

Sepsis: Early Recognition

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Objectives

- Current state
- Challenges/opportunities
- New Innovations
- Next Steps

Who Is University Hospitals (UH)?



**University
Hospitals**

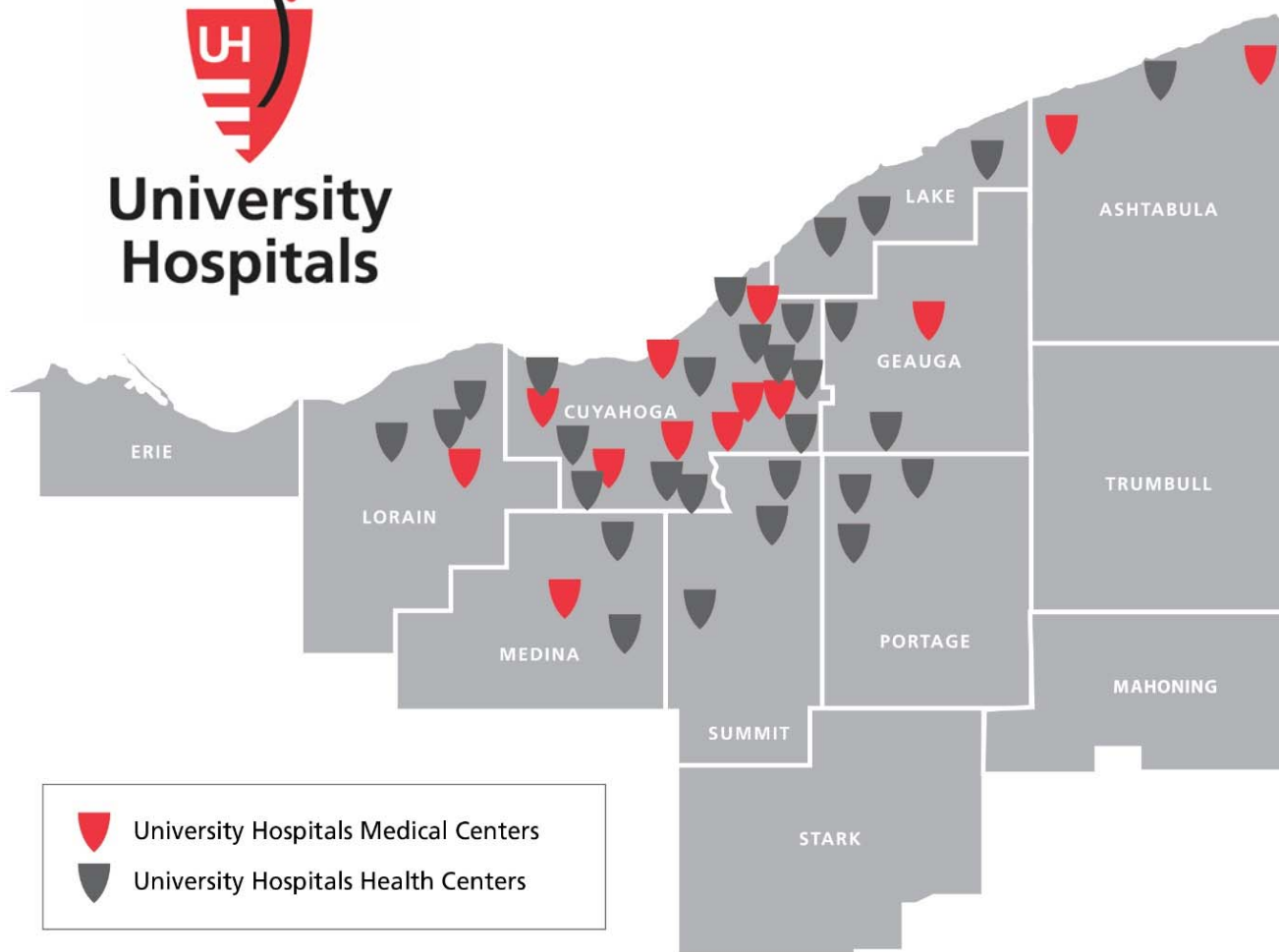
*To Heal
To Teach
To Discover*



- **Founded in 1866, Not-for-Profit Entity**
- **Tertiary Care Facility**
 - University Hospitals Case Medical Center
- **10 Wholly-owned Community Medical Centers**
- **2 Joint Venture Hospitals (Southwest General, Rehab - Centerre)**
- **25 Major Outpatient Centers**
- **~5,000 Affiliated Physicians, Providers**
- **UH Revenues \$2.8 Bil., With JV's \$3.3 Bil.***
- **2014: 98,856 Discharges* / 90,900 Surgeries***
 - * Includes St. John MC JV



University Hospitals



Current State

- System-wide complexity
 - EMR
 - Different community groups
 - Teaching and non-teaching facilities
- System-wide variations in workflow
 - ED screening in some facilities
 - Variable stages of implementation
 - Variable content of education

Challenges & Opportunities in early recognition

- Opportunity in recognition → intervention
 - SIRS is non-specific
- Knowledge of SIRS criteria and implications
 - Assistive personnel
 - Nursing
 - Physician
- Lack of standard hand-off in transitions of care
 - ED → inpatient
 - Inpatient → ICU
 - Inter-facility transfers
- Balancing alert sensitivity & specificity

Surviving Sepsis Campaign

3 hour bundle

- Measure lactate level
- Obtain cultures before antibiotic administration
- Administer broad spectrum antibiotics
- Administer 30cc/kg crystalloid for hypotension or lactate \geq 4mmol/L

6 hour bundle

- Apply vasopressors to maintain mean MAP \geq 65mmHg
- If persistent hypotension after initial fluid administration or if initial lactate was \geq 4mmol/L, re-assess volume status and tissue perfusion and document findings
- Re-measure lactate if initial lactate elevated

Reassessment of volume status & tissue perfusion with:

- Repeat focused exam (vitals, CP exam, cap refill, pulse, skin findings)
- OR 2 of the following:
- CVP
 - ScvO₂
 - Bedside CVUS
 - Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge

New Innovations

- ED Screening
- EMR Alert for inpatient screening
 - Clinical instructions for nursing
- Physician order set
 - Clinical decision support

ED Screening

- Standard EMR based screening tool
 - 2 SIRS = verbal notification to MD for evaluation
 - 3 SIRS = triggers nursing conditional orders for evaluation
- Use of standard ED sepsis order set
 - One-time STAT dosing of antibiotics

The screenshot shows a web-based screening tool with the following elements:

- Criteria Section:** A list of five criteria, each with a "Yes" and "No" checkbox. The "Yes" boxes are checked for Hypothermia < 36 C, Tachypnea > 20, and Known infection or recently taking antibiotics. The "No" boxes are checked for Tachycardia > 90 bpm and Systolic Blood Pressure < 90 mm Hg.
- Total number of signs present:** A text input field containing the number "5".
- Alert:** A box stating "3 or more of the above criteria are positive. Notify the physician and order the clinical guidelines below:".
- Clinical Guidelines:** A section with a red header and a "+ All - All" toggle. It contains a grid of checkboxes for various orders: CBC/Diff, Urinalysis, Cardiac Monitor, Saline Lock #1, CMP (Chem 14), Urine Culture, B/P Monitor, Saline Lock #2, PTT, Blood culture #1 of 2, Pulse Oximetry, Acetaminophen 650mg PO Fever > 38.1C, PT, Blood Culture #2 of 2, O2 @ 2 lpm NC, Serum Lactic Acid, Stat PCXR With DR./PA approval, and a yellow button "If unable to take orally order".
- Bottom Section:** Two yellow buttons: "Qual. B-HCG (all premenopausal)" and "Acetaminophen 650mg PR Fever > 38.1C".

If "Yes" is answered on 3 or more criteria, the screen is positive. If positive, notify the provider and implement the clinical guidelines.

