Improving Outcomes for Patients with Sepsis: CDC's Hospital Sepsis Program Core Elements and Best Practices in Sepsis Care

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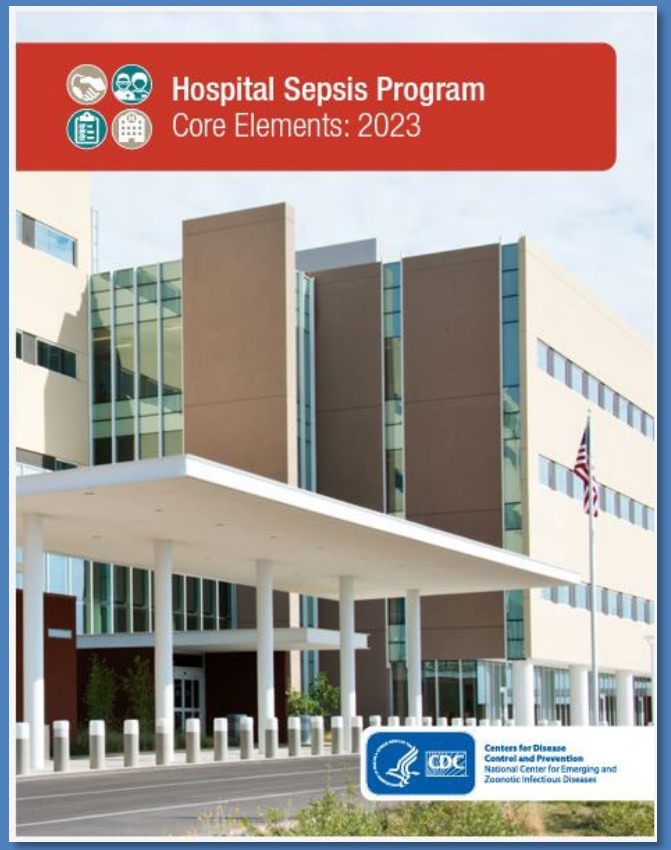

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Disclosure

- Sepsis Alliance Board of Directors
- Nursing Advisory Board- Baxter
- Society of Critical Care Medicine—ICU Liberation Course Director/Instructor

Objectives

Review the seven core elements in CDC's Hospital Sepsis Program Core Elements and their importance in achieving optimal sepsis outcomes

Identify resources and tools to assist with implementation of each of the elements.

Review key sepsis management best practices

Sepsis is a Public Health Problem

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Sepsis is common

1.7 million hospitalizations, more than heart attack and stroke combined[1]

2.5 million hospitalizations related to sepsis in 2021 (AHRQ report to Congress, 2024)

Sepsis is deadly

350,000 deaths, 33-50% of all hospital deaths[2,3]

Sepsis is costly

Most costly cause of hospitalization ($38 billion in 2020; 52 billion in 2021)

1-Rhee, et al. JAMA, 2017.
2-Liu, et al. JAMA, 2014.
3-Rhee, et al. JAMA Network Open, 2019.

Sepsis is a Major Driver of Morbidity

3-fold increase in mod-severe cognitive impairment[1]

1-2 new functional limitations (ADLs)[1]

Increased risk for re-hospitalization[2]
(recurrent infection/sepsis, acute kidney injury, and aspiration)

Half with psychological symptoms[3]

Post-acute mortality[4]

Only 55% of previously employed patients return to work within 6 months[5]

1-Iwashyna, *et al. JAMA*, 2010.
2-Prescott, *et al. JAMA*, 2015.
3-Bienvenu, *et al. Intensive Care Med*, 2018.
4-Prescott, *et al. BMJ*, 2016.
5-McPeake, *et al. AnnalsATS*, 2019.

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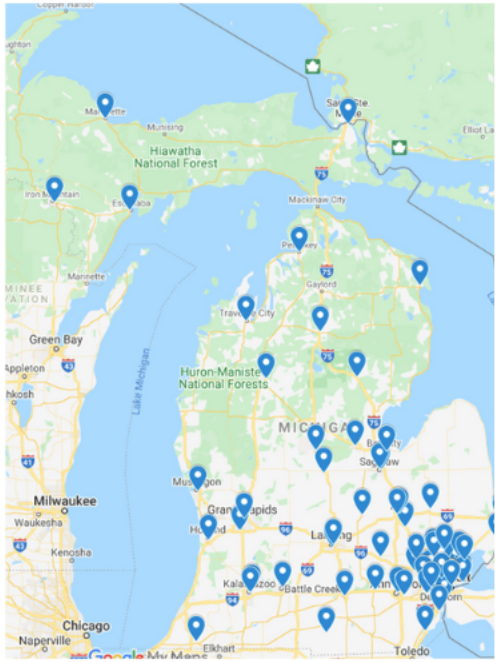
VALUED PARTNER

