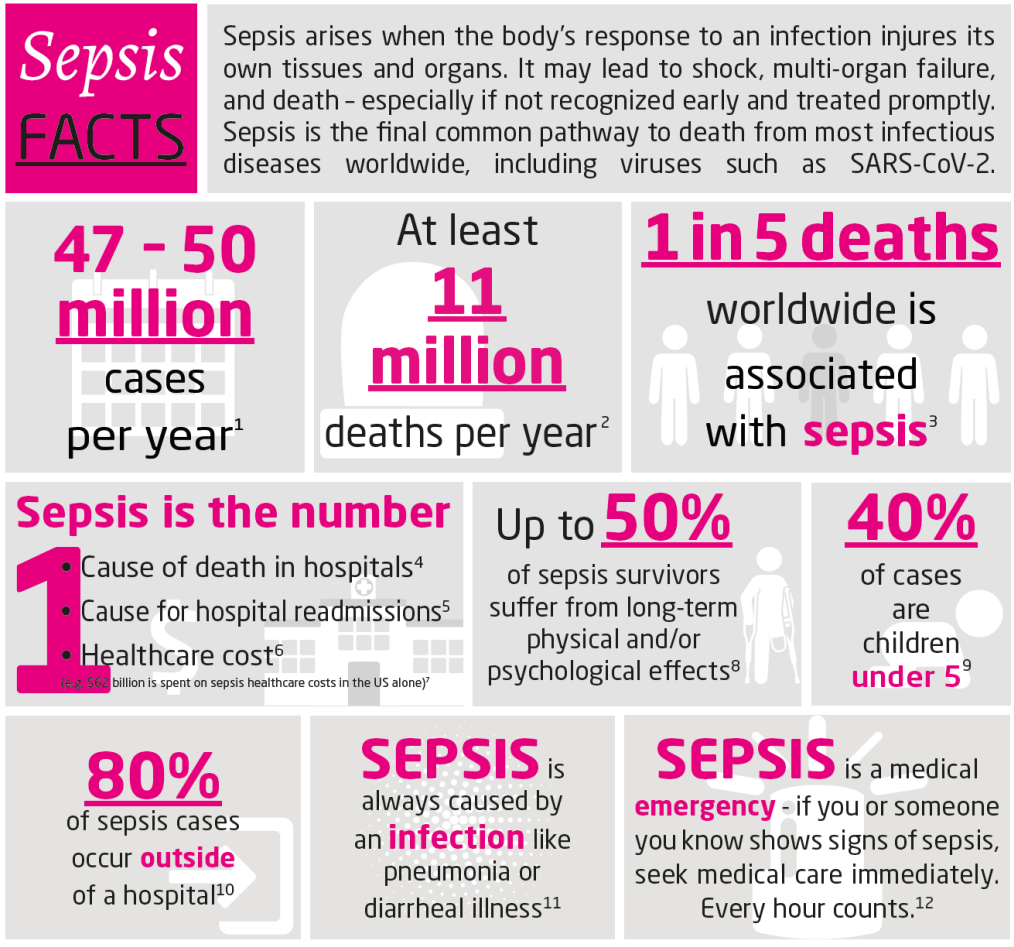
Rapid Antimicrobial Susceptibility Testing System for Blood and Body Fluid Cultures

