

# Sepsis

EMS' 4<sup>th</sup> Time Critical Event

Paul Zeeb, MD

Chair, Region IV Physician Advisory Board of EMS

If you have seen one EMS, you've seen one EMS system!



# If you have seen one EMS, you've seen one EMS system!!

- 1,100+ EMS systems in Ohio
- Paid full-time, paid part-time, volunteer
- Fire Based, 3<sup>rd</sup> Service, Private Service (non-profit & for-profit)
- EMT vs. EMTA vs. Paramedic
- Different protocols & medical directors
- Ohio EMS Regional Physician Advisory Boards

# Ohio EMS Scope of Practice

	EMT	AEMT	Paramedic
Pulse Ox/ET CO2	X	X	X
Intubate		X	X
IV & IV Fluids		X	X
Vasopressors			X
Finger Stick BS	X	X	X
Phlebotomy		X	X
IV Antibiotics			??

# EMS Provider Authorization to Practice

- EMTs, EMT-As and Paramedics can only practice as authorized by their medical director
- Medical director cannot authorize practice outside scope of practice published by the Emergency Medical, Fire and Transportation Services (EMFTS) Board
- Providers are authorized to practice via written protocol approved by medical director
- Little “on-line” medical control for EMS providers

# Sepsis – It's not that simple

- STEMI – 12 lead ECG
- Trauma – Ohio Trauma Triage Criteria – legislated – patient meets criteria, go to trauma center
- Stoke – LAMS, FAST, MEND, Cincinnati, LASS, RACE – pick one
- Sepsis – What-to-do, What-to-do, What-to-do!!

Sepsis – It's not that simple  
& **it's deadly**

In-hospital  
mortality

STEMI - <5%

Trauma - < 5%

Sepsis – **28-50%**



# Different Mind Set

How we think in the  
ED:

- Sepsis
- Severe Sepsis
- Septic Shock

It may take time to  
sort it out.

EMS Thinks:

Sick/Not Sick

No stay & play



# Pre-Hospital Screening

Is there a suitable pre-hospital screening tool?

What is a suitable level of sensitivity, specificity, positive predictive value and negative predictive value?

# Pre-Hospital Screening Tool

What are the necessary elements of a pre-hospital sepsis screening tool?

1. Suitable for all levels of knowledge/training (EMT, AEMT, Paramedic)
2. Criteria must be measurable in the field.
3. Within scope of practice.
4. Suitable sensitivity and positive predictive value (avoid sepsis-alert fatigue)
5. Linked with actions/treatment to be initiated by pre-hospital providers.

# qSOFA



16.3% sensitivity with 97.3% specificity for patients with confirmed severe sepsis, septic shock in ED.

# Screening Tool Performance

Open Access

Research

## BMJ Open Identification of adults with sepsis in the prehospital environment: a systematic review

Michael A Smyth,<sup>1,2,3</sup> Samantha J Brace-McDonnell,<sup>1,4</sup> Gavin D Perkins<sup>1,4</sup>

