UAB The University of Alabama at Birmingham

Using a Learning Health System Model to Evaluate Implementation of a Sepsis Clinical Decision Support Tool

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Authors and acknowledgement

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Background: Sepsis Burden

Significant global health burden from sepsis

- Worldwide: 48.9 million cases; 11 million deaths (CDC 2024)
- United States: 1.7 million; 270,000 deaths (CDC, 2024)
- Alabama's death rate ~17%; California 3.6%
- UAB Health System: Between 2018-October 2020~ of those with sepsis~48% to 55% died

Difficult to diagnosis

- Onset happens quickly
- Quick response necessary

UAB Health System

- Level 1 Trauma Center with 1,200 beds
- “Deep South”: vulnerable population
- Seeking to reduce mortality associated with sepsis
- Implemented a clinical decision support tool to facilitate early detection and treatment – July 2022
  - Phased implementation across 7 units → learning health system approach to evaluation
- UAB - Center for Outcomes Effectiveness Research and Education: Developing a LHS approach to apply to evaluations of health system interventions

Clinical Decision Support Tools & Sepsis Care

Embedded within electronic medical records

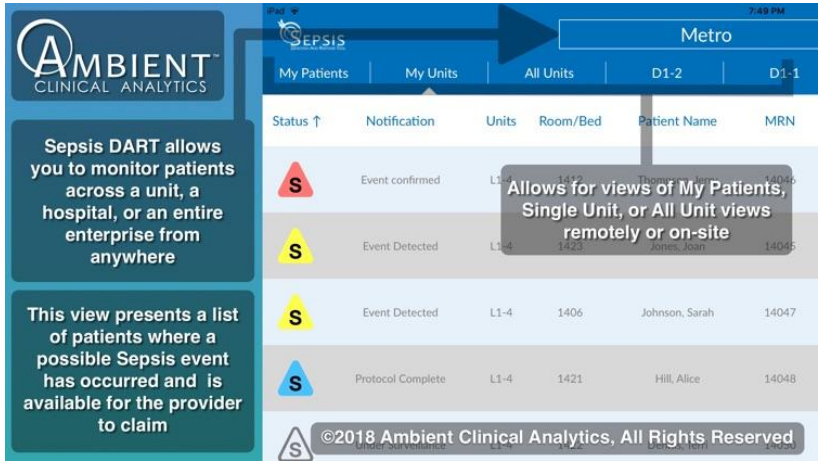
Benefits: reduce the incidence of errors and adverse events, adherence to clinical guidelines, reduce test and order duplication, automated documentation, diagnostic support, patient decision support, and improvements in workflow

Concerns: Alert fatigue, costs, maintenance, user distrust, disrupt or fragment the workflow

Emerging evidence of the benefits of CDST for Sepsis care specifically

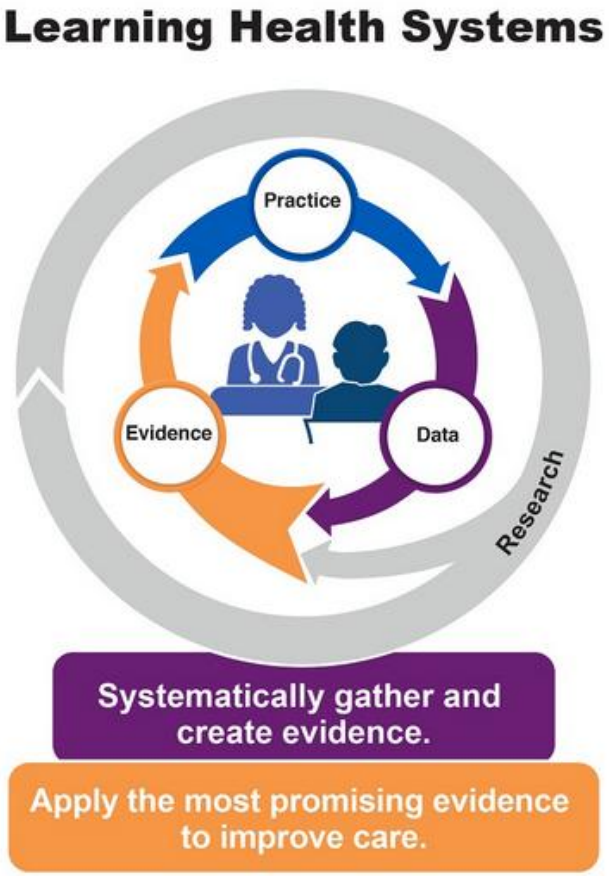
Sepsis DART (Detection and Response Tool) Clinical Decision Support Tool

