A Novel Approach to Identify Early Sepsis on Presentation to the Emergency Department

Jon Pangia

Nayda Parisio Poldiak

Leeda Roshan

Brian Doherty

Christina Vitale

See next page for additional authors

Authors
Jon Pangia, Nayda Parisio Poldiak, Leeda Roshan, Brian Doherty, Christina Vitale, and Radley Short

HCA South Atlantic

Division Approval to Access Enterprise Data Warehouse (EDW), Trauma Data Base (local), or Florida Trauma Data Base

Enterprise data warehouse (EDW) requests, Trauma Data Base (local) requests, and Florida Trauma Data Base requests require SATL Division approval. Once approved at division:

- **EDW requests are made using the** dataCLEAR form
  - **Cut-and-paste info from the current form into dataCLEAR**
  - **Append this approved (signed) form to your request**
  - **Data Analyst will store data request on virtual desktop interface (VDI)**
- **Trauma Data Base (local) requests**
  - **Submit this current, approved form to the hospital trauma data analyst**
  - **Data Analyst will forward data request to GME for storage in VDI**
- **Florida Trauma Data Base requests are made by submitting this form via electronic mail, to Selina Fritze, Enterprise Research Director** (Selina.fritze@hcahealthcare.com)

When your data request is completed, data files are housed in the Virtual Desktop Interface (VDI) as a de-identified data file (Safe Harbor Method). The safe harbor method, employed by enterprise-level data analysts, allows that IRB exempt status be granted for qualifying projects. IRB exempt determination is made using the HCA online algorithm—C.A.R.R.I.E. **Please attach C.A.R.R.I.E approval to your submission.**

Use the Data Dictionary when developing your EDW request. The Data Dictionary will help you determine what information is available in the EDW. At present, no imaging is available and access to provider notes is limited. Times for medications and labs associated with the procedure are available, but procedure times are not available. The data dictionary for EDW can be found at the following link: EDW data dictionary

The data dictionary for Trauma (FL) Data Base was sent in an email to program directors or can be accessed through your research coordinator.

- Please complete CITI training (or equivalent) before submitting this form.
- Does the conduct of your study require that you have access to patient identifiers? A list of identifiers to be removed by data analysts can be found at the end of this document. For more information: "Safe Harbor" removal of identifiers

  __X__ NO Proceed to Item 1, below.

  _____ YES **Stop**. Complete and submit an IRB protocol prior to making your data request. After you have IRB approval, complete this form. Include your IRB approval number _____.

1. HCA 3-4 ID: FNI7971
2. Date: 10/26/20
3. CITI (or equivalent) approval date? _05/30/2018_____

4. C.A.R.R.I.E. Determination as IRB exempt? _____ yes (append C.A.R.R.I.E. approval)_____ no

5. Title of project: A Novel Method to Predict Early Sepsis on Arrival to the Emergency Department

6. Resident names and program/specialties: Leeda Roshan (EM), Brian Doherty (EM), Christina Vitale (EM)

7. Faculty Mentor(s) and program/specialty: Jonathan Pangia, DO (EM), Radley Short, MD (EM)

8. GME Site __Grand Strand Medical Center: Myrtle Beach, SC__

9. This data request is for a: _____QI project (in-house data request): ____X_____ Research Project

   Note: A **division-wide data request** is the "default" for research. An **Enterprise-level data request** may be granted with appropriate justification.

10. This data request is for: ____X_____EDW _____Local Trauma _____ FL Trauma Data Base

Background & Significance

Several peer-reviewed studies have confirmed the inverse correlation between rapid antibiotics delivery for sepsis patients and patient mortality. [1,2,3] Specifically, it is now widely accepted that for every hour it takes to deliver IV antibiotics to a septic patient, their mortality increases proportionally. [4,5] Given this important time-dependent effect on patient outcomes, HCA facilities committed to eliminating delays to antibiotic administration in sepsis patients, but several obstacles had to be overcome.