Inpatient SIRS Alert Workflow

Assistive Personnel

- First to see the alert
- Enter vitals in the flow sheet
- Acknowledging the alert puts **1 hour** hold on additional alert

Nurse

- Auto-generated task in the worklist
- Signing off tasks places **8 hour hold** on additional alerts
- RN check of notification to MD

Physician

- Gets a call or text page for SIRS Alert
- Goes to the order set
- Indicate clinical decision in the order set

Graded Electronic Alert

SIRS Alert

- At least 3 out of 4 SIRS criteria met

Sepsis Alert

- At least 3 out of 4 SIRS criteria met
PLUS
- Blood culture (with status)

Severe Sepsis Alert

- At least 3 out of 4 SIRS criteria met
PLUS
- Blood culture (with status)
PLUS
- Systolic BP <100 OR labs with evidence of new organ failure

Nursing clinical instructions with each alert

- Notify Provider
- Consider evaluation for infection
- Consider lactate measurement

- Increase vitals
- Consider lactate
- Strict I&O
- Monitor respiratory and mental status

- Call a rapid response
- Call provider for immediate bed-side assessment
- Initiate bundle

SIRS ALERT

Alert Detail - EMRPROCESSANALYST, DAVID - Save Flowsheet

Alert Summary

Ack...	Viewed	Doc...	Alert	Priority	Type	Comment	Scope
✓	✓		SIRS Alert!	HIGH	NOTICE	!	Chart

Alert: SIRS Alert!

Message: SIRS Alert!
The SIRS score is 3. Notify provider. Sign off SIRS communication task. The task can page the provider for you.

[Expand](#)

MRN= 78937118, EMRPROCESSANALYST, DAVID
SIRS Score = 3
Heart Rate= 150 @ 27-Aug-2015 12:51:00
Respiratory Rate= 39 @ 27-Aug-2015 12:51:00
Temperature C= 38.5 @ 27-Aug-2015 12:51:00
BP= 90/60 @ 27-Aug-2015 12:51:00

Acknowledgement Comment:

! A comment must be added before clicking Proceed.

Acknowledge when seen << Previous Alert 1 of 1 Next >>

Acknowledge all on Proceed

To continue with the Save Flowsheet unchanged click Proceed.

To return to the Save Flowsheet and discard alerts click Go Back.

- SIRS alert:
at least 3 out of
4 SIRS criteria
met

SEPSIS ALERT

Alert Detail - MOLE, LAVENDER - Save Flowsheet

Alert Summary

Ack...	Viewed	Doc...	Alert	Priority	Type	Comment	Scope
✓	✓		SIRS/Sepsis Alert!	HIGH	NOTIFICATION	!	Chart

SEPSIS ALERT

Alert: SIRS/Sepsis Alert!

Message: **SEPSIS ALERT!!**
The SIRS score is 3. Notify provider. Sign off SIRS communication task. The task can page the provider for you.

[Expand](#)

MRN= 98845778, MOLE, LAVENDER
SIRS Score = 3
Heart Rate= 150 @ 31-Aug-2015 09:10:00
Respiratory Rate= 39 @ 31-Aug-2015 09:10:00
Temperature C= 39.5 @ 31-Aug-2015 09:10:00

Blood Culture Ordered, Status = ,Pending Collection on ,31-Aug-2015 08:41:01.

Acknowledgement Comment:

Acknowledge when seen
 Acknowledge all on Proceed

Unacknowledge << Previous Alert 1 of 1 Next >>

To continue with the Save Flowsheet unchanged click Proceed. Proceed

To return to the Save Flowsheet and discard alerts click Go Back. Go Back

Help

- SEPSIS alert:
at least 3 out of 4
SIRS criteria met
PLUS blood
culture
ordered/pending/
resulted

SEPSIS ALERT

Alert Detail - MOLE, LAVENDER - Save Flowsheet

Alert Summary

Ack...	Viewed	Doc...	Alert	Priority	Type	Comment	Scope
✓	✓		SIRS/Sepsis Alert!	HIGH	NOTICE	!	Chart

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Acknowledgement Comment:

A comment must be added before clicking Proceed.

Acknowledge when seen Unacknowledge << Previous Alert 1 of 1 Next >>

Acknowledge all on Proceed

To continue with the Save Flowsheet unchanged click Proceed. Proceed

To return to the Save Flowsheet and discard alerts click Go Back. Go Back

Help

- SEPSIS alert: at least 3 out of 4 SIRS criteria met PLUS blood culture ordered/ pending/ resulted
- Ordered

Blood Culture Ordered, Status = ,Pending Collection on ,31-Aug-2015 08:41:01.

- Pending

Blood Culture Ordered. Status = Collected on 27-Aug-2015 13:14:57.