- Based on a surveillance tool developed by the Mayo Clinic
- Surveillance algorithm tailored to UAB
- Automated and customizable detection of sepsis
- Tracks the delivery of sepsis bundle elements
- Embedded within the EMR
- 7 unit roll out
- Delays in roll-out (implications for study findings)



Harrison AM, Thongprayoon C, Kashyap R, et al. Developing the surveillance algorithm for detection of failure to recognize and treat severe sepsis. Mayo Clin Proc. 2015;90(2):166-175.

Learning Health Systems



Agency for Healthcare Research and Quality
https://www.ahrq.gov/learning-health-systems/about.html

Study Aims

Two specific aims were originally proposed:

- assess the fidelity to a sepsis detection and treatment program and iteratively identify adaptations required to scale up the program;
- examine the influence of the sepsis detection and treatment program on clinical and implementation outcomes;

Research Design

- Embedded mixed methods design
  - *findings from rollout in one unit to inform rollout in subsequent units*

- 1 year project…not able to observe rollout across the 7 units…one unit observed

Data Collection

- Web-based survey of users: learning and implementation climates; two units at different time points
  - Feasibility
  - Acceptability
  - Appropriateness
- In-depth interviews with users
- Investigators embedded within implementation meetings
- Electronic Medical Records to assess changes in clinical outcomes
  - Multivariate analyses comparing patients ‘exposed to DART’ vs patients ‘not exposed to DART’

General conclusions

- Importance of building evaluation/learning capacity to provide building blocks for organizational scale-up
  - Managed combination of clinical and research enterprises
  - Embedded researchers need to be part of the implementation team
  - Research and implementation timelines are not in alignment
- Some evidence that DART can be associated with better clinical outcomes
- Important to pay attention to human factors in the design and implementation of interventions

Findings: In-depth Interviews (1 physician; 3 nurses)

- Theme 1: Early perception that tool was useful for sepsis identification
- Theme 2: Clinicians experience alert fatigue
- Theme 3: Difficulty in maintaining 100% compliance with the sepsis bundle
- Theme 4: Implementation requires significant organizational investment to support ‘buy-in’
- Theme 5: Other factors (such as overcrowding in the ED) limit effectiveness of the tool

Findings: Web-Based Survey Comparison Across Units

Measure	Emergency Department (Time Period 1)	Inpatient unit (Time Period 2)	t-statistic	p-value
Feasibility (FIM)	3.89 (0.91) n=16	3.55 (0.79) n=25	1.282	0.207
Acceptability (AIM)	3.73 (0.77) n=16	3.97 (0.82) n=25	-0.917	0.365
Appropriateness (IAM)	3.97 (0.95) n=16	3.95 (0.75) n=25	0.071	0.944

Findings: Analysis of Electronic Medical Record Data

Patients exposed to DART experienced:

- Lower 30-day readmission rates (OR 0.83, 95% CI 0.69-0.99, p<0.05)
- Reduced mortality (OR 0.70, 95% CI 0.56-0.88, p<0.01)
- *Reduced length of stay (coefficient -0.67, 95% CI -1.43 to 0.12, NS)*

Notably, Black/African American compared to White patients experienced (regardless of exposure):

- longer lengths of stay (coefficient 0.74, 95% CI 0.04 to 1.44, p<0.05)
- higher 30-day readmission rates (OR 1.31, 95% CI 1.11 to 1.54, p<0.01)

Observations from Implementation Meetings

- Implementation delays ~ >1 year

Reasons:

- ED workflow difficult to replicate in the inpatient units
- Low response rates associated with alerts

Limitations

- Not enough time – longer term evaluation needed
  - Delayed implementation – does not fit with an evaluation timeline
- Low response rates to surveys and requests for interviews

Conclusion

- Mixed methods approach provides insights that would not have been observed with one method alone
- Evidence that CDST can be effective
- Focus needs to be on implementation, spread, and uptake

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Questions?

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