ICD-10 C&M Meeting

March 7, 2023

Sepsis is a Global Health Threat



Toolkits — World Sepsis Day – 2022

References

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4 Rhee et al, https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2724768
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6 Torio et al, https://www.hcup-us.ahrq.gov/reports/statbriefs/sb204-Most-Expensive-Hospital-Conditions.pdf
7 Buchman et al, https://doi.org/10.1097/CCM.0000000000004224
8 Mostel et al, https://doi.org/10.1186/s10020-019-0132-z
10 Rhee et al, https://jamanetwork.com/journals/jama/fullarticle/2654187
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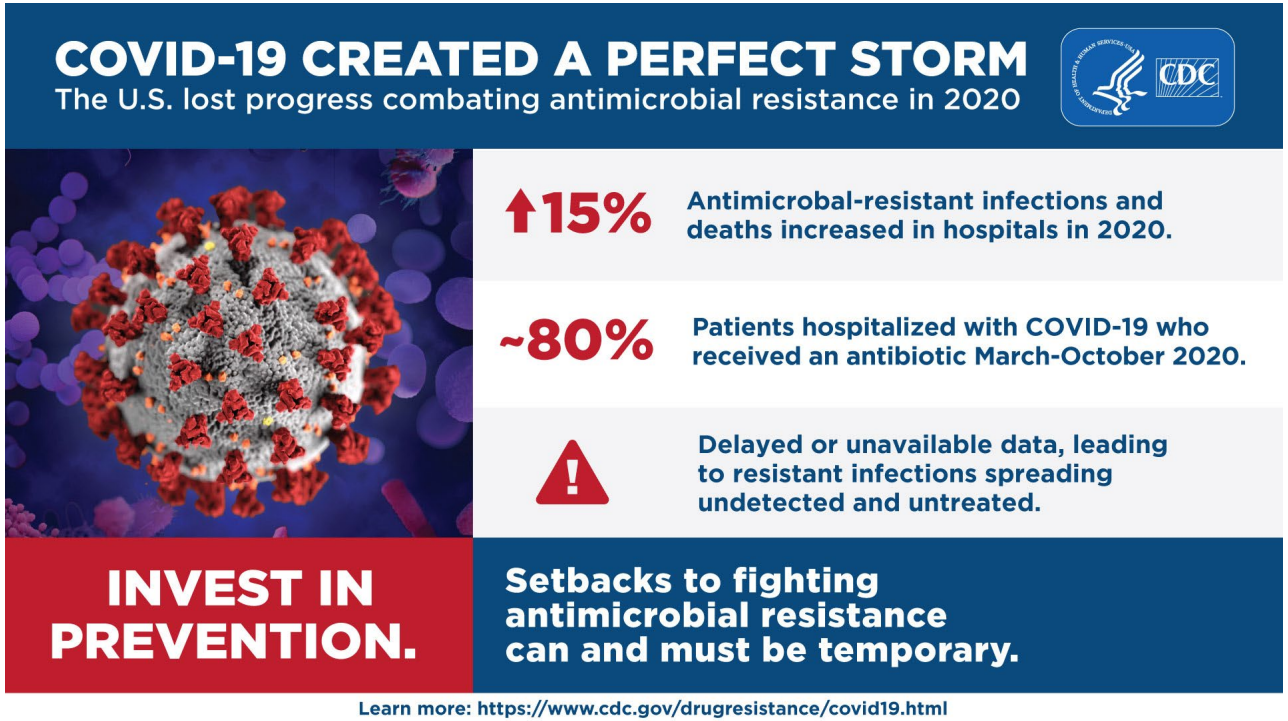
Emerging Challenge of Antimicrobial Resistance



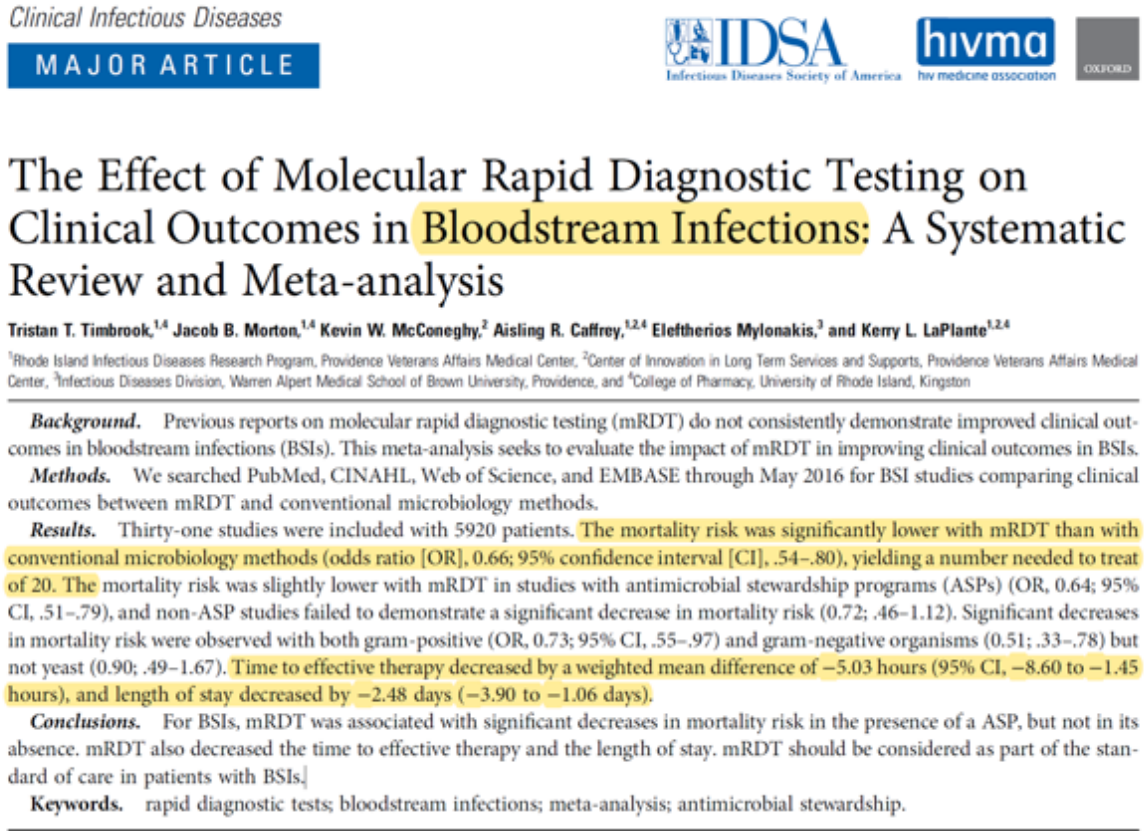
6 of the 18 most alarming antimicrobial resistance threats cost the US more than $4.6 billion annually