**Table 4** Performance of screening tools

Author	Sensitivity	Specificity	PPV	NPV
Seymour (CIS)	0.76 (95% CI 0.75 to 0.77)	Not reported	Not reported	Not reported
Polito (PRESS)	0.85 (95% CI not reported)	0.47 (95% CI not reported)	0.19 (95% CI not reported)	0.96 (95% CI not reported)
Bayer (PRESEP)	0.85 (95% CI 0.77 to 0.92)	0.86 (95% CI 0.82 to 0.90)	0.63 (95% CI not reported)	0.95 (95% CI not reported)
McClelland (sepsis) (modified Robson tool)	0.43 (95% CI 0.28 to 0.58)	0.14 (95% CI 0 to 0.40)	Not reported	Not reported
McClelland (severe sepsis) (modified Robson tool)	0.30 (95% CI 0.12 to 0.47)	0.77 (95% CI 0.60 to 0.95)	Not reported	Not reported
Bayer (modified Robson tool)	0.95 (95% CI not reported)	0.43 (95% CI not reported)	0.32 (95% CI not reported)	0.97 (95% CI not reported)
Wallgren (sepsis) (Robson tool)	0.75 (95% CI not reported)	Not reported	Not reported	Not reported
Wallgren (severe sepsis) (Robson tool)	0.93 (95% CI not reported)	Not reported	Not reported	Not reported
Bayer (BAS 90-30-90)	0.62 (95% CI not reported)	0.83 (95% CI not reported)	0.51 (95% CI not reported)	0.89 (95% CI not reported)
Wallgren (sepsis) (BAS 90-30-90)	0.73 (95% CI not reported)	Not reported	Not reported	Not reported
Wallgren (severe sepsis) (BAS 90-30-90)	0.70 (95% CI not reported)	Not reported	Not reported	Not reported
Bayer (MEWS)	0.74 (95% CI not reported)	0.75 (95% CI not reported)	0.45 (95% CI not reported)	0.91 (95% CI not reported)
Guerra	0.48 (95% CI not reported)	Not reported	Not reported	Not reported
Erwin (sepsis)	0.33 (95% CI 0.18 to 0.53)	0.89 (95% CI 0.08 to 0.94)	0.50 (95% CI 0.28 to 0.72)	0.80 (95% CI 0.70 to 0.87)
Erwin (severe sepsis)	0.20 (95% CI 0.05 to 0.51)	0.94 (95% CI 0.87 to 0.97)	0.29 (95% CI 0.08 to 0.64)	0.91 (95% CI 0.83 to 0.95)
Shiuh	0.75 (95% CI not reported)	Not reported	Not reported	Not reported
Travers	0.73 (95% CI 0.61 to 0.83)	0.79 (95% CI 0.75 to 0.82)	0.31 (95% CI 0.24 to 0.38)	0.96 (95% CI 0.94 to 0.98)

CIS, critical illness score; MEWS, Modified Early Warning Score; PRESEP, Prehospital Early Sepsis Detection.

# Early Identification

Open Access

Research

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### Strengths and limitations of this study

- Despite using very broad search criteria, little robust evidence regarding prehospital sepsis screening was identified.
- The studies found employed disparate methodologies, exhibit significant heterogeneity, generally involve small numbers of patients (limiting the precision of reported results) and were invariably of very low quality.
- The conclusions that can be drawn from this systematic review are, therefore, limited and findings should be interpreted with caution.

# Prehospital Screening Tool



Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

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Original Contribution

## A prehospital screening tool utilizing end-tidal carbon dioxide predicts sepsis and severe sepsis



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### ABSTRACT

**Objective:** To determine the utility of a prehospital sepsis screening protocol utilizing systemic inflammatory response syndrome (SIRS) criteria and end-tidal carbon dioxide (ETCO<sub>2</sub>).

**Methods:** We conducted a prospective cohort study among sepsis alerts activated by emergency medical services during a 12 month period after the initiation of a new sepsis screening protocol utilizing  $\geq 2$  SIRS criteria and ETCO<sub>2</sub> levels of  $\leq 25$  mmHg in patients with suspected infection. The outcomes of those that met all criteria of the protocol were compared to those that did not. The main outcome was the diagnosis of sepsis and severe sepsis. Secondary outcomes included mortality and in-hospital lactate levels.

**Results:** Of 330 sepsis alerts activated, 183 met all protocol criteria and 147 did not. Sepsis alerts that followed the protocol were more frequently diagnosed with sepsis (78% vs 43%,  $P < .001$ ) and severe sepsis (47% vs 7%,  $P < .001$ ), and had a higher mortality (11% vs 5%,  $P = .036$ ). Low ETCO<sub>2</sub> levels were the strongest predictor of sepsis (area under the ROC curve (AUC) of 0.99, 95% CI 0.99-1.00;  $P < .001$ ), severe sepsis (AUC 0.80, 95% CI 0.73-0.86;  $P < .001$ ), and mortality (AUC 0.70, 95% CI 0.57-0.83;  $P = .005$ ) among all prehospital variables. Sepsis alerts that followed the protocol had a sensitivity of 90% (95% CI 81-95%), a specificity of 58% (95% CI 52-65%), and a negative predictive value of 93% (95% CI 87-97%) for severe sepsis. There were significant associations between prehospital ETCO<sub>2</sub> and serum bicarbonate levels ( $r = 0.415$ ,  $P < .001$ ), anion gap ( $r = -0.322$ ,  $P < .001$ ), and lactate ( $r = -0.394$ ,  $P < .001$ ).

