

## Infections in a Tertiary Care Teaching Hospital

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### Background

- At our institution, a nursing screening tool was developed to identify patients presenting to the Emergency Department with possible sepsis.
- The electronic tool utilizes a patient's vital signs, mental status, and physical findings in triage to identify patients requiring provider notification and ordering of Sepsis Triage labs including blood culture (BC).
- Many early warning sepsis screening tools demonstrate high sensitivity however low specificity.
- Positive blood cultures are beneficial for antibiotic streamlining however most bottles are negative.
- A 6-month internal retrospective blood culture report determined an overall positive blood culture rate of 0.09% (798/8,541 bottles incubated).
- Previously published literature report positive blood culture rates of approximately 30% in critically ill patients with septic shock.
- Inappropriate selection of empiric antimicrobial treatment is a significant contributor to increased mortality. Therefore, accurate timely identification of patients with blood stream pathogens may be helpful.
- T2Biosystems® currently offers the T2B® Panel, which provides sensitive detection of specific sepsis-causing bacterial pathogens directly from a whole blood specimen in approximately 3-5 hours.
- The panel's high sensitivity allows for organism identification as low as 1 CFU/mL compared to 100 to 1,000 CFU/mL.
- The Panel identifies five common bacteria known to cause sepsis: *Enterococcus faecium*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*.
- Taking into consideration diagnostic stewardship, there is little information available on which patients would benefit the most from this test.

### Purpose

The purpose of this study is to determine the clinical and financial impact of the T2Bacteria® Panel in early pathogen identification and antimicrobial optimization in select septic patients presenting to the Emergency Department.

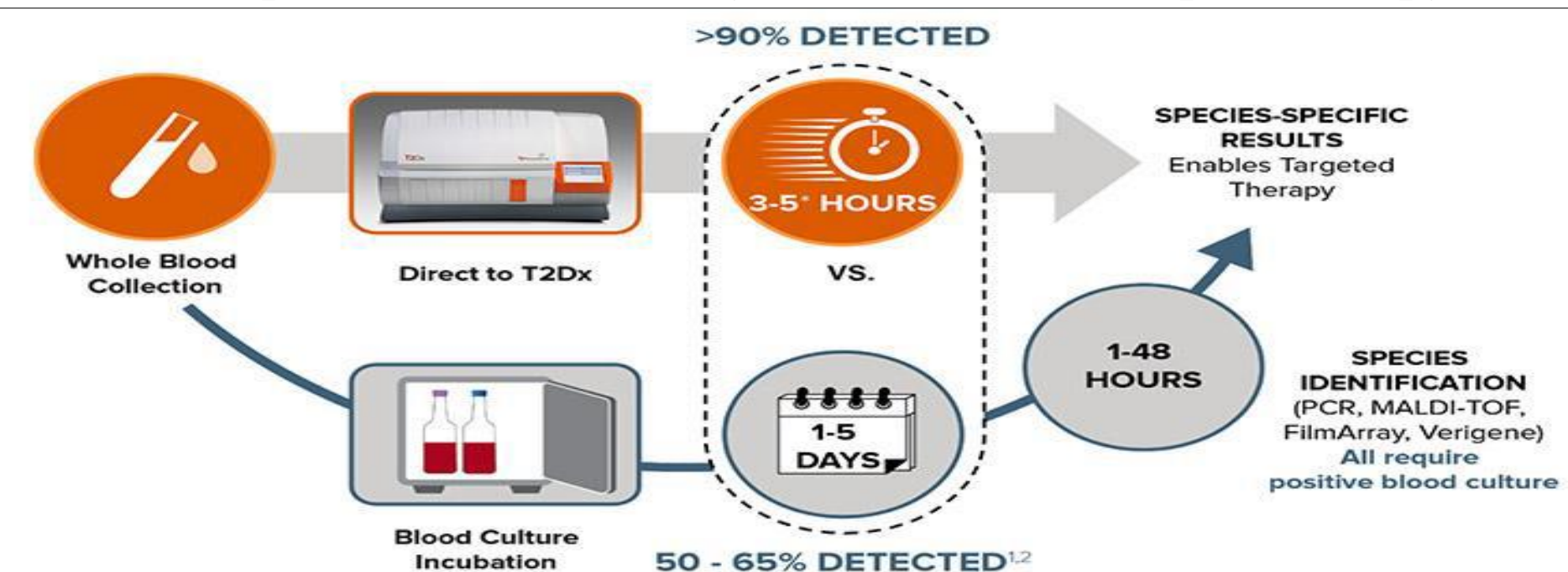
### Methodology

Study design: February 11 – March 31, 2019 (Interim analysis 9/48 tests provided by company. Study is ongoing)