- Vancomycin-resistant Enterococcus (VRE)
- Carbapenem-resistant Acinetobacter species
- Methicillin-resistant Staphylococcus aureus (MRSA)
- Carbapenem-resistant Enterobacterales (CRE)
- Multidrug-resistant (MDR) Pseudomonas aeruginosa
- Extended-spectrum cephalosporin resistance in Enterobacterales suggestive of extended-spectrum ß-lactamase (ESBL) production

https://www.cdc.gov/drugresistance/covid19.html
https://www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf

8. American Hospital Association (2022). *AHA annual survey database*. Retrieved from http://www.ahadata.com/

Value of Rapid Diagnostic Testing in Bloodstream Infections is Well Established



Clinical Infectious Diseases

MAJOR ARTICLE

IDSA Infectious Diseases Society of America | hivma hiv medicine association | OXFORD

The Effect of Molecular Rapid Diagnostic Testing on Clinical Outcomes in Bloodstream Infections: A Systematic Review and Meta-analysis

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Background. Previous reports on molecular rapid diagnostic testing (mRDT) do not consistently demonstrate improved clinical outcomes in bloodstream infections (BSIs). This meta-analysis seeks to evaluate the impact of mRDT in improving clinical outcomes in BSIs.

Methods. We searched PubMed, CINAHL, Web of Science, and EMBASE through May 2016 for BSI studies comparing clinical outcomes between mRDT and conventional microbiology methods.

Results. Thirty-one studies were included with 5920 patients. The mortality risk was significantly lower with mRDT than with conventional microbiology methods (odds ratio [OR], 0.66; 95% confidence interval [CI], .54–.80), yielding a number needed to treat of 20. The mortality risk was slightly lower with mRDT in studies with antimicrobial stewardship programs (ASPs) (OR, 0.64; 95% CI, .51–.79), and non-ASP studies failed to demonstrate a significant decrease in mortality risk (0.72; .46–1.12). Significant decreases in mortality risk were observed with both gram-positive (OR, 0.73; 95% CI, .55–.97) and gram-negative organisms (0.51; .33–.78) but not yeast (0.90; .49–1.67). Time to effective therapy decreased by a weighted mean difference of −5.03 hours (95% CI, −8.60 to −1.45 hours), and length of stay decreased by −2.48 days (−3.90 to −1.06 days).

Conclusions. For BSIs, mRDT was associated with significant decreases in mortality risk in the presence of a ASP, but not in its absence. mRDT also decreased the time to effective therapy and the length of stay. mRDT should be considered as part of the standard of care in patients with BSIs.

Keywords. rapid diagnostic tests; bloodstream infections; meta-analysis; antimicrobial stewardship.