[1] Gaieski DF, Mikkelsen ME, Band RA, et al. Impact of time to antibiotics on survival in patients with severe sepsis or septic shock in whom early goal-directed therapy was initiated in the emergency department. *Crit Care Med.* 2010; 38: 1045-105

[2] Ryoo SM, Kim WY, Sohn CH, et al. Prognostic value of timing of antibiotic administration in patients with septic shock treated with early quantitative resuscitation. *Am J Med Sci.* 2015; 349: 328-333

[3] Liu VX, Fielding-Singh V, Greene JD, Baker JM, Iwashyna TJ, Bhattacharya J, et al. The timing of early antibiotics and hospital mortality in sepsis. *Am J Respir Crit Care Med*. 2017;196:856–863

[4] Ferrer R, Martin-Loeches I, Phillips G, Osborn TM, Townsend S, Dellinger RP, et al. Empiric antibiotic treatment reduces mortality in severe sepsis and septic shock from the first hour: results from a guideline-based performance improvement program. *Crit Care Med*. 2014;42:1749–1755

[5] Seymour CW, Gesten F, Prescott HC, Friedrich ME, Iwashyna TJ, Phillips GS, et al. Time to treatment and mortality during mandated emergency care for sepsis. *N Engl J Med*. 2017;376:2235–2244

Limitations of Current Practice

Early sepsis was infrequently recognized on initial presentation to the Emergency Department with many patients "ruling in" over an hour after arrival when the white blood cell value was returned. Delivering the IV antibiotics within the first hour was possible, but only if adequate preparation time was given to the nursing staff. As such, the order for antibiotics needed to be placed within 30 minutes of arrival to give the nursing staff adequate time. Complicating these efforts was the timing of initial vital signs are that they are not typically posted to the tracker until 15 minutes after arrival. These timing issues created a need for the team to find an adjunct to vital signs which might provide an indication of early sepsis. In addition, it is pertinent to review the shortcomings of current sepsis identification tools available to the emergency clinician.

Sensitivity and Specificity of SIRS

SIRS is an objective diagnostic tool with the main purpose of providing criteria to help recognize sepsis in a patient presenting with fever, hypotension, tachypnea, and tachycardia. SIRS criteria have been found to have a low sensitivity (69%) in the recognition of an infection, as well as a low specificity (35%), despite all clinical parameters being sufficiently met, and no other obvious etiologies being present to cause SIRS.[6] The limitations of clinical tools like SIRS and qSOFA in identifying sepsis inherently leads clinicians using these criteria to falsely identify patients as septic while simultaneously not identifying patients with serious systemic infections in imminent danger of rapidly progressing to sepsis.[7][8] As such, despite the importance of initiating sepsis treatment as early as possible, clinicians lack reliable criteria to focus these resources on the patients who need them in the shortest timeframe possible.

Study Intervention

The study team implemented a novel way to objectively capture the expertise of the experienced clinician to increase the recognition of sepsis patients within the first half hour of their emergency medical care. This study will compare the novel assessment tool's effectiveness compared to current "normal standards". The tool is designed to both capture the experienced clinician's unique ability to rapidly calculate multiple poorly quantified variables and provide an indication for possible sepsis during the first encounter. The tool consists of two questions and direction as follows:

- Will this patient probably be discharged home? *If no, continue to the next question:*
- Are this patient's presenting symptoms most probably due to a non-infectious cause? *If no, engage sepsis order set using the most likely infectious source for antibiotic choice.*

Specific Aims and Hypotheses

This study aims to show the effectiveness of the simple assessment tool for ruling out sepsis on arrival to the Emergency Department. We hypothesize that the time of antibiotic delivery will not be different when using the assessment tool or