- One of 24 Collaborative Quality Initiatives in Michigan
- Funded by Blue Cross Blue Shield of Michigan
- Coordinating Center at Michigan Medicine
- Up to 2 Data Abstractors at each hospital (69 total sites)
- Eligible Michigan hospitals are required to participate
- Participating hospitals are of diverse sizes and types
- Participants at each site are multi-disciplinary



HMS GOAL

Improve the quality of care for hospitalized medical patients who are at risk for adverse events

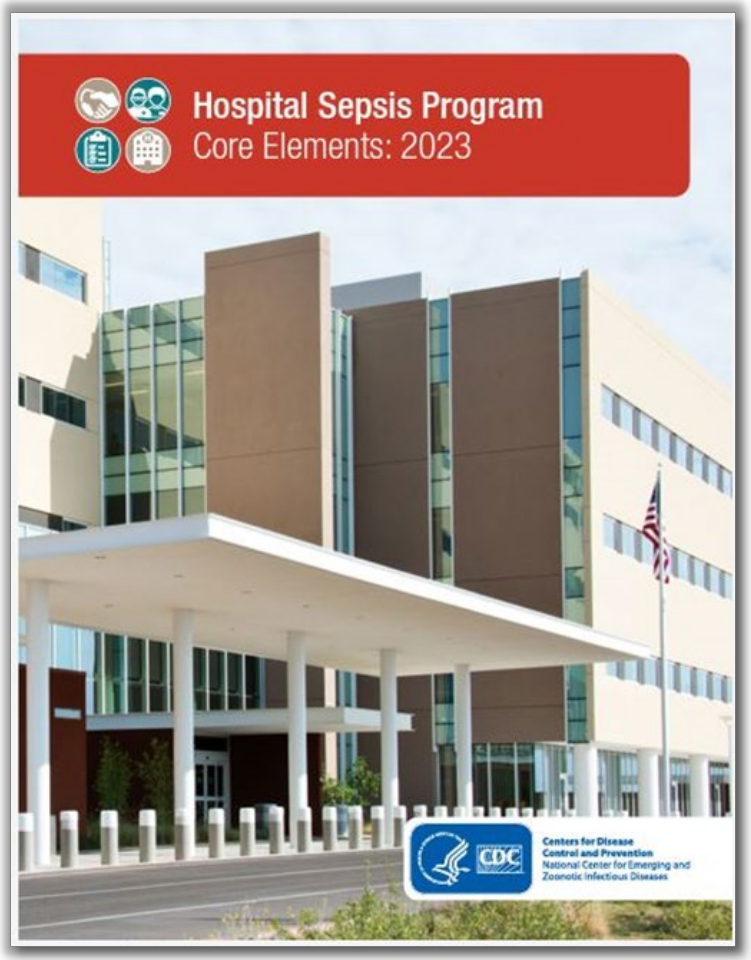
HOW DOES HMS IMPROVE CARE?

- Robust data reporting
- Best-practice sharing
- Facilitated implementation of best practices
- Pay-for-Performance & Value Based Reimbursement

CDC Hospital Sepsis Program Core Elements

The CDC Hospital Sepsis Program Core Elements were launched in 2023 and modeled after the CDC's successful Hospital Antibiotic Stewardship work.

The Core Elements provide a "managers guide" for establishing and running an effective program to monitor and optimize hospital sepsis care.



Elements within the Program

Hospital Leadership Commitment

Identify an Executive Sponsor: Appoint a senior administrator (CCO, CMO, CNO) to ensure program has resources and support.

Assign Sepsis Program Leaders: Provide dedicated time. Amount of time required based on type and size of hospital.

Identify sepsis as a hospital priority and communicate this to hospital staff.

Provide resources: IT, data analytics, etc

Ensure relevant staff from key clinical groups and departments have **sufficient time to help with sepsis**.

Accountability

1-2 Co-Leaders for Sepsis Program: Strongly recommend a physician and a nurse.