Molecular Diagnostic Limitations

- Until now, Rapid Diagnostic Testing has been primarily limited to Molecular Identification and Genotypic Resistance testing
- For gram-negative bacteremia, phenotypic susceptibility is critical due to myriad mechanisms of resistance
- Selux provides this mechanism agnostic, rapid phenotypic option

Overview of Selux Rapid AST Technology

Redefining Speed

- Same shift AST results in ~5.5 hours
- Assays to determine true MIC value without waiting for organism death
- AST with gram type only – Selux can run AST without organism ID
- Optimizes workflow and time to result

Comprehensive Panels with Accurate Results

- 384-well plate to test all clinically relevant antibiotics in parallel
- Capacity to expand as new antibiotics become available
- Reduction in reflex testing
- Updated breakpoints for accurate results & broad dilution series for future updates

Sample Types

- Isolated colonies
- Positive blood cultures

Selux Rapid AST Platform – System Overview

PBC Separator

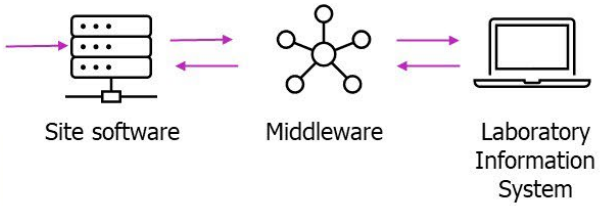
0.5 McFarland Preparation

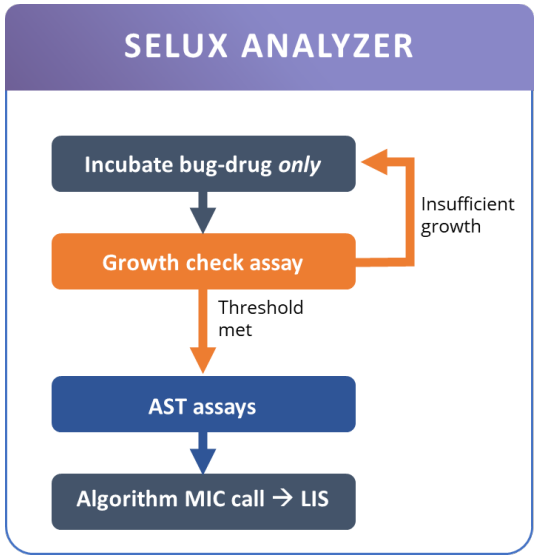
Inoculator

Dilutes bacteria sample into growth media & inoculates across panel

Analyzer

Random access for all sample types w/ stat capability; 20+ samples/hour
100 panel capacity