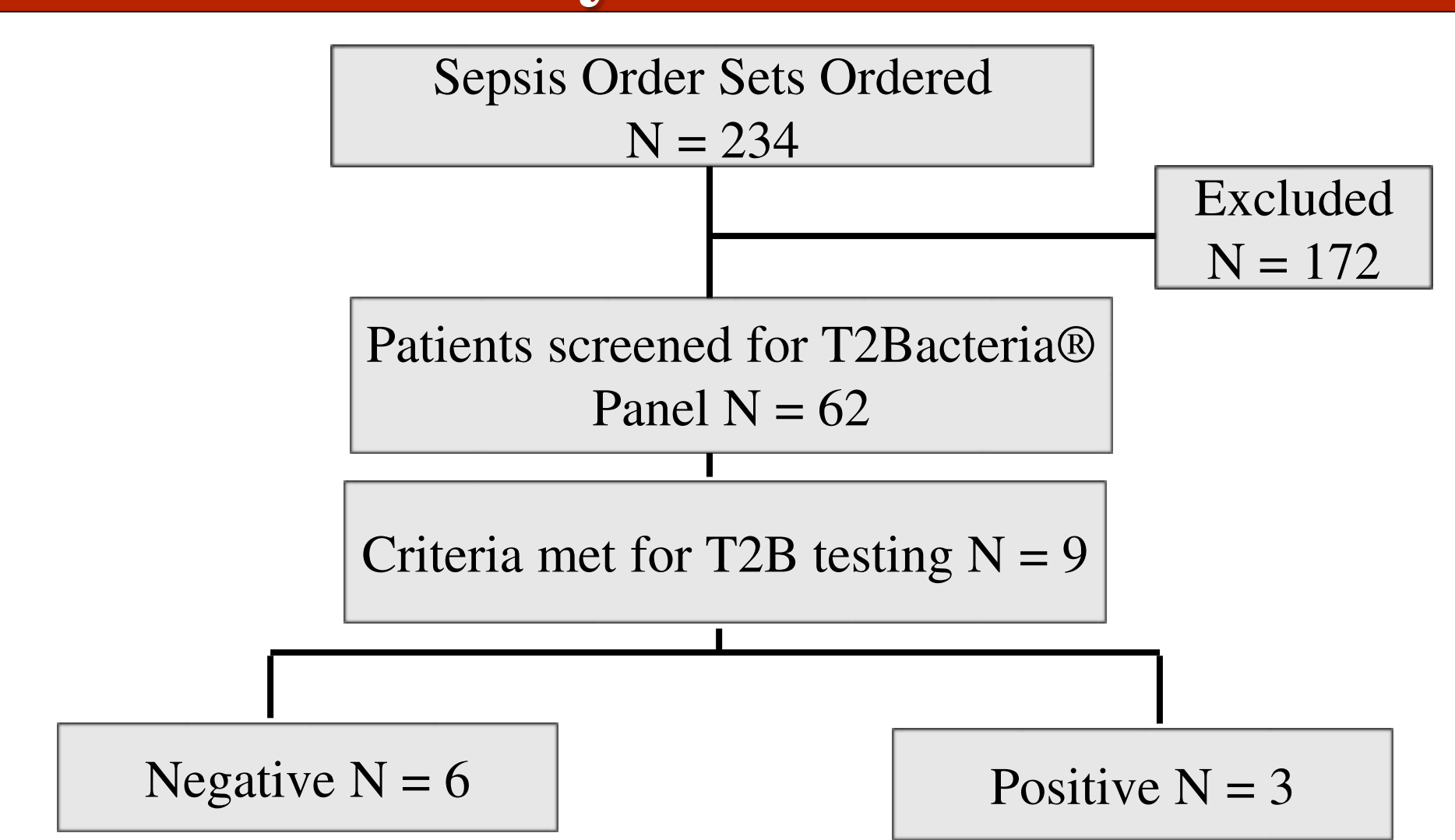
Prospective interventional study of ED patients 0700 – 1530 M-F

Study Sample:

- Adult patients presenting to ED with possible sepsis
- ED Pharmacist eligibility screening criteria:
  - Age  $\geq$  18 years of age
  - Sepsis order set ordered by provider and Severe Sepsis Risk defined as  $\geq$  2 SIRS Criteria **PLUS** Suspected Source of Infection **PLUS** SBP  $<$ 90 or MAP  $<$ 65 **OR** AMS
  - Written informed consent
- ID Pharmacist Testing/Intervention Timetable  
0700 – 1300: SAME DAY antimicrobial intervention  
> 1300 < 1530: NEXT DAY antimicrobial intervention
- Exclusion Criteria:  
No pharmacy/microbiology trained staff available
- Outcomes:
  - Primary: To determine if the results from the T2Bacteria® panel facilitated timely modification of empiric therapy



### Study Enrollment



### Results

Pt #	Admission Diagnosis	T2B result	Infectious Disease Pharmacist Interventions	Blood Culture results	Outcomes
1	HCAP vs. Aspiration Pneumonia Started on Ceftazidime, Vanc, CD	<i>K. pneumoniae</i>	<ul style="list-style-type: none"> <li>Changed ceftazidime to meropenem based on internal antibiogram (88% versus 99%)</li> <li>Discontinued clindamycin</li> <li>Ordered expectorated sputum to rule out need to continue vancomycin</li> </ul>	Negative	<ul style="list-style-type: none"> <li>WBC declined from 25 to 10 next am</li> <li>Meropenem DOT 7 days</li> <li>Transferred back to nursing home</li> <li>Vancomycin DOT 3 days</li> </ul>
2	Sepsis in a dialysis patient with decreased responsiveness and AMS started on zosyn and vancomycin	<i>Staphylococcus aureus</i> and <i>Pseudomonas aeruginosa</i>	<ul style="list-style-type: none"> <li>Set vancomycin high trough goal of (15-20)</li> <li>Initiated MRSA contact precautions</li> <li>Obtained ID consult for <i>Staph aureus</i> bacteremic bundle</li> </ul>	Positive for MRSA	<ul style="list-style-type: none"> <li>Vancomycin continued</li> <li>Source control achieved</li> <li>Bacteremia cleared and patient discharged to complete 6 weeks</li> <li>Zosyn DOT 3 days</li> </ul>
3	Sepsis in a dialysis patient who became unresponsive started on zosyn and vancomycin	<i>Staphylococcus aureus</i>	<ul style="list-style-type: none"> <li>Set vancomycin high trough goal of (15-20)</li> <li>Initiated MRSA contact precautions</li> <li>Obtained ID consult for <i>Staph aureus</i> bacteremic bundle</li> </ul>	Positive for MRSA	<ul style="list-style-type: none"> <li>Vancomycin continued</li> <li>Source control achieved</li> <li>Bacteremia cleared and patient discharged to complete 6 weeks</li> </ul>

- The percent positivity of the T2B for patients meeting criteria was 33% (3/9).
- The T2Bacteria® Panel resulted in Improved time to: Appropriate antibiotics and vancomycin trough goals, timely Infectious disease consultations for *Staphylococcus aureus* bacteremia and timely initiation of contact precautions.
- The T2B was able to identify one patient with negative blood cultures
- The T2B was able to rule out relapsing *E. coli* bacteremia in an oncology patient completing treatment for bacteremia from a previous visit. This allowed the provider to explore other reasons for fever present during readmission.
- At our institution, providers use the sepsis order set to rule out sepsis in patients presenting to the ED. Therefore the rate of patients meeting criteria were low.
- Sepsis order set use was not a good marker for patients who might benefit from the T2B assay.
- Additionally, in our community teaching hospital, molecular assays are limited to first shift which reduces the opportunity to enroll patients.
- A previous internal 16-month review of positive blood cultures with organisms included in the T2B assay revealed a lactic acid level of 2 or more in 51% (43/83) of cases. Therefore, future initiatives will include: POC LA levels and modification of the protocol to include patients with LA values of  $\geq$  2.

- De Prost *et al*: Unrevealing culture-negative severe sepsis. *Critical Care* 2013, 17:1001.
- Liesenfeld O, Lehman L, Hunfeld K-P, Kost G. Molecular Diagnosis of Sepsis: New Aspects and Recent Developments. *European Journal of Microbiology & Immunology*. 2014;4(1):1-25.
- T2MR Applications: T2 Magnetic Resonance (T2MR) - The Technology Platform for Next-Generation Diagnostics. T2 Biosystems. <https://t2biostaging.wpengine.com/t2mr-technology/>. Accessed July 20, 2018.

### Disclosures

The individuals of this presentation have received research support from T2 Biosystems in the form of instrumentation and reagents.