Set concrete goals to improve processes and outcomes, monitor progress toward the goal, and revise as needed.

Identify unit-level physician and nurse champions.

Report sepsis program activities and outcomes to senior hospital leadership regularly.

Multi-Professional Expertise

Collaborate across hospital locations: Clinicians and leaders from the ED, inpatient wards, and ICUs should be fully engaged in sepsis program activities.

Engage multi-professional experts: Antimicrobial stewardship, critical care, emergency medicine, hospital medicine, infectious disease, nursing, pharmacy, and social work.

Engage relevant support services: IT, data management and analytics, QI and patient safety.

Elements within the Program

Action

Implement a standardized process for **sepsis screening**.

Develop and maintain a hospital guideline or **standardized care pathway for management of sepsis**.

Create hospital **order sets** for management of sepsis.

Develop structures and processes to **facilitate prompt antimicrobial delivery.**

Develop **effective hospital hand-offs** for sepsis patients.

Tracking

Categories of tracking include:

- Sepsis epidemiology metrics
- Sepsis management metrics
- Sepsis outcomes metrics
- Progress towards achieving sepsis program goals
- Use, usability, and impact of sepsis program tools
- Chart reviews of sepsis hospitalizations
- Chart reviews for clinician feedback and education

Reporting

Reporting sepsis treatment and outcomes to relevant staff can help maintain staff engagement and motivate behavior change.

Regular reports to hospital, unit, and clinical leaders at routine intervals with trends over time and benchmarking.

Additional reporting: focused feedback to individual clinicians, live sepsis dashboard.

Education

Include sepsis-specific training in the onboarding process for healthcare staff.

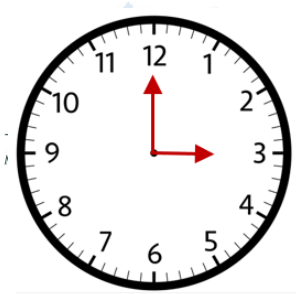
Provide annual sepsis education to staff.

Provide written and verbal education on sepsis to patients, families, and caregivers prior to discharge.

Post information on sepsis recognition, hold **grand rounds**, include sepsis training in RN **annual competencies**.

Best Practices in Sepsis Management

SEP-1: Early Management Bundle



To be completed within 3 hours of time of presentation *

1. Measure lactate level
2. Obtain blood cultures prior to administration of antibiotics
3. Administer broad spectrum antibiotics
4. Administer 30ml/kg crystalloid for hypotension or lactate ≥4mmol/L

* *Time of presentation* is defined as the time of earliest chart annotation consistent with all elements of severe sepsis or septic shock, as ascertained through chart review.

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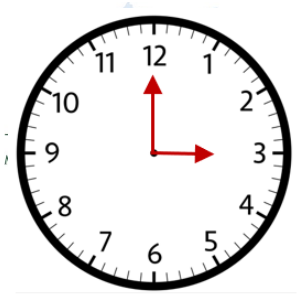
SEP-1: Continued



TO BE COMPLETED WITHIN 6 HOURS OF TIME OF PRESENTATION:

5. Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥65mmHg
6. In the event of persistent hypotension after initial fluid administration (MAP < 65 mm Hg) or if initial lactate was ≥4 mmol/L, re-assess volume status and tissue perfusion and document findings according to table 1.
7. Re-measure lactate if initial lactate elevated.

Guideline Recommendations and Newer Data

Antimicrobial timing

Fluid resuscitation volume

- Early
- Ongoing

Fluid type

- 2021 SSC Guideline rec(s)
- Background
- Newer literature
- Impact on Guidelines

Antimicrobial Timing

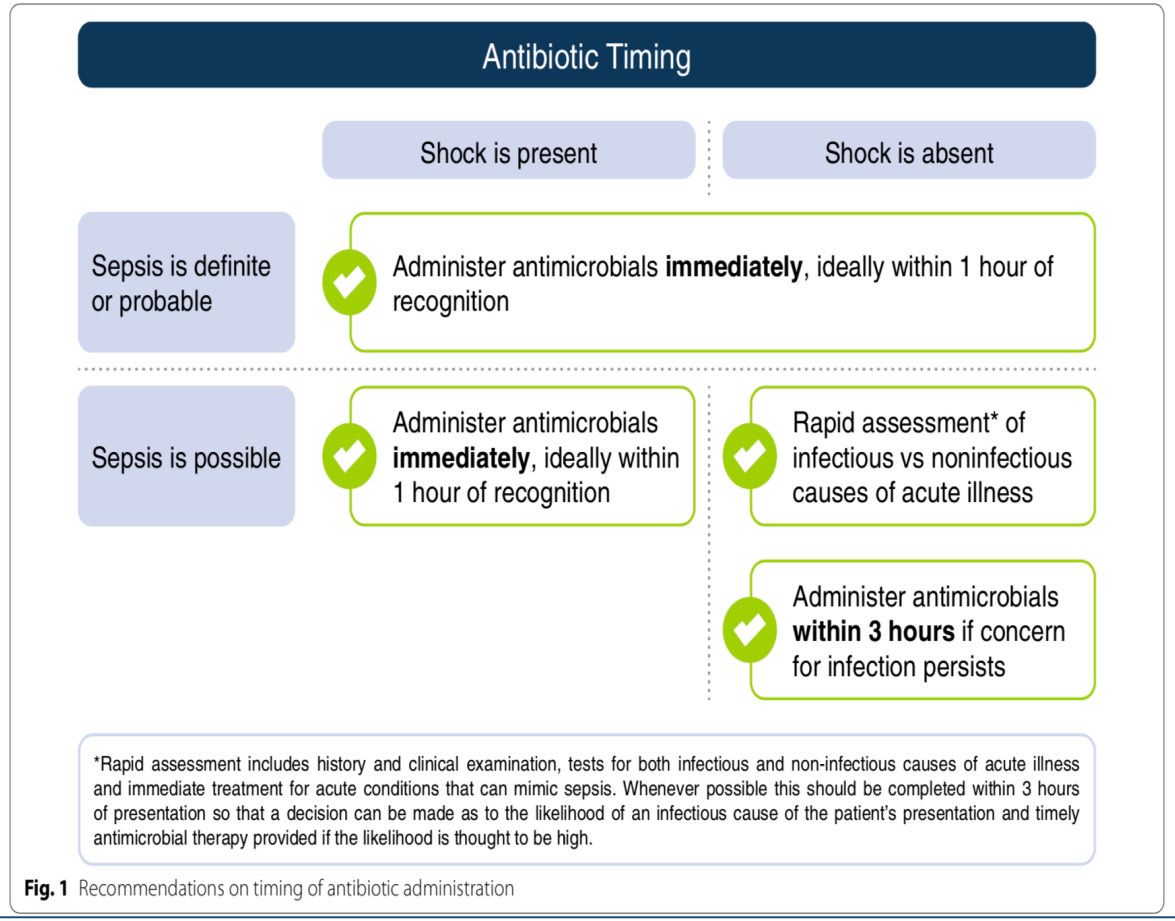


Fig. 1 Recommendations on timing of antibiotic administration

For adults with possible septic shock or a high likelihood for sepsis, we recommend administering antimicrobials immediately, ideally within 1 hour of recognition.

Quality of evidence: Low

Infection | Strong | Time to Antimicrobials

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Background for Recommendations

Time-to-antibiotics matters, particularly for patients in shock

Diagnostic uncertainty is common in practice (~22% of sepsis diagnoses overturned)

Seymour, *et al. NEJM*. 2017.
Liu, *et al. AJRCCM*. 2017.
Peltan, *et al. Chest*. 2019.
Pak, *et al. CID*. 2023.
Hechtman, et al. AJRCCM. 2024.
Klouwenberg, et al. Critical Care, 2015.
Taylor, et al. AnnalsATS, 2020.
Hooper, et al. Clinical infectious Dis., 2023

Research

JAMA Internal Medicine | Original Investigation

Temporal Trends in Antimicrobial Prescribing During Hospitalization for Potential Infection and Sepsis

Hallie C. Prescott, MD, MSc; Sarah Seelye, PhD; Xiao Qing Wang, MPH; Cainnear K. Hogan, MSW; Joshua T. Smith, PharmD; Patricia Kipnis, PhD; Fernando Barreda, MHA; John P. Donnelly, PhD; Jason M. Pogue, Pharm D; Theodore J. Iwashyna, MD, PhD; Makoto M. Jones, MD, MS; Vincent X. Liu, MD, MS

IMPORTANCE Some experts have cautioned that national and health system emphasis on rapid administration of antimicrobials for sepsis may increase overall antimicrobial use even among patients without sepsis.

OBJECTIVE To assess whether temporal changes in antimicrobial timing for sepsis are associated with increasing antimicrobial use, days of therapy, or broadness of antimicrobial coverage among all hospitalized patients at risk for sepsis.

DESIGN, SETTING, AND PARTICIPANTS This is an observational cohort study of hospitalized patients at 152 hospitals in 2 health care systems during 2013 to 2018, admitted via the emergency department with 2 or more systemic inflammatory response syndrome (SIRS) criteria. Data analysis was performed from June 10, 2021, to March 22, 2022.

EXPOSURES Hospital-level temporal trends in time to first antimicrobial administration.

OUTCOMES Antimicrobial outcomes included antimicrobial use, days of therapy, and broadness of antibacterial coverage. Clinical outcomes included in-hospital mortality, 30-day mortality, length of hospitalization, and new multidrug-resistant (MDR) organism culture positivity.

RESULTS Among 1 559 523 patients admitted to the hospital via the emergency department with 2 or more SIRS criteria (1 269 998 male patients [81.4%]; median [IQR] age, 67 [59-77] years), 273 255 (17.5%) met objective criteria for sepsis. In multivariable models adjusted for patient characteristics, the adjusted median (IQR) time to first antimicrobial administration to patients with sepsis decreased by 37 minutes, from 4.7 (4.1-5.3) hours in 2013 to 3.9 (3.6-4.4) hours in 2018, although the slope of decrease varied across hospitals. During the same period, antimicrobial use within 48 hours, days of antimicrobial therapy, and receipt of broad-spectrum coverage decreased among the broader cohort of patients with SIRS. In-hospital mortality, 30-day mortality, length of hospitalization, new MDR culture positivity, and new MDR blood culture positivity decreased over the study period among both patients with sepsis and those with SIRS. When examining hospital-specific trends, decreases in antimicrobial use, days of therapy, and broadness of antibacterial coverage for patients with SIRS did not differ by hospital antimicrobial timing trend for sepsis. Overall, there was no evidence that accelerating antimicrobial timing for sepsis was associated with increasing antimicrobial use or impaired antimicrobial stewardship.

CONCLUSIONS AND RELEVANCE In this multihospital cohort study, the time to first antimicrobial for sepsis decreased over time, but this trend was not associated with increasing antimicrobial use, days of therapy, or broadness of antimicrobial coverage among the broader population at-risk for sepsis, which suggests that shortening the time to antibiotics for sepsis is feasible without leading to indiscriminate antimicrobial use.

Supplemental content

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When hospitals shorten time to antibiotic delivery for sepsis, do they prescribe more or broader antibiotics?

Trends in 152-hospital cohort (2013→2018)

Time-to-antimicrobial **for sepsis** declined (by 37 minutes)

Antibiotic initiation in **all SIRS-positive** declined (by 0.3%)

Days of therapy in **all SIRS-positive** declined (by 0.6 days)

Use of broad-spectrum coverage in **all SIRS-positive** dec. (by 2-4%)

Prescott, *et al. JAMA Internal Medicine*, 2022.

Guideline Recommendations and Newer Data

Antimicrobial timing

Fluid resuscitation volume

- **Early**
- **Ongoing**

Fluid type

- 2021 SSC Guideline rec(s)
- Background
- Newer literature
- Impact on Guidelines

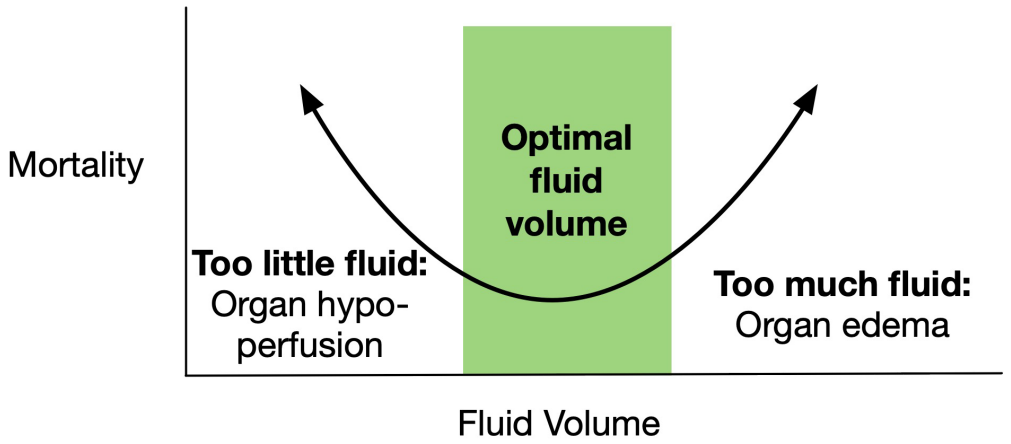
Initial Fluid Resuscitation Volume

Initial Fluid Resuscitation Volume

5 For patients with sepsis induced hypoperfusion or septic shock we **suggest** that at least 30 mL/kg of intravenous (IV) crystalloid fluid should be given within the first 3 hours of resuscitation.

Why 30ml/kg? – Strong Theoretical Rationale

- Restore intravascular volume
- Treat hypotension
- Improve organ perfusion
- Halt further progression of sepsis



Liu, *et al. Annals ATS*, 2013.
Kuttab, *et al. CCMed*, 2019.
Wang, *et al. Am J Emerg Med*, 2021.

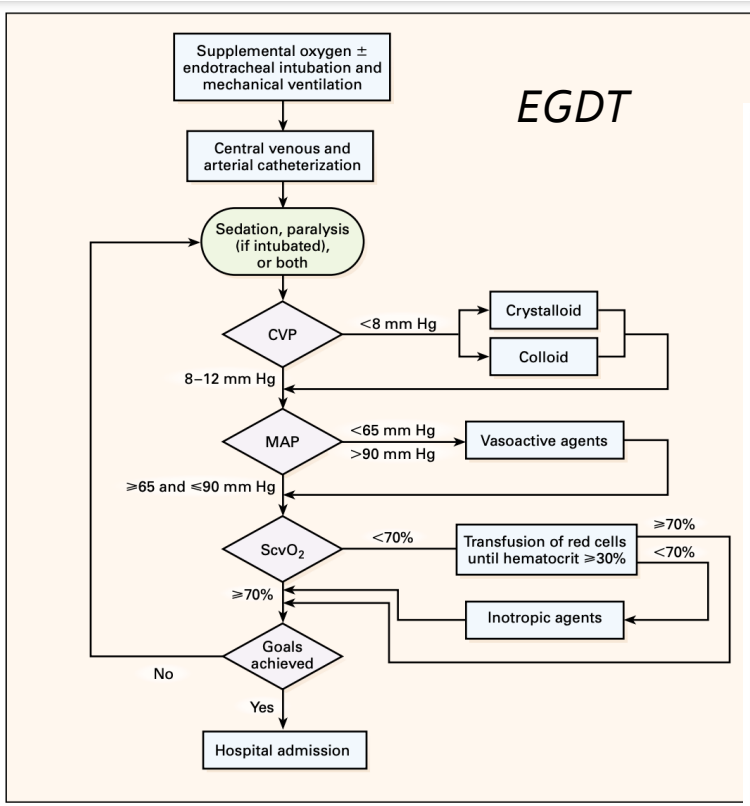
Why 30 ml/kg? – Trial Data

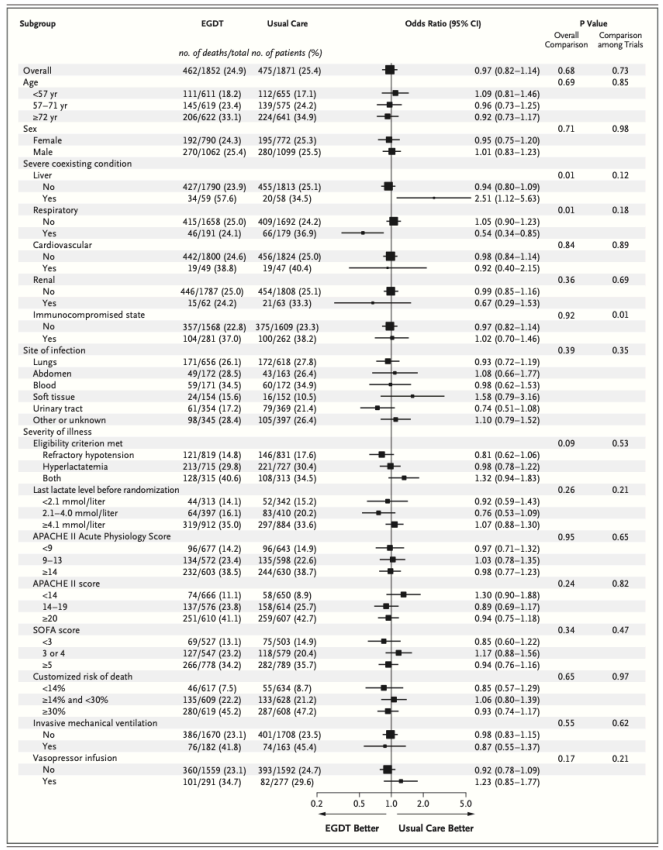
Earlier SSC Guidelines (2004, 2008, 2012) recommended EGDT.[1]