[6] Jaimes F, Garces J, Cuervo J, et al. The systemic inflammatory response syndrome (SIRS) to identify infected patients in the emergency room. *Intensive Care Med* 2003;29:1368-1371.
[7] Raith EP, Udy AA, Bailey M, et al. Prognostic Accuracy of the SOFA Score, SIRS Criteria, and qSOFA Score for In-Hospital Mortality Among Adults With Suspected Infection Admitted to the Intensive Care Unit. *JAMA.* 2017;317(3):290–300.
[8] Jiang, J., Yang, J., Mei, J. *et al.* Head-to-head comparison of qSOFA and SIRS criteria in predicting the mortality of infected patients in the emergency department: a meta-analysis. *Scand J Trauma Resusc Emerg Med* **26,** 56 (2018).

the current standard. In addition, we hypothesize that the timeliness of antibiotic delivery to sepsis patients will cause a high rate of "over treatment" of patients with antibiotics who had no bacterial infection causing their symptoms.

Methods

This is a retrospective analysis of existing, de-identified data, making a query of the HCA EDW. To eliminate non-experimental variability, this study will make use of a difference-in-difference analysis by comparing data before and after implementation of the experimental recognition process at both the study hospital and another hospital outside of HCA which had exposure to the same progress in national attention and education for sepsis care but without any of the pressures to innovate solutions around the same obstacles as was present at HCA. The "outside data" will be put into the VDI for comparison with HCA data.

Collaboration with the outside hospital will be limited to sharing processed data. In other words, we will only be sharing each other's "n" and outcomes as listed below. This collaboration is necessary because no hospital within HCA has failed to engage some method to overcome the obstacles listed above and therefore using an HCA site as comparison is comparing different methods and not comparing against a control (e.g., national standard).

Analysis Plan

Independent variables:

Sepsis protocol at HCA and Non-HCA hospital

Primary outcome:

- Number Needed to Treat (NNT) for sepsis

Secondary outcomes:

- Time to first antibiotic order
- NNT for bacterial infection (i.e., infections but not sepsis)
- Antibiotic-derived adverse outcomes (defined by a documented diagnosis of "drug reaction", "allergic reaction", or "antibiotic reaction")

The data extraction will include all patients who either had a sepsis order set ordered in the Emergency Department or were diagnosed with sepsis during their hospital stay during the study period and the months preceding it. Statistical analysis will be focused on NNT and a difference in difference estimate for the HCA and non-HCA emergency departments during select time periods. In addition, logistic regression will be calculated for the binary variable sepsis, with time to antibiotic treatment, age, sex, infectious pathology, and temperature at the time of triage as covariates.

Required Data Collection:

- Clinical records for all patients who received a sepsis order set as part of their emergency department care during the study period.
    - Study period: January 2017 – January 2018 & March 2018 – March 2019
    - Requested data:
        - All final diagnoses (by name and ICD-10 code please)
        - All ED diagnoses
        - ED disposition (admitted vs discharge)

- Clinical records for patients admitted to Grand Strand with the following ICD-10 codes during the following study period, including the requested data:
    - Study period: January 2017 – January 2018 & March 2018 – March 2019
    - ICD-10 codes: R65.21 (septic shock) & R65.20 (severe sepsis)
    - Requested data:
        - All final discharge diagnoses
        - ED triage time to ED antibiotic delivery time

Save as a pdf and send to Michael G. Flynn, Division Director of GME Research, mike.flynn@hcahealthcare.com

Principal Investigator/ Project leader name: Jonathan Pangia

Signature:_____

Division Office Use:

EDW Approval ____✓____ (Researchers submit this signed form with their data request through dataCLEAR)

Local Trauma Data Base Approval _____ (Researchers submit this signed form to trauma data analyst)

Trauma (FL) Data Base approval _____ (Researchers submit this signed form via email to Selina Fritze, Director of Research)

Michael G. Flynn, Ph.D.

Digitally signed by Michael G. Flynn, Ph.D.
DN: cn=Michael G. Flynn, Ph.D., o=HCA South Atlantic, ou=Division Director of Research, email=mike.flynn@hcahealthcare.com, c=US
Date: 2021.02.11 15:11:07 -05'00'

Division Director of GME Research

Date: