



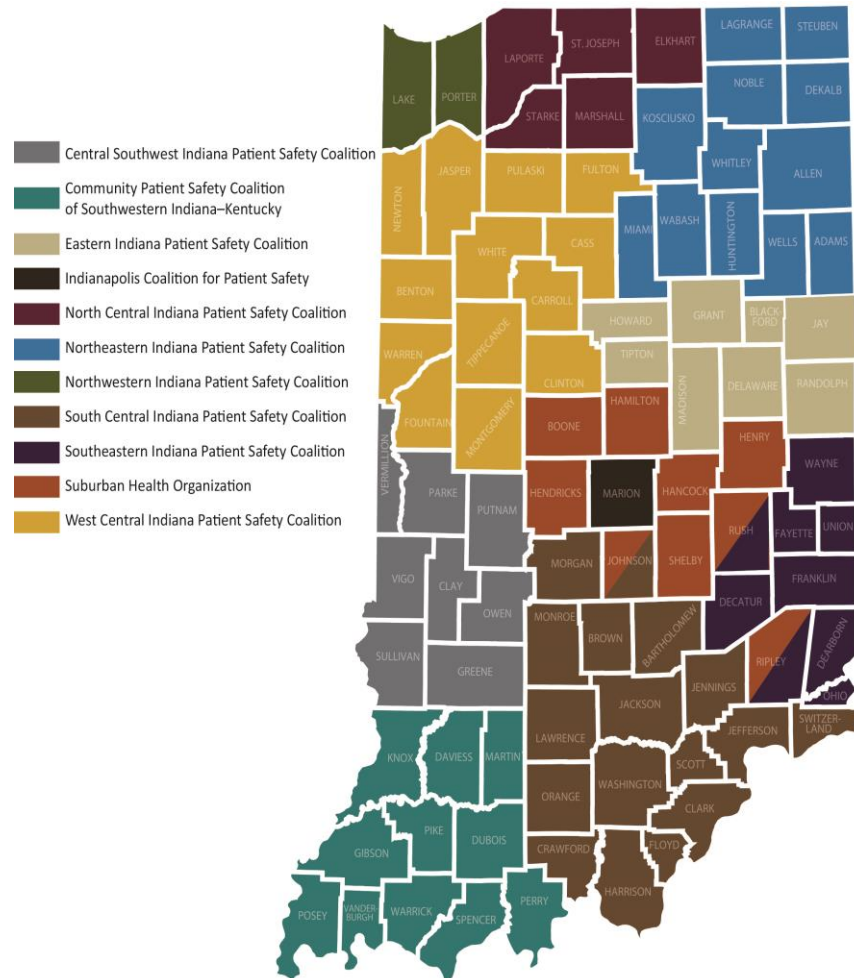
**Indiana Patient
Safety Center**

of the Indiana Hospital Association

Sepsis Awareness Month Advances in Fluid Management

Sept 29, 2022

Our Mission



Advancing Health in Indiana

- Engage and inspire health care providers
- Create safe cultures
- Create reliable systems of care
- Prevent patient harm in Indiana

PREVENT PATIENT HARM

To create high reliability organizations who collaborate and engage in continuous improvement to achieve best in class outcomes

IMPROVE COMMUNITY HEALTH

To partner with communities and stakeholders to develop, plan, and coordinate initiatives that span the prevention and care continuum

INCREASE PATIENT AND FAMILY ENGAGEMENT

To engage patients and families in all aspects of their care and seek their input and inclusion in advisory capacities throughout organizations

LEAD A CULTURE OF SAFETY

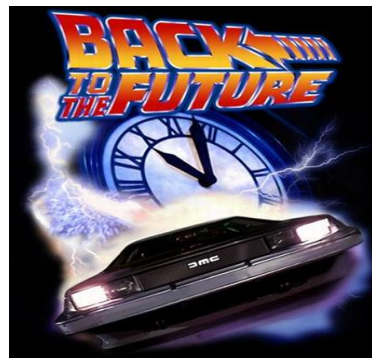
To create an environment of mutual trust, respect, and transparency among organizations, patients, and families

Sepsis: Back and to the Future

IHA 2022 Sepsis Awareness Month Webinars

1-Sept.	3 p.m. ET	Indiana Sepsis State of the State
8-Sept.	3 p.m. ET	Sepsis Pathophysiology & Bundle Compliance
15-Sept.	3 p.m. ET	Sepsis Diagnostic Advances
22-Sept.	3 p.m. ET	Maternal Sepsis
★ 29-Sept.	3 p.m. ET	Sepsis Fluid Management Advances
6-Oct.	3 p.m. ET	Personal Hygiene and Sepsis Prevention

Click on link to register for each webinar



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Sepsis Webinar Details

2022 IHA Clinical Webinar Series - 3 - 4 p.m. ET

Sepsis: Back & to the Future (Click link to register)

Sept. 1: [Indiana Sepsis 2022: Current State of the State and New Resources](#),

Rebecca Hancock PhD, RN, CNS, Patient Quality & Safety Advisor, IHA

Chris Newkirk, BSN, RN, CCM, Clinical Quality Advisor, Columbus Regional Health

Sept. 8: [Sepsis Back to Basics: Pathophysiology and Bundle Compliance](#),

Tom Ahrens, PhD, RN, FAAN

Sept. 15: [Sepsis Future: Advances in Sepsis Diagnostics](#),

Dr. Sandy Estrada, Pharm.D., Clinical Consultant

Sept. 22: [Sepsis Future: Focus on Maternal Sepsis](#),

Brittany Waggoner, Patient Safety & Quality Advisor, RN, MSN, CNS, IHA

Sept. 29: [Sepsis Future: Fluid Management](#)

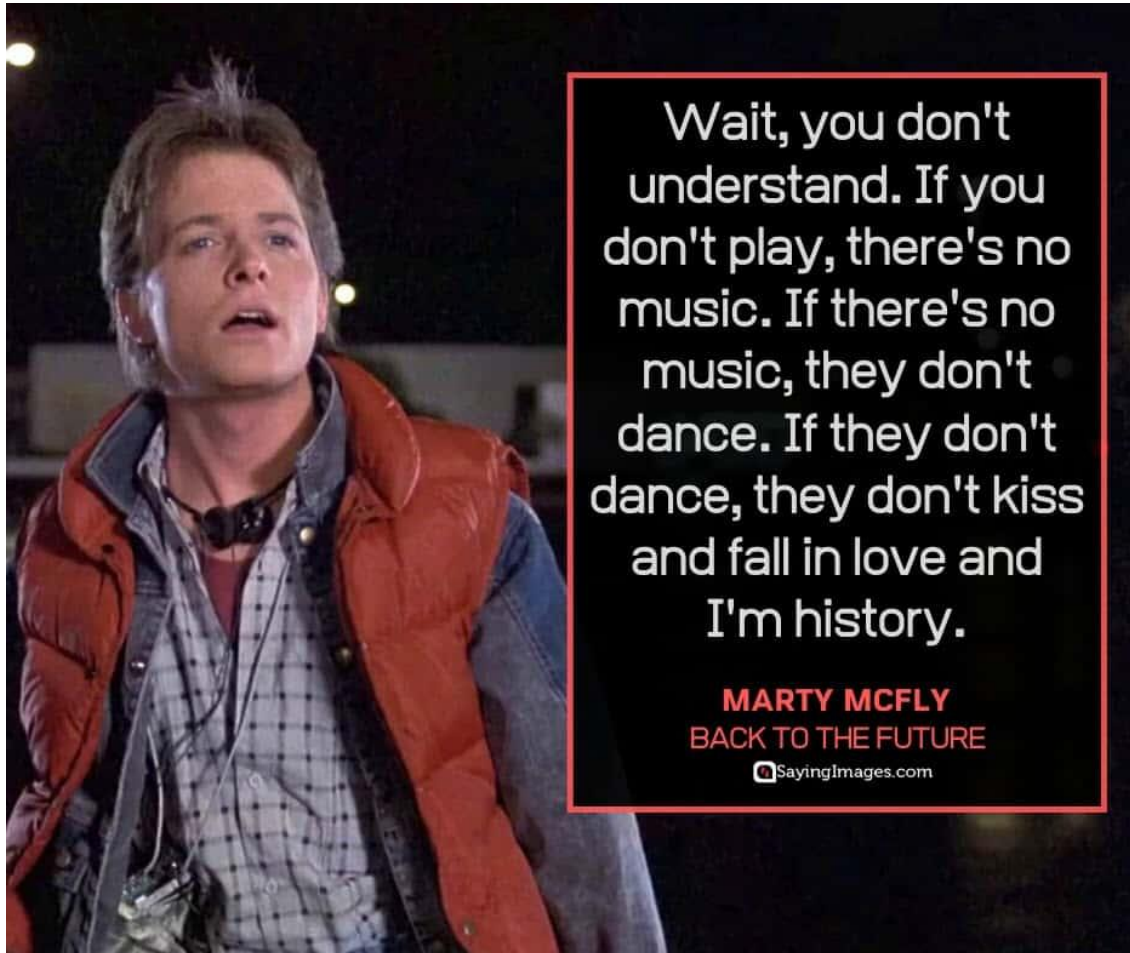
Danielle Herr BSN, CCRN, Therapy Development Specialist

Vince Holly, MSN, RN, CCNS, ACNS-BC, CCRN, FCNS, Indiana University Health-Bloomington

Oct. 6: [Back to the Basics with Personal Hygiene for Infection Prevention](#)

Rebecca Hancock, Patient Quality & Safety Advisor, IHA

Annette Handy, Clinical Director, Patient Safety Center, IHA



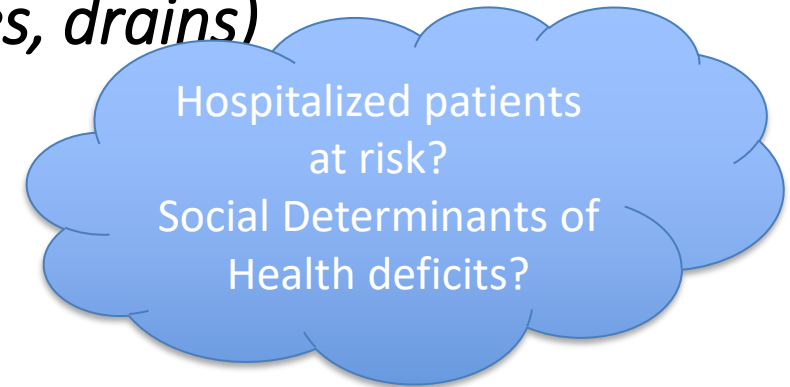
If we don't improve, we won't reduce mortality. If we don't improve sepsis care sequences....?

Objectives

1. Describe challenges in sepsis fluid resuscitation
2. Describe research in fluid resuscitation responsiveness and assessments (FRESH, Kansas City studies)
3. Apply fluid volume resuscitation management device to sepsis patient scenario

Risk Factors for Sepsis

- *Recent UTI, pneumonia or operative event (lines, drains)*
- *Diabetes*
- *Immunosuppressive therapy*
- *Elective surgery*
- *Chronic renal failure*
- *Alcohol abuse*
- *Splenectomy*
- *Sickle Cell*
- *Non-modifiable factors: age (very old or young), gender (M>F), race (B>W)*



(Kumar et al, 2006; Torres et al, 2004; Englert & Ross, 2015)

Sepsis Signs & Symptoms (Clinical)

EMR
Screening
with AI

Systemic Inflammatory Response Syndrome (SIRS) Criteria:

- **Suspected new or worsening infection with 2 or more:**
 1. Fever $> 38.3^{\circ}\text{C}$ / 100.4°F or less than 36°F / 96.8°F (NSAIDS / Tylenol can mask)
 2. HR > 90 bpm (beta blockers can mask)
 3. RR > 20 bpm
 4. WBC $> 12,000$ or $< 4,000$ or $> 10\%$ bands

Other:

1. Altered mental status, falls
2. Severe Sepsis/Shock: SBP < 90 mm Hg or SBP decrease > 40 mm HG in adults
3. Delirium, anorexia, malaise, urinary incontinence, weakness, functional decline, withdrawal, agitation (Girard et al., 2015; Nasa et al., 2012; Englert & Ross, 2015)

Symptoms atypical in very old and very young

Sepsis Signs & Symptoms

Systemic Inflammatory Response Syndrome (SIRS)

- *Suspected or worsened infection with:*
 - Low blood pressure <90 SBP
 - Fever (consider recent anti-pyretics-Tylenol/Advil)
 - Lactate >2; WBC >
 - Hypothermia
 - Heart rate over 90 bpm (consider beta blockers that lower HR)
 - Respiratory rate over 20 bpm
 - Significant edema
 - Hyperglycemia in absence of diabetes
 - Altered mental status?



(Dellinger et al., 2013)

SYMPTOMS OF SEPSIS

S Shivering, fever, or very cold
E Extreme pain or general discomfort (“worst ever”)
P Pale or discolored skin
S Sleepy, difficult to rouse, confused
I “I feel like I might die”
S Short of breath

 Watch for a combination of these symptoms. If you suspect sepsis, see a doctor urgently, CALL 911 or go to a hospital and say, “I AM CONCERNED ABOUT SEPSIS.”


SEPSIS.ORG



When it comes to sepsis, remember **IT'S ABOUT TIME™**. Watch for:

T	I	M	E
TEMPERATURE higher or lower than normal	INFECTION may have signs and symptoms of an infection	MENTAL DECLINE confused, sleepy, difficult to rouse	EXTREMELY ILL “I feel like I might die,” severe pain or discomfort

Watch for a combination of these symptoms. If you suspect sepsis, see a doctor urgently, CALL 911 or go to a hospital and say, “I AM CONCERNED ABOUT SEPSIS.”

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CMS Sepsis Bundle

Numerator

Type of Measure: Process

Improvement Noted As: An increase in the rate

Numerator Statement: Patients who received ALL of the following:

Within three hours of presentation of severe sepsis:

- Initial lactate level measurement
- Broad spectrum or other antibiotics administered
- Blood cultures drawn prior to antibiotics

AND received within six hours of presentation of severe sepsis. ONLY if the initial lactate is elevated:

- Repeat lactate level measurement

AND within three hours of initial hypotension:

- Resuscitation with 30 mL/kg crystalloid fluids

OR within three hours of septic shock:

- Resuscitation with 30 mL/kg crystalloid fluids

AND within six hours of septic shock presentation, ONLY if hypotension persists after fluid administration:

- Vasopressors are administered

AND within six hours of septic shock presentation, if hypotension persists after fluid administration or initial lactate ≥ 4 mmol/L:

- Repeat volume status and tissue perfusion assessment is performed

[CMS IPQR Sepsis Specs Specifications Manual for National Hospital Inpatient Quality Measures Discharges 01-01-22 \(1Q22\) through 06-30-22 \(2Q22\) Version 5.10](#)

Denominator/Exclusions

Denominator Statement: Inpatients age 18 and over with an ICD-10-CM Principal or Other Diagnosis Code of Sepsis, Severe Sepsis, or Septic Shock and not equal to U07.1 (COVID-19).

Included Populations: Discharges age 18 and over with an ICD-10-CM Principal or Other Diagnosis Code of Sepsis, Severe Sepsis, or Septic Shock as defined in Appendix A, Table 4.01.

Excluded Populations:

- Patients with an ICD-10-CM Principal or Other Diagnosis Code of U07.1 (COVID-19)
- Directive for Comfort Care or Palliative Care within six hours of presentation of severe sepsis
- Directive for Comfort Care or Palliative Care within six hours of presentation of septic shock
- Administrative contraindication to care within six hours of presentation of severe sepsis
- Administrative contraindication to care within six hours of presentation of septic shock
- Length of Stay >120 days
- Transfer in from another acute care facility
- Patients enrolled in a clinical trial for sepsis, severe sepsis or septic shock treatment or intervention
- Patients with severe sepsis who are discharged within six hours of presentation
- Patients with septic shock who are discharged within six hours of Presentation
- Patients receiving IV antibiotics for more than 24 hours prior to presentation of severe sepsis

IHAconnect.org/Quality-Patient-Safety

Sepsis CMS Specification Changes

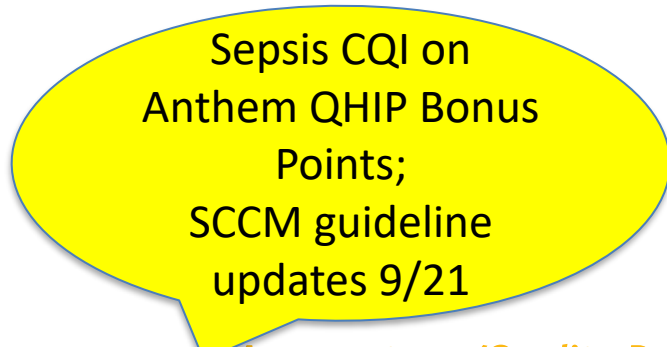
starting 7/1/2021

Fluids Exclusion

- Provider must specifically and accurately document end stage heart failure NYHA Class 3 or 4, or renal disease as noted in specs,
- Volume patient would have received, and
- Expected volume to infuse in place of 30 ml/kg of ideal body weight

Antibiotic Modification

- Broad spectrum or other antibiotic specifications criteria removed, but timeframe for administration remains with focus on timing of administration rather than antibiotic selection



Sepsis CQI on
Anthem QHIP Bonus
Points;
SCCM guideline
updates 9/21

[Quality Net Inpatient Specs v. 5.1, Q3-Q4 2021](#)

CMS Fluid Specs 1/1/2022

1. *Crystalloid fluid volumes ordered that are equivalent to 30 mL/kg or a lesser volume with a reason for the lesser volume specifically documented by the physician/APN/PA are the target ordered volume.*
2. *A physician/APN/PA order for a volume of crystalloid fluids that is within 10% less than 30 mL/kg is acceptable for the target ordered volume. Documentation of a reason for a volume that is within 10% less than 30 mL/kg is not required.*
3. *There is a physician/APN/PA order for the lesser volume of crystalloid fluids as either a specific volume (e.g. 1500 mL) or a weight-based volume (e.g. 25 mL/kg).*
4. *The ordering physician/APN/PA documented within a single note in the medical record all of the following:*
 - The volume of fluids to be administered as either a specific volume (e.g. 1500 mL) or a weight-based volume (e.g. 25 mL/kg) AND a reason for ordering a volume less than 30 mL/kg of crystalloid fluids.
 - Reasons include and are not limited to:
 - concern for fluid overload
 - heart failure
 - renal failure
 - blood pressure responded to lesser volume
 - a portion of the crystalloid fluid volume was administered as colloids (if a portion consisted of colloids, there must be an order and documentation that colloids were started or noted as given)

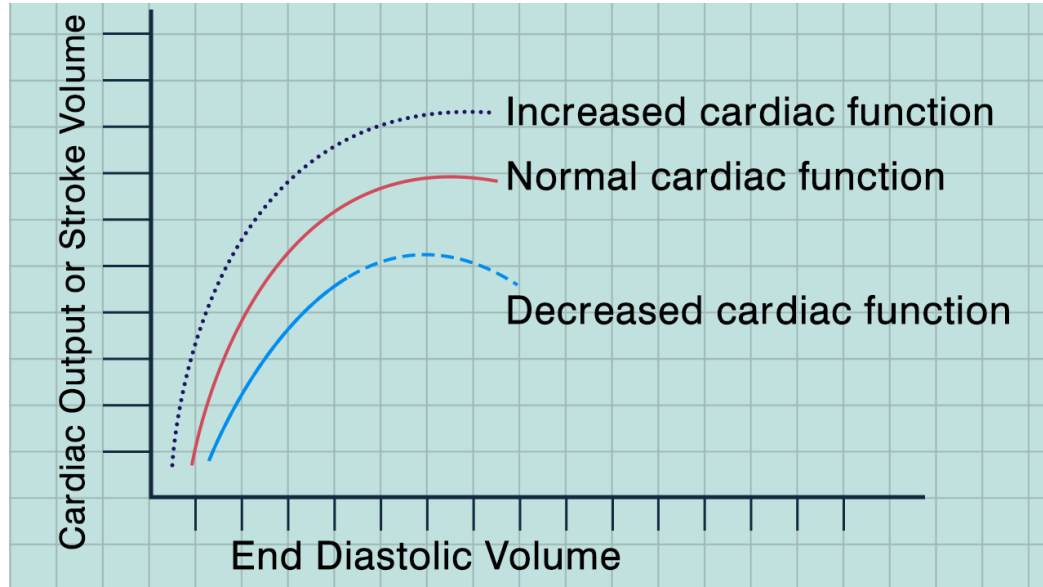
Sep-1 vs Sep-3 diagnostic criteria—CMS clearing mud!

Hospital-Based Sepsis Care: The Evolving Definition of Sepsis and the Roles of the ED Medical Director and Quality Team in Sepsis Care (qualityreportingcenter.com), Nov 2021

2021 SCCM Sepsis Guidelines

Recommendation	Quality of Evidence / Strength of Recommendation
For patients with sepsis-induced hypoperfusion or septic shock, we suggest that at least 30 mL/kg of IV crystalloid fluid be given within the first 3 hours of resuscitation.	Low/ Weak
For adults with sepsis or septic shock, we suggest using dynamic measures to guide fluid resuscitation over physical examination or static parameters alone.	Very Low/Weak
For adults with septic shock, we suggest using capillary refill time to guide resuscitation as an adjunct to other measures of perfusion.	Low / Weak
For adults with septic shock on vasopressors, we recommend an initial target mean arterial pressure (MAP) of 65 mm Hg over higher MAP targets.	Moderate / Strong
For adults with septic shock, we suggest using capillary refill time to guide resuscitation as an adjunct to other measures of perfusion.	Low / Weak

Frank-Starling law



The Frank-Starling law mechanism can be defined as ‘an intrinsic adaptive response which serves to adjust each ventricular output to its inflow by increasing the force of contraction of the myocardium proportionally to any increase in the length of the muscle fibers’, i.e., increase in the volume of blood entering the heart stretches the walls of the ventricle, which causes the heart to contract with more force, like a stretched rubber band, increasing the volume of each stroke of the heart.

Guest Speakers

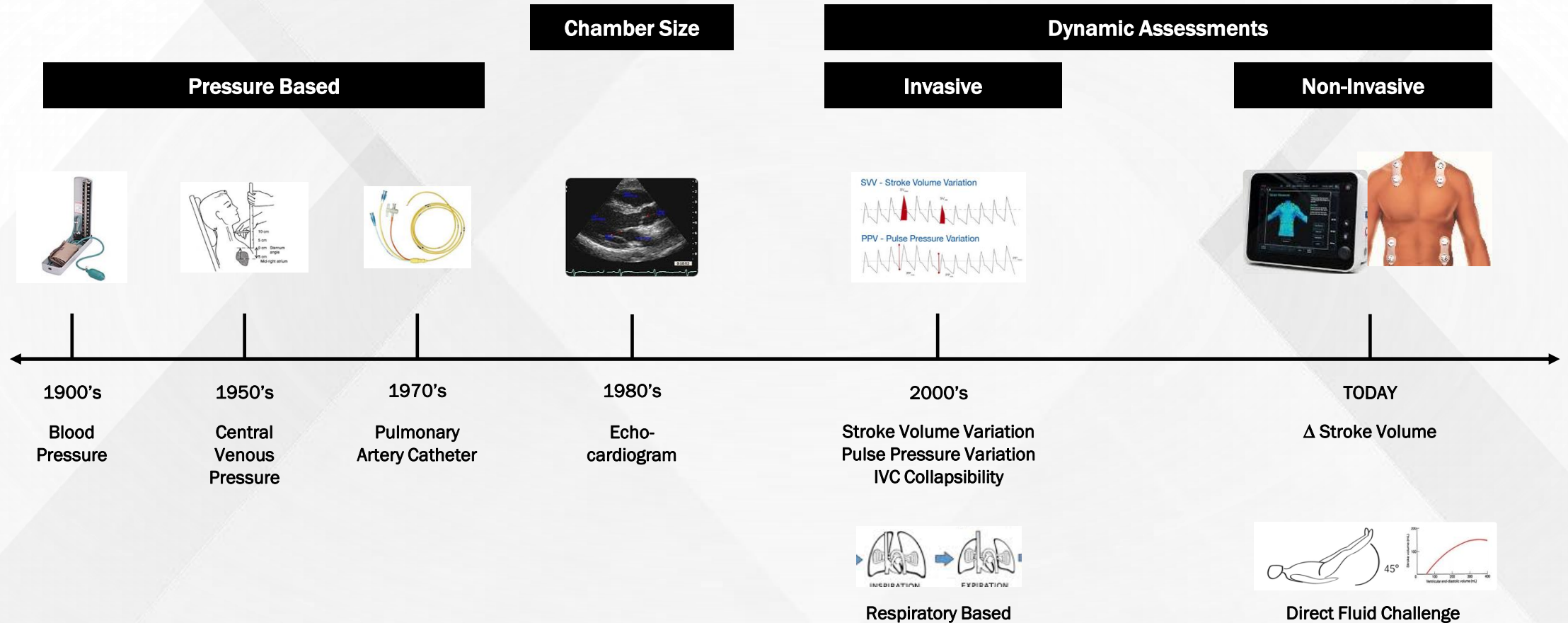


Danielle Herr, RN, BSN
Therapy Development Specialist at
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Vince Holly, MSN, RN, CCNS, ACNS-BC, CCRN, FCNS,
Clinical Nurse Specialist - Critical Care
Indiana University Health-Bloomington

100+ YEARS OF TECHNOLOGY: WILL MY PATIENT RESPOND TO IV FLUID?



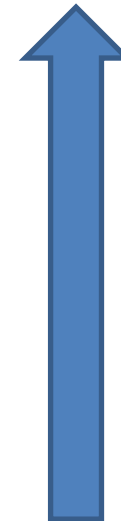
Optimization of Preload in Severe Sepsis and Septic Shock

Adil Shujaat and Abubakr A. Bajwa

TABLE 1: Accuracy of various parameters used to predict preload responsiveness [7, 10].

Parameter	Technology	AUC with 95% CI
PLR*	Various methods of CO measurement	0.95 (0.92–0.97)
PPV	Arterial BP waveform	0.94 (0.93–0.95)
SVV	Arterial BP waveform analysis by proprietary algorithm	0.84 (0.78–0.88)
LVEDAI	Echocardiography	0.64 (0.53–0.74)
GEDV	Thermodilution	0.56 (0.37–0.67)
CVP	Central venous catheter	0.55 (0.48–0.62)

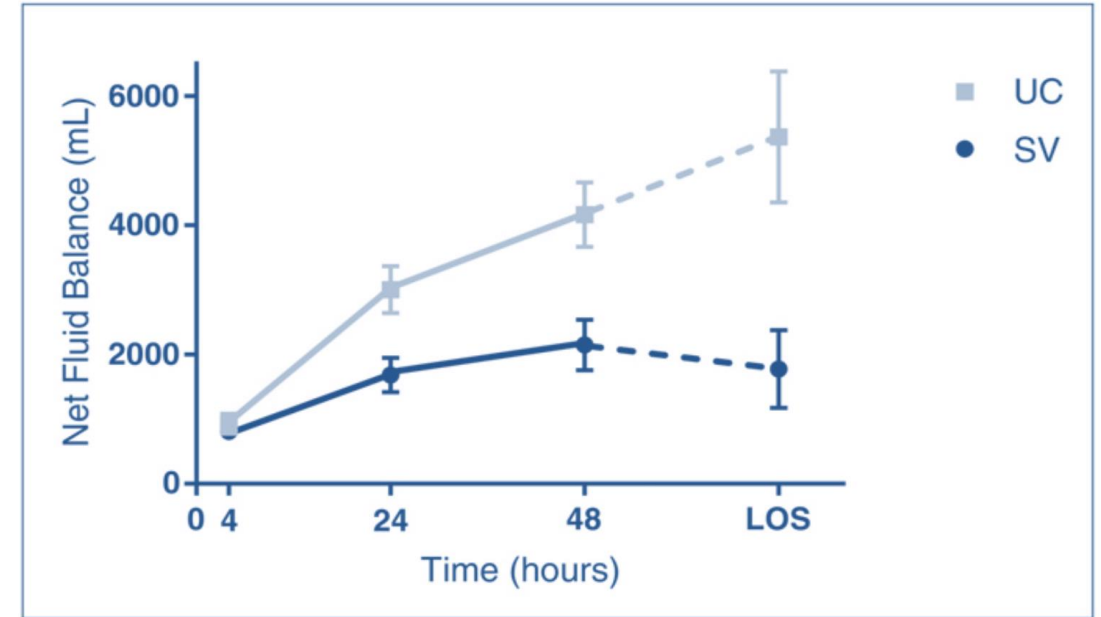
PLR: passive leg raising, PPV: pulse pressure variation, SVV: stroke volume variation, LVEDAI: left ventricular end-diastolic area index, GEDV: global end-diastolic volume, CVP: central venous pressure, AUC: area under receiver operating characteristics curve.



KU – DYNAMIC MEASURES IN SEPSIS

- *Stroke volume guided resuscitation in severe sepsis and septic shock may improve outcomes*

- *Heath E. Latham, Charles D. Bengtson, Lewis Satterwhite, Mindy Stites, Dipti P. Subramaniam, G. John Chen, Steven Q. Simpson*
- *Retrospective, matched, single-center study of nearly 200 patients:*
- *SV guided fluid in severe sepsis and septic shock*
- *100 SV vs. 91 Usual Care*
- *Retrospective cohort study*



- *Reduced Fluid Balance – 1.77L vs. 5.36L ($p = 0.022$)*
- *Reduced ICU LOS – 2.89 days ($p = 0.03$)*
- *Less vasopressor – 32.8 hours ($p = 0.001$)*
- *Less mechanical ventilation – RR .51 ($p = 0.0001$)*
- *Less dialysis – 6.25% vs. 19.5% RR .32 ($p = 0.01$)*
- *53% Fluid Responsive*

FRESH STUDY

*Published in
CHEST journal October 2020*

- *Multi-Center Randomized Clinical Trial*
- *13 hospitals participated*
- *Enrolled patients from ER to ICU*
- *Used dynamic assessments to determine need for fluids vs pressors*

Clinical Decision is made to treat the patient with either fluid and/or vasoactive medications. This may be due:

- MAP < 65, SBP < 90, or BP is rapidly trending lower
- low urine output
- any other clinical indication to administer/after fluid bolus or pressors

Vasoactive medication may be de-escalated at the clinician's discretion but re-escalation should trigger this PLR algorithm

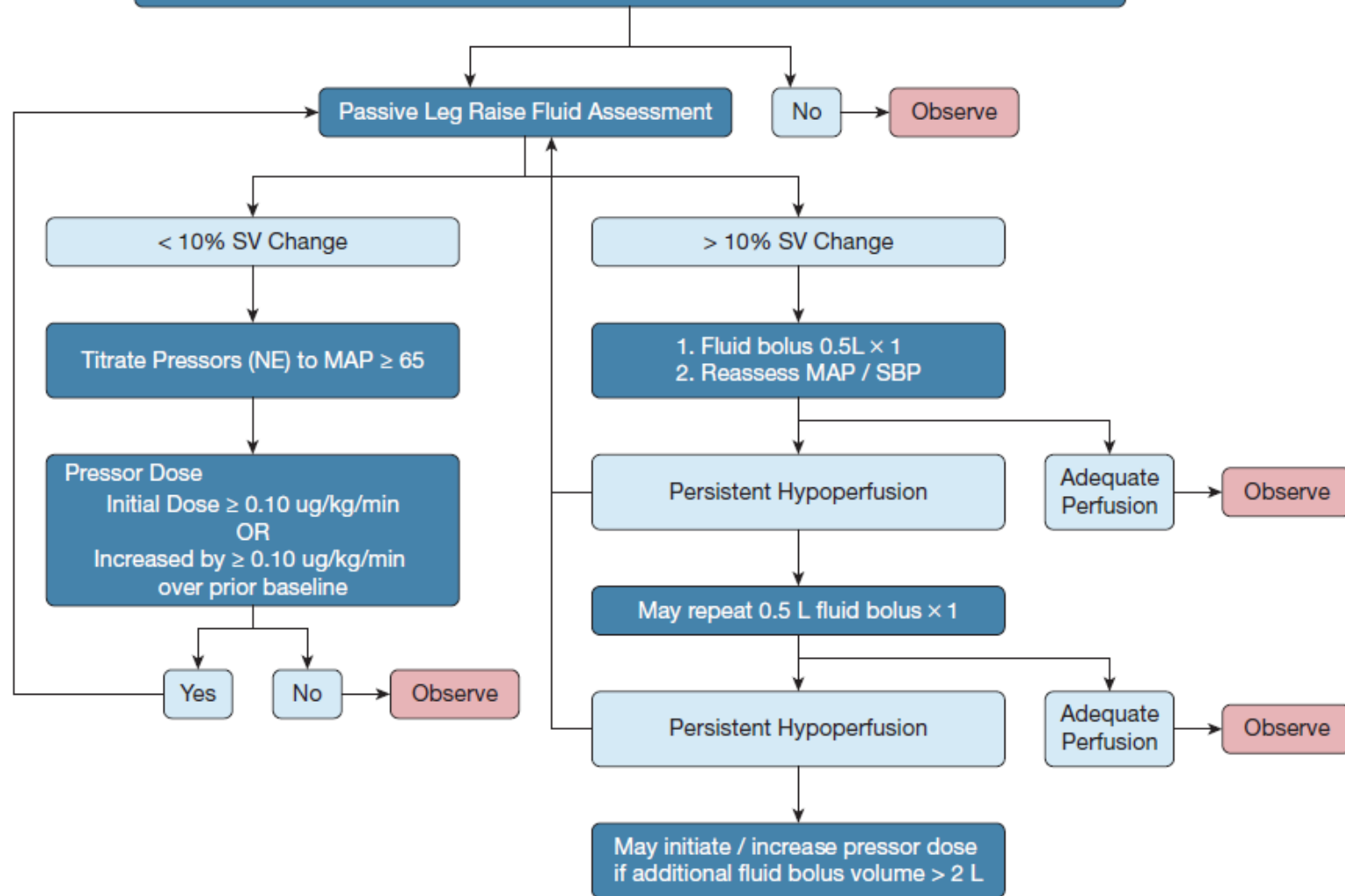
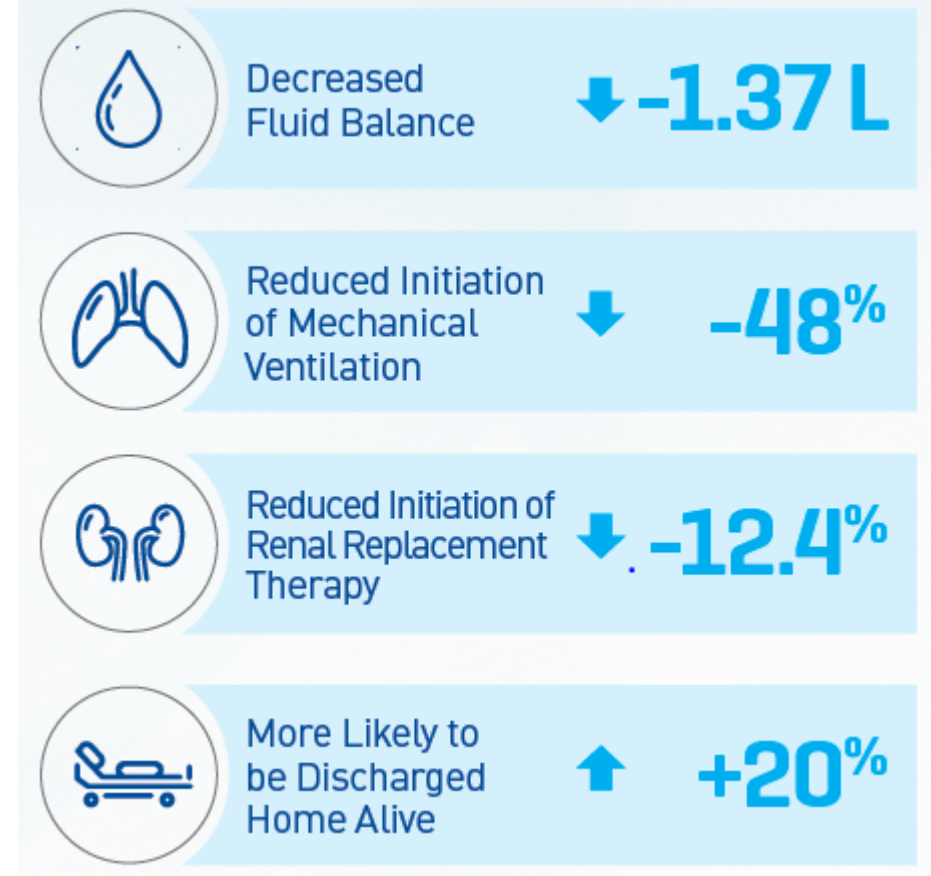


Figure 1 – Flow chart model of the algorithm used to guide treatment in the Fluid Responsiveness Evaluation in Sepsis-associated Hypotension study. MAP = mean arterial pressure; NE = norepinephrine; PLR = passive leg raise; SBP = systolic BP; SV = stroke volume.

FRESH SEPSIS TRIAL DEMONSTRATES IMPROVED PATIENT OUTCOMES

- *When Using Dynamic Measures to Guide Fluid Decisions¹*
 - 13 hospitals in the United States and the United Kingdom
 - 83 SV vs. 41 Usual Care
 - 523 PLR assessments
 - Investigators were asked to perform a PLR any time they were considering fluid administration .
 - Primary clinical outcome was fluid balance at 72-hours or ICU discharge, whichever occurred *first*.

FRESH is the first prospective, multi-center randomized clinical trial demonstrating improved outcomes when a dynamic assessment of fluid responsiveness (PLR) is used to guide treatment in severe sepsis and septic shock patients



DYNAMIC MEASURES TO GUIDE FLUID IN SEPTIC SHOCK

Variable	SV Guided ¹	Control ¹	Δ / p ¹	Cost Assumptions*	Cost Avoidance*
Fluid Balance (Liters)	1.77L ± 0.60	5.36L ± 1.01	3.59L p=0.002		
ICU LOS (Days)	5.98 ± 0.68	8.87 ± 1.18	2.89 days p=0.03	\$US 4004/ICU day ² \$US 906/floor day ³	\$8,953
Pressor Use (Hours)	32.08 ± 5.22	64.86 ± 8.39	32.78 hours p=0.001		
Mechanical Ventilation Risk	29%	57%	RR=0.51 p = 0.001	\$US 1522/day ⁴ 5.1 days ³	\$1,940
Acute Dialysis Therapy Initiated	6.25%	19.5%	13.25% P = 0.01	\$27,182 x (12.73 cases avoided/ 96 total patients) ³	\$3,605

Estimated Savings Per Treated Patient

\$14,498

COST ASSUMPTIONS

ICU Length of Stay (LOS): 2.89 days x (\$4,004 [Avg ICU Day] – \$906 [Avg Floor Day]) = \$8,953

Mechanical Ventilation (MV): \$1,522 x 5.1 days x .25 = \$1,940

Assumes:

1. Incremental cost of MV \$1,522/day. 2. Average duration of MV in septic shock 5.1 days. 3. Assumes an absolute 25% reduction of patients receiving mechanical ventilation.

Acute Dialysis Therapy: \$27,182 (avg. dialysis-related hospital costs) x (12.73 cases avoided/96 total patients) = \$3,605

¹ Latham H, et al. Stroke volume guided resuscitation in severe sepsis and septic shock improves outcomes. J Crit Care 2017; 28:42-46

² Huynh T, et al. The frequency and cost of treatment perceived to be futile in critical care. JAMA Internal Med. 2013; 173.

³ Premier Data Set, 2013. Premier, Inc.

⁴ Dasta JF, McLaughlin TP, Mody SH, Piech CT. Daily cost of an intensive care unit day: The contribution of mechanical ventilation. Crit Care Med. 2005; 33(6):1266-1271.

EASILY INTEGRATES INTO YOUR WORKFLOW

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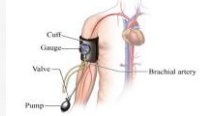
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1. Do I have a perfusion problem?

Is a perfusion problem developing?
MAP and/or clinical signs

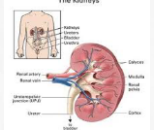
BLOOD PRESSURE



MAP > 65
SBP > 90

PHYSIOLOGY

The Kidneys



Urine Output

YES

2. Do I need fluid?

Fluid responsiveness – will fluid work?

PASSIVE LEG RAISE



BOLUS CHALLENGE



TRENDING THERAPY



3. Do I need pressors?

Vascular resistance – TPRI /SVRI

AFTERLOAD



4. Do I need inotropes?

Low cardiac output after preload & vascular tone optimization
Consider Echo/cardiac w/u

CONTRACTILITY



Case Study #1

Emergency Dept



- *54-year-old male C/O SOB x 3 days*
- *Productive cough*
- *PMH: Hyperlipidemia, GERD*
- *Chest Xray*
- *Sputum and Blood cultures*
- *Abx for Community Acquired Pneumonia*
- *Labs ordered*

Case Study #1

Emergency Dept.

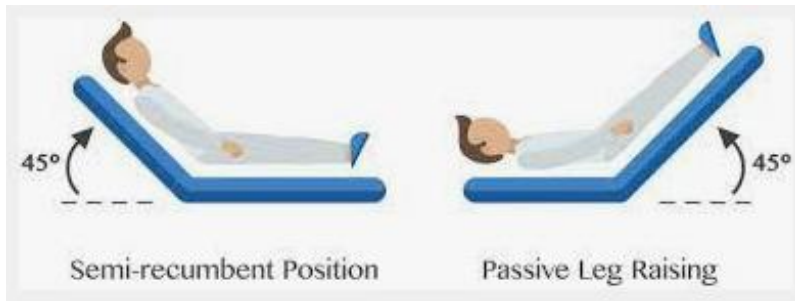
- *WBC: 17.5 k*
- *HR: 98 bpm*
- *RR: 25 bpm*
- *Temp: 37.5° C*
- *BP: 82/33 mmHg MAP 49 mmHg*
- *Lactate: 5.6 mmol/L*
- *SpO2: 92% on High Flow NC*

- *Fluid Bolus???*

Case #1

Transfer to ICU

- *Received 30ml/kg (2,600 ml) bolus*
- *BP 87/38mmHg MAP 54 mmHg*
- *Started Norepinephrine 5 mCg/min*
- *BP 96/50mmHg MAP 65mmHg*
- *Reevaluate*
 - Lactate
 - Dynamic fluid responsiveness assessment using PLR



Case Study #2

Emergency Dept

- *72-year-old female*
- *UTI, acute mental status change, poor PO intake*
- *Chronic Kidney Disease*
- *CHF*

Case #2

Emergency Dept

- *WBC: 13.2 k*
- *BP: 80/54 mmHg MAP 63 mmHg*
- *HR: 103 bpm*
- *Temp: 38.5° C*
- *BUN: 85mg/dL*
- *Cr: 1.76 mg/dL*
- *Lactate: 4.2 mmol/L*

- *Fluid Bolus??*

Case Study #3

Inpatient Sepsis Screening

SIRS Alert and Sepsis Screen

1. Is the patient's history suggestive of a new infection? If "None" selected, STOP and do not continue screening

- | | | | |
|---|---|---|---|
| <input type="checkbox"/> None | <input type="checkbox"/> Endocarditis | <input type="checkbox"/> Meningitis | <input type="checkbox"/> Soft Tissue Injury, Skin |
| <input type="checkbox"/> Abdomen | <input type="checkbox"/> Implantable device infection | <input checked="" type="checkbox"/> Pneumonia | <input type="checkbox"/> Urinary Tract Infection |
| <input type="checkbox"/> Anti-infective therapy | <input type="checkbox"/> Invasive procedure <30 days | <input type="checkbox"/> Positive culture | <input type="checkbox"/> Other (See Comment) |

2. Check all that apply: SIRS criteria met if 2 or more responses checked below

- | | | |
|---|--|--|
| <input type="checkbox"/> None | <input type="checkbox"/> Temp <36 DegC or >38 DegC | <input checked="" type="checkbox"/> RR > 20 per minute |
| <input checked="" type="checkbox"/> WBC <4,000/uL or >12,000/uL | <input checked="" type="checkbox"/> HR > 90 bpm | |

If a response other than "None" is selected for #1 and SIRS criteria met for #2 - Order a Lactate Venous PL QN

When lab is result, MODIFY PowerForm and continue with #3 and NEXT STEP

Result: Lactate Venous PL QN mmol/L

3. Does patient meet any criteria for ORGAN DYSFUNCTION?

- | | | | |
|--|--|--|---|
| <input type="checkbox"/> None | <input type="checkbox"/> PaO ₂ /FiO ₂ ratio <300 | <input checked="" type="checkbox"/> Lactate Venous >2 mmol/L | <input checked="" type="checkbox"/> PTT >60 sec |
| <input type="checkbox"/> SBP <90 mmHg or MAP <65 mmHg | <input checked="" type="checkbox"/> UOP <0.5 ml/Kg/hr | <input type="checkbox"/> Platelets <100,000 K/uL | <input type="checkbox"/> Bilirubin >2 mg/dl |
| <input type="checkbox"/> New, Acute Mental Status change | <input checked="" type="checkbox"/> Creatinine >2 mg/dl | <input type="checkbox"/> INR >1.5 | |

Case Study #4

Inpatient Rapid Response Call

- *18-year-old male*
- *Admitted to Med/Surg post operative appendectomy*
- *BP 88/42mmHg MAP 57mmHg*
- *PMH: Nothing significant*

- *Bolus v. tx ICU?*

Case Study #4

Inpatient Rapid Response Call

Dynamic Fluid Responsiveness Assessment Script

SVI increase of 10% or more

Dr. _____, Pt _____ in room _____ became hypotensive. I did a fluid responsiveness assessment using the ***** Monitor. The Stroke Volume Index increased by ____%. This increase indicates the patient will respond to a fluid bolus. Would you like 500ml or 1000ml and what fluid would you like me to give?

SVI increase of less than 10%

Dr. _____, Pt _____ in room _____ became hypotensive. I did a fluid responsiveness assessment using the *****| Monitor. The Stroke Volume Index increased by only ____%. An increase less than 10% indicates the patient will NOT respond to a fluid bolus. Would you like start a vasopressor?

Thank you for your attention



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Rebecca Hancock
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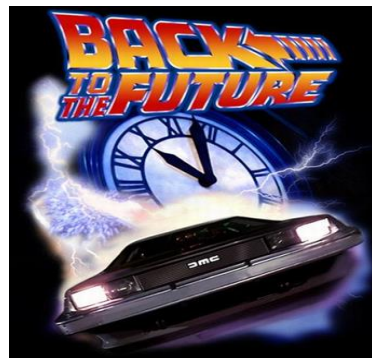
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6-Oct.	3 p.m. ET	Personal Hygiene and Sepsis Prevention



Click on link to register for each webinar



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Nov. 1 – 2

The Westin Indianapolis

Learn more and register on our website:



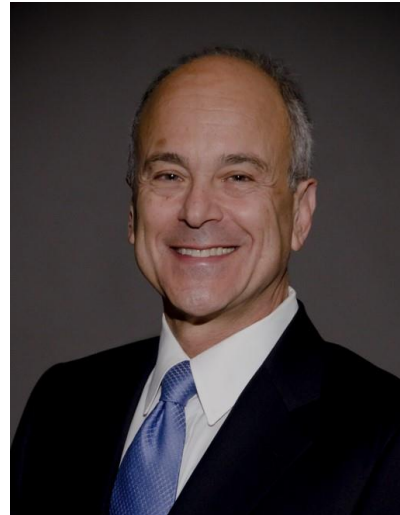
Annual Meeting Keynote Speakers



Sean Astin

Actor & Director

Mental Health



Dr. Mark Chassin

President Emeritus,
The Joint Commission

Quality & Patient
Safety



Steve Cadigan

Former VP of Talent, LinkedIn

Workforce &
Culture

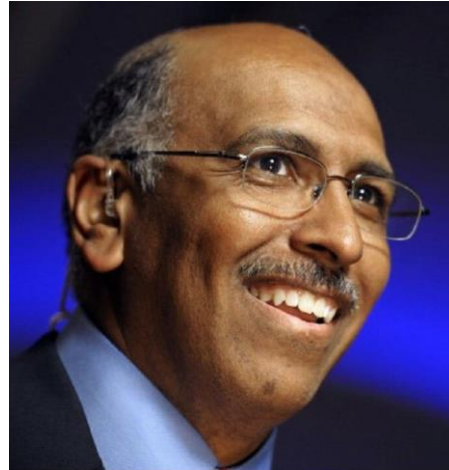
Annual Meeting Keynote Speakers



Donna Brazile

Veteran Democratic
Political Strategist

Political Point/Counterpoint



Michael Steele

Former RNC Chair



John Riggi

National Advisor for
Cybersecurity and Risk, AHA

Cybersecurity



Alan Beaulieu

President
ITR Economics

Health Care
Economic Forecast

Quality and Patient Safety Team



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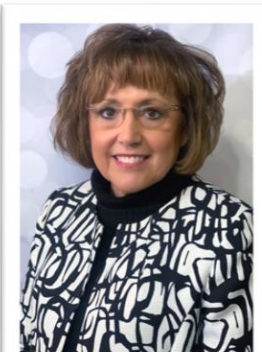


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