Subsequent RCTs (ARISE, ProCESS, and ProMISe)[2,3,4] and an individual-patient meta-analysis (PRISM)[5]: showed no difference between usual care (evolved), EGDT, or other protocolized resuscitation.

Virtually all patients in ARISE, ProCESS, and ProMISE got ≥30 ml/kg.

Interpretation: EGDT is not wrong, just not required.





[1]Rivers, *et al. NEJM*, 2001.
[2]Peake, *et al. NEJM*, 2015.
[3]Angus, *et al. NEJM*, 2016.
[4]Mouncey, *et al, NEJM*, 2016.
[5]Rowan, *et al. NEJM*, 2017.

Why 30 ml/kg? Prospective Observational Data

Improvement in Process of Care and Outcome After a Multicenter Severe Sepsis Educational Program in Spain

The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis

Guideline Bundles Adherence and Mortality in Severe Sepsis and Septic Shock

Mortality Changes Associated with Mandated Public Reporting for Sepsis
The Results of the New York State Initiative

Association Between State-Mandated Protocolized Sepsis Care and In-hospital Mortality Among Adults With Sepsis

Surviving Sepsis Campaign

NEW YORK STATE Department of Health

Improved implementation of sepsis bundles (inc. 30ml/kg) are associated with reduced mortality over time in pre/post and Difference-In-Difference studies

...but multicomponent intervention, confounded by increasing recognition

Ferrer, *et al. JAMA*, 2008.
Levy, *et al. Intensive Care Medicine*, 2010.
Van Zanten, *et al. Critical Care Medicine*, 2014.
Levy, *et al. AJRCCM*, 2018.
Kahn, *et al. JAMA*, 2019.

Why 30 ml/kg? Prospective Observational Data

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Multicenter Implementation of a Treatment Bundle for Patients with Sepsis and Intermediate Lactate Values

Vincent X. Liu[1,2], John W. Morehouse[2], Gregory P. Marelich[2], Jay Soule[2], Thomas Russell[2], Melinda Skeath[3], Carmen Adams[3], Gabriel J. Escobar[1,2], and Alan Whippy[2]

Conclusions: Multicenter implementation of a treatment bundle for patients with sepsis and intermediate lactate values improved bundle compliance and was associated with decreased hospital mortality. These decreases were mediated by improved mortality and increased fluid administration among patients with a history of heart failure and/or chronic kidney disease.