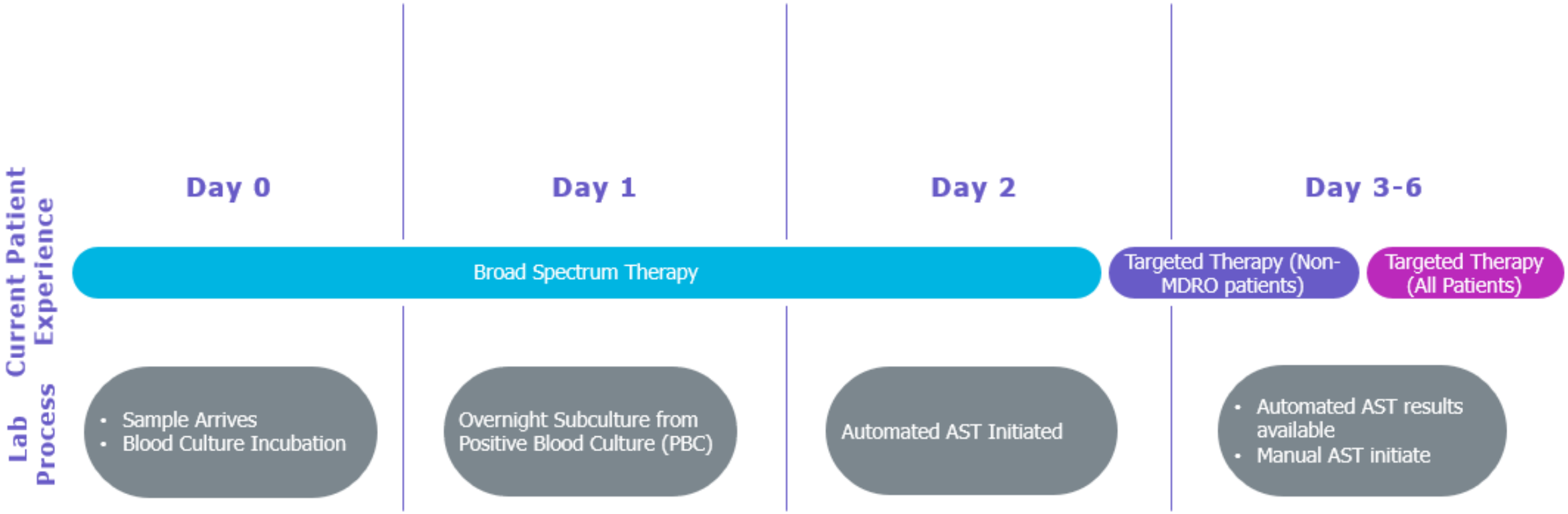




AST in Blood Stream Infections Today

Limited innovation in 20+ years

- Microscan (1980), Vitek 2 (2000), & Phoenix 2001
- 18-hour subculture required

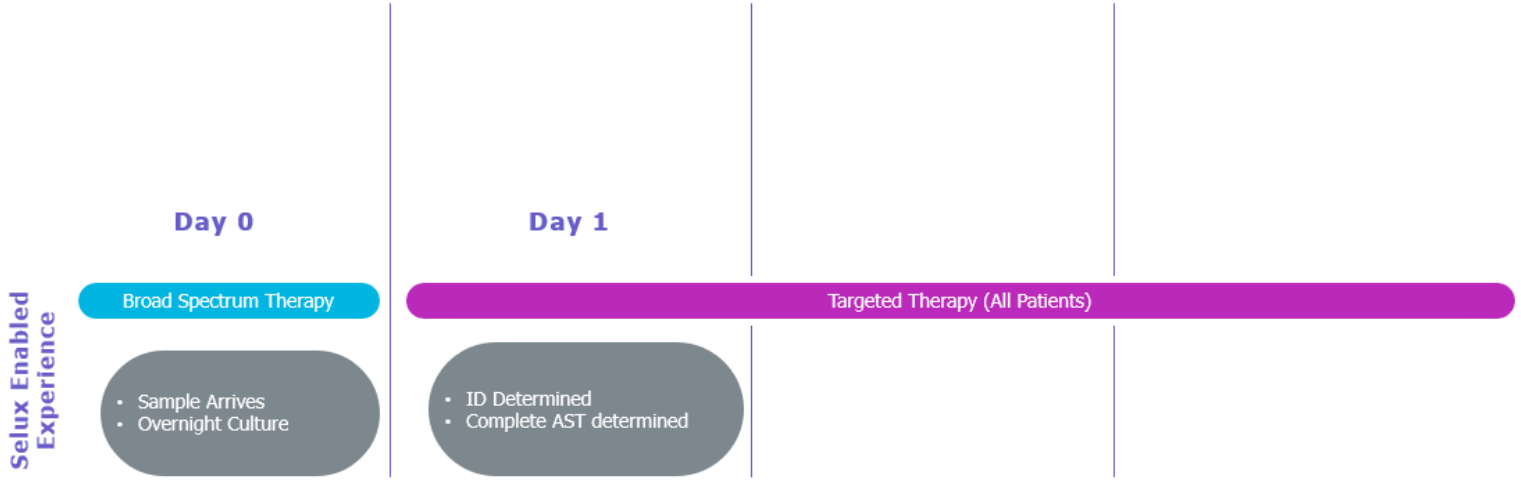


Selux Rapid AST

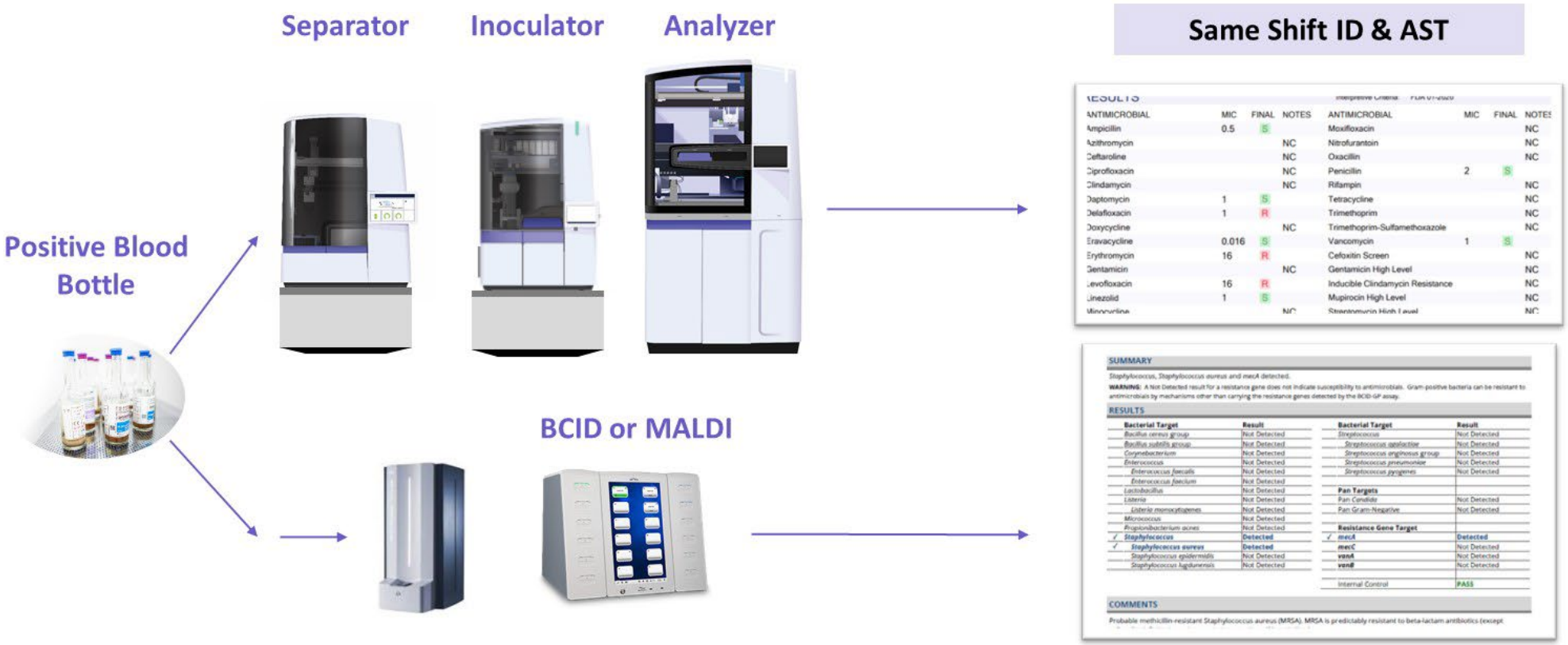
Provides Comprehensive AST Information Days Sooner

- No subculture required (Separator creates a tuned bacterial concentrate from PBC in ~45 min)
- Average AST run time under 6 hours
- Extensive bug/drug combinations with room for expansion as new antibiotics emerge.
- Latest FDA and CLSI breakpoints with extensive dilution series to meet new requirements

Organism Group	Mean Time-To-Results (hr)
Enterococcus faecalis	5.37
Enterococcus faecium	5.47
Staphylococcus aureus	5.38
Coagulase negative *Staphylococcus* spp.	5.63
Acinetobacter baumannii	5.70
Citrobacter freundii	5.59
Citrobacter koseri	5.66
Enterobacter cloacae	5.71
Escherichia coli	5.53
Klebsiella aerogenes	5.60
Klebsiella oxytoca	5.66
Klebsiella pneumoniae, variicola	5.59
Morganella morganii	5.48
Proteus mirabilis	5.51
Proteus vulgaris	5.54
Pseudomonas aeruginosa	7.17
Serratia marcescens	5.68



Workflow for Selux Rapid AST



- The approach for documenting the procedure in the medical record will vary by provider
- Documentation Example
  - Notes anti-susceptibility testing in the order set in the medical record under Laboratory results, Microbiology, either with the Culture result or under Susceptibility

Summary

- Selux Rapid AST Platform is a breakthrough designated device that is awaiting FDA authorization.
  - Selux has applied for NTAP for Selux Rapid AST Platform as part of the FY 2024 cycle.

- Proposed indication: The Selux DPBC-AST Platform is intended for in vitro diagnostic (IVD) use in the clinical microbiology laboratory for automated quantitative AST by minimal inhibitory concentration (MIC) of aerobic and facultative anaerobic gram-negative bacteria separated from monomicrobial positive blood culture bottle samples.

- There is no existing code that accurately describes the Selux Rapid AST Platform. Thus, Selux requests the creation of a new ICD-10-PCS code that describes this type of technology.

Thank You