**Conclusion:** A prehospital screening protocol utilizing SIRS criteria and ETCO<sub>2</sub> predicts sepsis and severe sepsis, which could potentially decrease time to therapeutic intervention.

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# EMS' Capabilities

What can we do in the field to improve sepsis care?

## Assessment

- History – High risk features
- Vital Signs
- Exam
- Capnography
- Fingerstick Blood Sugar
- ? Serum Lactate

## Interventions

- Be suspicious
- IV Fluids (AEMT and Paramedic)
- Vasopressors
- Ask for help – “Sepsis Alert”

# What have we done via COTS?

EMS Agency Name		√
Patient Name		
Date/Time		
<b>PATIENT HISTORY</b>		
	*Known or Suspected Infection	
	*Recent Antibiotic Therapy	
	*Recent Medical/Surgical Procedure	
	*Recent Hospitalization	
	*Indwelling catheter	
	*History of Cancer	
	*Patient resident of LTC/rehab facility	
	If patient history is positive for any of the above, continue to "clinical criteria"	
<b>CLINICAL CRITERIA</b>		
	*HR > 90	
	*RR > 20	
	*Temperature $\geq 100.4$ F or $\leq 96.8$ F	
	If patient meets 2 or more clinical criteria, AND ETCO <sub>2</sub> $\leq 25$ mmHG, activate sepsis alert	
<b>ED SEPSIS ALERT</b>		
	Sepsis Alert to ED	
	Time Sepsis Alert Activated _____	

- **THERAPEUTIC INTERVENTION**

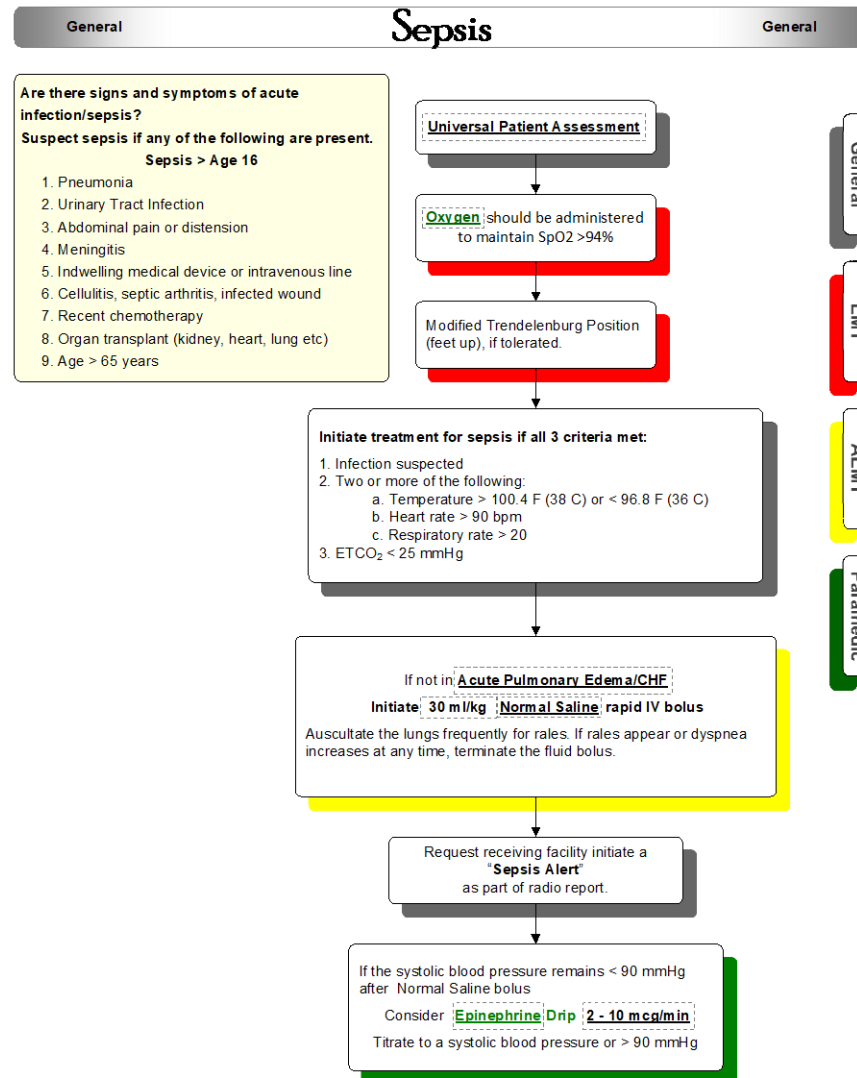
- Establish Patient Airway/Intubate if necessary
- Administer 100% O<sub>2</sub> at 15 liters per minute by non-re-breather mask (NRB), regardless of SpO<sub>2</sub>.
- Initiate at least one large bore IV of 0.9NS, and preferably two large bore, if time allows, without delaying transport
- Administer rapid infusion of normal saline fluid boluses, reassessing blood pressure, pulse and breath sounds with every 500 ml of fluid given to the patient. (If  $\uparrow$  rales, D/C bolus and maintain IV KVO)
- Notify Receiving Hospital of Sepsis Alert (if applicable)