- Resulted

Blood Cx = Gram positive cocci, clusters @ 02-Sep-2015 08:40:18

SEVERE SEPSIS ALERT

Alert Detail - EMRPROCESSANALYST, DAVID - Save Flowsheet

Alert Summary

Acck...	Viewed	Doc...	Alert	Priority	Type	Comment	Scope
✓	✓		SIRS/Sepsis Alert!	HIGH	NO		Chart

Alert: SIRS/Sepsis Alert!

Message: **SEVERE SEPSIS ALERT!!**
The SIRS score is 3. Notify provider... The task can page the provider for you.

Expand

MRN= 78937118, EMRPROCESSANALYST, DAVID
SIRS Score = 3
Heart Rate= 150 @ 02-Sep-2015 07:34:00
Respiratory Rate= 39 @ 02-Sep-2015 07:34:00
Temperature C= 39.5 @ 02-Sep-2015 07:34:00
BP= 99/60 @ 02-Sep-2015 07:34:00

Blood Culture Ordered, Status = Collected on 27-Aug-2015 13:14:57.

Expand

WBC Count= 15 X10E9/L
Blood Cx = Gram positive cocci, clusters @ 02-Sep-2015 08:40:18
Lactate, Level = 3 mmol/L
Platelet Count= 150 X10E9/L
Creatinine, Serum= 3 mg/dL
APTT= 75 sec
INR= 2 sec
Bilirubin= 3 mg/dL

Acknowledgement Comment:

A comment must be added before clicking Proceed.

Acknowledge when seen Unacknowledge << Previous Alert 1 of 1 Next >>

Acknowledge all on Proceed

To continue with the Save Flowsheet unchanged click Proceed. Proceed

To return to the Save Flowsheet and discard alerts click Go Back. Go Back

Help

- SEVERE SEPSIS alert: at least 3 out of 4 SIRS criteria met PLUS systolic BP <100 OR
- Labs showing evidence of organ failure

Nursing Task View

SIRS Alert Task - EMRPROCESSANALYST, DAVID

SIRS Alert Task - EMRPROCESSANALYST, DAVID

Administered At

Date: 23-Sep-2015 Time: 10:20

Task Information

Task: SEVERE Sepsis Task

Start Date/Time: 23-Sep-2015 10:20 Stop Date/Time:

Review Alert:
Click to View Alert

Interventions

Call a rapid response or Code White. Call provider for immediate bedside assessment. Consider lactate measurement

Discussed with MD/LIP face-face/phone

Physician Pager (5 digit internal):
Nurse's Name:

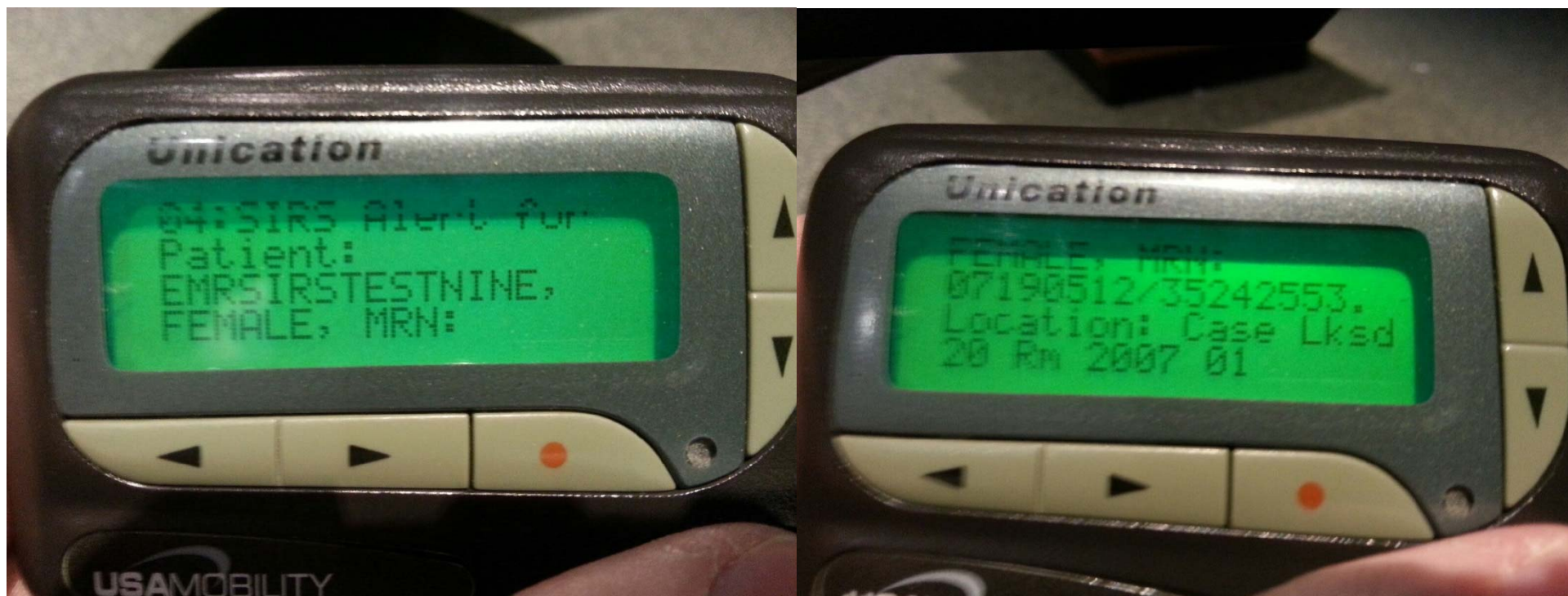
Name of MD/LIP/Team Notified
Nurse Callback Number:

Comment

RN Clinical instructions

MD notification

Sample MD/LIP Text Page



Physician Work-Flow: Order Set

SIRS [18 orders of 123 are selected]

Relevant Results

Creatinine, Serum: 1.00; Combined Measurements
Height (cm)
182.8

Micromedex Link to Up to Date

SIRS acknowledged, treatment underway

Suspect sepsis and infection - Select if work-up and treatment desired

Creatinine Clearance (Calculated)
75

Checking any of these 2 options turns OFF the alert for 24 HOURS

Select one option

Additional orders

Clinical Instructions

Adjust dosage for alterations in renal, hepatic dysfunction and obesity.

Nursing

	Order	Comments / Instructions	Frequency	Frequency Qualifier	PRN	PRN Reason	Site Modifier	Site	Priority	Requested Date	Evid
<input type="checkbox"/>	DNAR								STAT	T	
<input checked="" type="checkbox"/>	Vital Signs	Every 30 minutes, including pulse ox x2, then q1h until pt...	Multiple - see...		<input type="checkbox"/>				Routine	21-May-2015	
<input type="checkbox"/>	Electrocardiogram 12 Lead								STAT	T	
<input type="checkbox"/>	Urinary Catheter, Insert, to gravity		Once		<input type="checkbox"/>				Routine	T	
<input checked="" type="checkbox"/>	IV, Insert	Maintain 2 functional peripheral IVs.	Once		<input type="checkbox"/>				Routine	21-May-2015	
<input checked="" type="checkbox"/>	Intake & Output	Strict	Continuous		<input type="checkbox"/>				Routine	21-May-2015	
<input checked="" type="checkbox"/>	Weight	Please obtain weight for accurate medication dosing, if...	Once		<input type="checkbox"/>				Routine	21-May-2015	
<input checked="" type="checkbox"/>	Blood Glucose POCT		Once		<input type="checkbox"/>				Routine	21-May-2015	
<input checked="" type="checkbox"/>	SIRS Assessment Complete				<input type="checkbox"/>				Routine	21-May-2015	

Contingency

	Order	Reason	Less Than	Greater Than	Over	Time Frame	Comments / Instructions	Priority	Requested Date	Evid
<input checked="" type="checkbox"/>	Call Physician	mean arterial pressure	65				after initial NS bolus.	Routine	21-May-2015	
<input checked="" type="checkbox"/>	Call Physician	SaO2	92%				after treatment initiated.	Routine	21-May-2015	
<input checked="" type="checkbox"/>	Call Physician	heart rate		120			after initial IV fluids.	Routine	21-May-2015	
<input checked="" type="checkbox"/>	Call Physician	urine output	< 35cc/hr...				after starting fluids.	Routine	21-May-2015	
<input type="checkbox"/>	Call Physician	if any BP meds are due						Routine	T	

Pharmacy IV Fluids

	Solution Name	Rate	Line Type	Frequency	Reference Info	Start Date	Priority	Stop After (Duration)	Clinician Notes to Orders Tab & eMAR	Evid
<input type="checkbox"/>	Sodium Chloride 0.9% IV Bolus			Once		T	STAT		Recommended weight...	
<input type="checkbox"/>	Sodium Chloride 0.9% IV Bolus			Once		T	STAT		Recommended weight...	

Laboratory and Blood Bank

	Order	Clinician Instructions	Collection Date	Collection Priority	Floor to Collect	Time	Priority	# of Units	Source	Evid
<input checked="" type="checkbox"/>	Complete Blood Count + Differential		21-May-2015	STAT	<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Renal Function Panel		21-May-2015	STAT	<input checked="" type="checkbox"/>					
<input type="checkbox"/>	Hepatic Function Panel		T	STAT	<input checked="" type="checkbox"/>					
<input type="checkbox"/>	Blood Gas, Arterial		T	STAT	<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Coagulation Screen		21-May-2015	STAT	<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Lactate, Level		21-May-2015	STAT	<input checked="" type="checkbox"/>					
<input type="checkbox"/>	D Dimer		T	STAT	<input checked="" type="checkbox"/>					
<input type="checkbox"/>	Fibrinogen Assay		T	STAT	<input checked="" type="checkbox"/>					
<input type="checkbox"/>	Troponin I, Serum		T	STAT	<input checked="" type="checkbox"/>					
<input type="checkbox"/>	CKMB		T	STAT	<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Urinalysis		21-May-2015		<input checked="" type="checkbox"/>		Routine			

Microbiology

	Order	Source	Site	Site/Source	Current Antibiotic Therapy	Special Instructions	Collection Date	Priority	Evid
<input checked="" type="checkbox"/>	Culture, Blood	Blood (BLD)				Should be drawn from 2...	21-May-2015		
<input checked="" type="checkbox"/>	Culture, Blood	Blood (BLD)				Should be drawn from 2...	21-May-2015		
<input checked="" type="checkbox"/>	Culture, Urine	Urine (URINE)					21-May-2015	Routine	
<input type="checkbox"/>	Legionella Antigen, Urine						T	Routine	
<input type="checkbox"/>	Culture, Respiratory Lower, incl. smear	Sputum...					T	Routine	
<input type="checkbox"/>	Clostridium Difficile Toxin, PCR						T	Routine	
<input type="checkbox"/>	Culture, Stool	Stool (STL)					T	Routine	
<input type="checkbox"/>	Culture, Body Fluid, includes smear	Fluid (FLU)					T	Routine	

Blood Products

	Order	# of Units	# of mls	Transfusion Indication	Special Needs	Directed/ Autologous	Special Instructions	Requested Date	Priority	Evid
<input type="checkbox"/>	Type + Screen							T		
<input type="checkbox"/>	Blood Bank OS									

Diagnostic Radiology Xray US NM MRI MRA

	Order	Portable	Current Signs and Symptoms	Is Preg -nant	LMP	Check all Conditions that Apply	Requesting Physician Contact #	Special Instructions	Date	Priority	Evid
<input type="checkbox"/>	Xray Chest 1 View	<input checked="" type="checkbox"/>								Level 2 - Urgent within...	
<input type="checkbox"/>	Xray Chest 2 View PA + Lateral									Level 2 - Urgent within...	

Ordering antibiotics in SIRS/Sepsis Order Set

MDR Risk Factors: Hospitalized in last 90 days, nursing home patient with feeding tube, bed bound, chronic dialysis, recent antibiotic therapy, immunocompromised, recent surgical procedure.

MDR risk factors

Penicillin Allergy?	Suspected Source	Multidrug Resistance?	Other suspected organisms
Yes <input type="checkbox"/>	Lung <input type="checkbox"/>	Yes <input type="checkbox"/>	MRSA <input type="checkbox"/>
No <input type="checkbox"/>	Urinary <input type="checkbox"/>	No <input type="checkbox"/>	Pneumococcal Meningitis <input type="checkbox"/>
	GI/Intrabd <input type="checkbox"/>		Viral Encephalitis <input type="checkbox"/>
	Skin/Soft tissue <input type="checkbox"/>		Listeria <input type="checkbox"/>
	CNS <input type="checkbox"/>		C Diff <input type="checkbox"/>
	Source unknown <input type="checkbox"/>		Necrotizing Fasciitis <input type="checkbox"/>

PCN allergy

Antibiotics

Medications	BRAND	Dose	Units	Rate	Route	Frequency	Does Patient Have Pneumonia?	Reference Info	Start Date	Priority	Stop After (Duration)	Clinician Notes to Orders Tab & eMAR	Evid
- Antibiotics - 26 item(s)													
<input type="checkbox"/> Acyclovir IV Piggy Back	ZOVR...		mg		IntraVenous...	Every 8 Hours		10 mg/kg...	T	STAT		if viral encephalitis suspected	
<input type="checkbox"/> Ampicillin IV Piggy Back		2	gram(s)		IntraVenous...	Every 4 Hours			T	STAT		if Listeria suspected	
<input type="checkbox"/> Ampicillin - Sulbactam IV Piggy Back	UNAS...	3	gram(s)		IntraVenous...	Every 6 Hours			T	STAT			
<input type="checkbox"/> Azithromycin IV Piggy Back	ZITHR...	500	mg		IntraVenous...	Every 24 Hours			T	STAT			
<input type="checkbox"/> Aztreonam 1 gram/ D5W IVPB Premixed...	AZAC...				IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Aztreonam 2 gram/D5W IVPB Premixed...	AZAC...				IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Cefazolin 1 gram IVPB/ Premixed Soln...	ANCEF				IntraVenous...	Every 6 Hours			T	STAT			
<input type="checkbox"/> Cefepime 2 gram IVPB/ Premixed Soln...	MAXIP...				IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Cefepime 2 gram IVPB/ Premixed Soln...	MAXIP...				IntraVenous...	Every 12 Hours			T	STAT			
<input type="checkbox"/> Ceftazidime 2 gm IVPB/ Premixed Soln...	FORT...				IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Ceftriaxone 1 gram/ Dextrose 5% IVPB...	ROCE...				IntraVenous...	Every 24 Hours			T	STAT			
<input type="checkbox"/> Ceftriaxone 2 gram/Dextrose 5% IVPB...	ROCE...				IntraVenous...	Every 12 Hours			T	STAT			
<input type="checkbox"/> Ciprofloxacin 400 mg IVPB/ Premixed...	CIPRO				IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Ciprofloxacin 400 mg IVPB/ Premixed...	CIPRO				IntraVenous...	Every 12 Hours			T	STAT			
<input type="checkbox"/> Clindamycin 600 mg IVPB/ Premixed...	CLEO...				IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Dexamethasone Injectable	DECA...		mg		IntraVenous...	Every 6 Hours		0.15 mg/kg	T	STAT	48 Hours	Administer before 1st dose of antibiotics if...	
<input type="checkbox"/> Ertapenem IV Piggy Back	INVANZ	1	gram(s)		IntraVenous...	Every 24 Hours			T	STAT			
<input type="checkbox"/> Levofloxacin 750 mg IVPB/ Premixed...	LEVA...				IntraVenous...	Every 24 Hours			T	STAT			
<input type="checkbox"/> Meropenem IV Piggy Back	MERR...	1	gram(s)		IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Meropenem IV Piggy Back	MERR...	2	gram(s)		IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Metronidazole 500 mg IVPB/ Premixed...	FLAG...				IntraVenous...	Every 6 Hours			T	STAT			
<input type="checkbox"/> Metronidazole 500 mg IVPB/ Premixed...	FLAG...				IntraVenous...	Every 8 Hours			T	STAT			
<input type="checkbox"/> Piperacillin - Tazobactam 3.375 gram/Iso...	ZOSYN				IntraVenous...	Every 6 Hours			T	STAT			
<input type="checkbox"/> Piperacillin - Tazobactam 4.5 gram/Iso...	ZOSYN				IntraVenous...	Every 6 Hours			T	STAT			
<input type="checkbox"/> Vancomycin IV Piggy Back			mg		IntraVenous...	Every 12 Hours		15 mg/kg	T	STAT			
<input type="checkbox"/> Vancomycin Oral Liquid		125	mg		Oral	Every 6 Hours			T	STAT			

Algorithm will only open antibiotics based on above selected criteria to guide therapy

STAT default

Next steps

- ED enhancements
 - Using e-boards to notify MD's of septic patients
- Inpatient enhancements
 - Clinical instructions → Conditional orders
- Standardize workflow across system
- Standardize workflow across patient continuum of care
- Development of standard response teams/individuals

Thank you!

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