- **PATIENT MONITORING**

- Vital signs, including temperature and pulse oximetry
- Apply Cardiac Monitor
- Transfer patient flat (if tolerated)
- Breath sounds
-



# One Example



# Where can we go from here?

- Sepsis follow up report – we do it for STEMI, trauma, and CVA. Why not sepsis?
- Prehospital blood cultures & antibiotics?
  - How long does transport time need to be to make this reasonable?
- Put norepinephrine back on trucks?
- Is there a role for pre-hospital lactates?
  - Who pays for it?
  - Is ETCO<sub>2</sub> acceptable surrogate?


# EMS Feedback

SEPSIS ALERT FEEDBACK REPORT to EMS						
Date of Arrival:		Day of Week: Tuesday		Time of Arrival:		
Mode of Arrival: EMS – Medic				<u>PRESENTING SYMPTOMOLOGY</u>		
ED Care						
1.	Door → Room times					
2.	Door → Sepsis Alert times					
3.	Door → Blood CX times					
4.	Door → Antibiotics times					
5.	Sepsis Alert → Antibiotics times					
6.	Door → Out of ED times					
7.	Diagnosis					
8.	Treatment Decision					
9.	Amount of Fluids Given					
Discharge						
Disposition	Home	MICU	In-patient Unit	Step-Down Unit	Hospice	Deceased

For additional information, please email

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**PARAMEDIC-INITIATED CMS SEPSIS CORE MEASURE BUNDLE PRIOR TO  
HOSPITAL ARRIVAL: A STEPWISE APPROACH**

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PEC Early Online 2016

1,185 “Sepsis Alerts” - Two or more SIRS criteria

- One set of blood cultures + blood tube for lactate
- IV ceftriaxone for suspected pneumonia
- IV piperacillin/tazobactam for everything else
- PCN allergic – no ATB
- 4.96 BC contamination rate
- Antibiotics matched (+) BCs for 72% of patients

# Sepsis Continuum of Care

- Partner with EMS on sepsis training for EMS providers.
- Is there an opportunity to assist EMS purchase needed equipment?
- Collaborate on common treatment plan:
  - EMS IDs at-risk patient.
  - Sepsis screen by EMS
  - EMS starts IV fluids
  - Sepsis alert prior to patient arrival – hospital mobilizes resources
  - Prompt handoff of care with continuation of prehospital care
  - Feedback to crew
    - Was patient truly septic
    - Time intervals
    - How did the patient do
    - Opportunities for care improvement

# Potential Pitfalls

- Sepsis screening too complex.
- Sepsis screening tool exceeds EMS provider's scope of practice.
- Sepsis screening tool has poor sensitivity or poor specificity.
- Request for sepsis alert not taken seriously by receiving ED. "Sepsis alert fatigue"

## In Summary

- Pre-hospital sepsis care – “Its not complicated, but it’s not easy!”
- If you’ve seen one EMS system, you’ve seen one EMS system.
- There is no perfect sepsis pre-hospital screening tool.
- Collaboration between EMS and the receiving hospital is essential.

Questions?