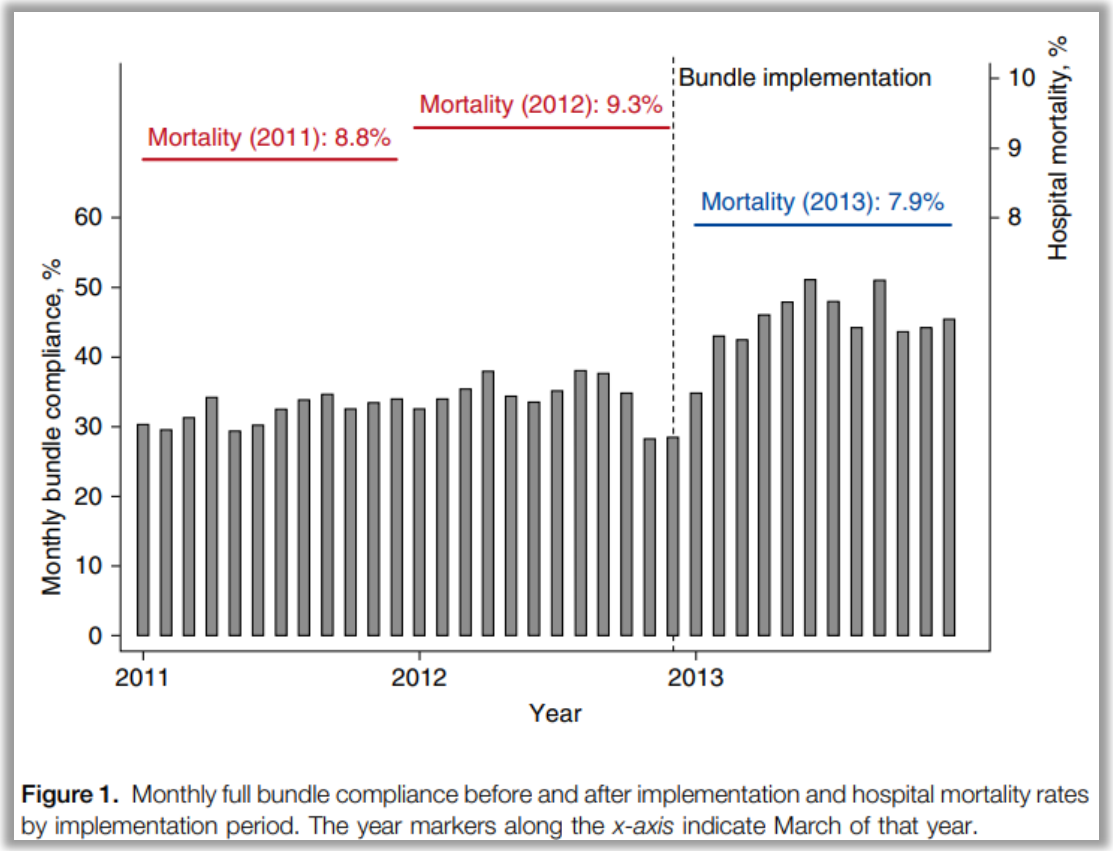


Figure 1. Monthly full bundle compliance before and after implementation and hospital mortality rates by implementation period. The year markers along the *x-axis* indicate March of that year.

Ongoing Fluid Resuscitation Volume

Surviving Sepsis Campaign

45 There is insufficient evidence to make a recommendation on the use of restrictive versus liberal fluid strategies in the first 24 hours of resuscitation in patients with sepsis and septic shock who still have signs of hypoperfusion and volume depletion after the initial resuscitation.

Why No Recommendation on Subsequent Resuscitation?

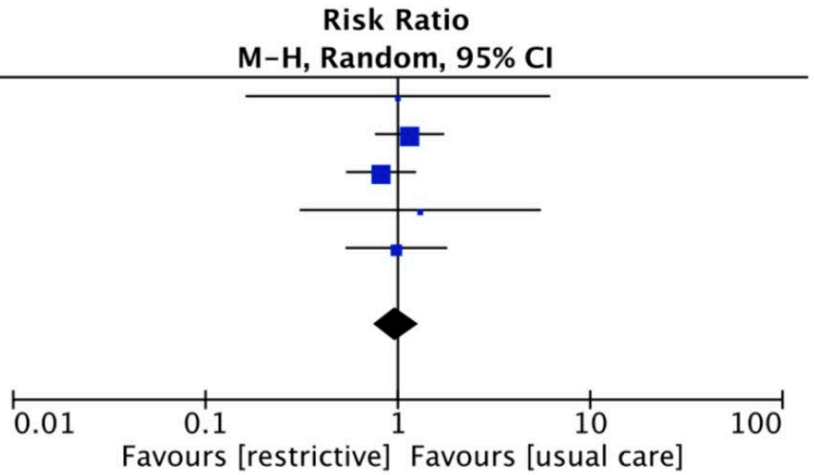
5 pilot RCTs – no signal

Wide heterogeneity in definitions of conservative vs. liberal

Study or Subgroup	Restrictive Events	Restrictive Total	Usual care Events	Usual care Total	Weight	Risk Ratio M-H, Random, 95% CI
BALANCE	2	15	2	15	2.0%	1.00 [0.16, 6.20]
Chen 2015	23	41	20	41	38.9%	1.15 [0.76, 1.74]
CLASSIC	25	75	31	76	38.0%	0.82 [0.54, 1.24]
REFRESH	4	50	3	49	3.2%	1.31 [0.31, 5.54]
RIFTS	15	55	15	54	18.0%	0.98 [0.53, 1.81]
Total (95% CI)		**236**		**235**	**100.0%**	**0.98 [0.76, 1.27]**
Total events	69		71			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.45$, df = 4 (P = 0.83); $I^2 = 0\%$

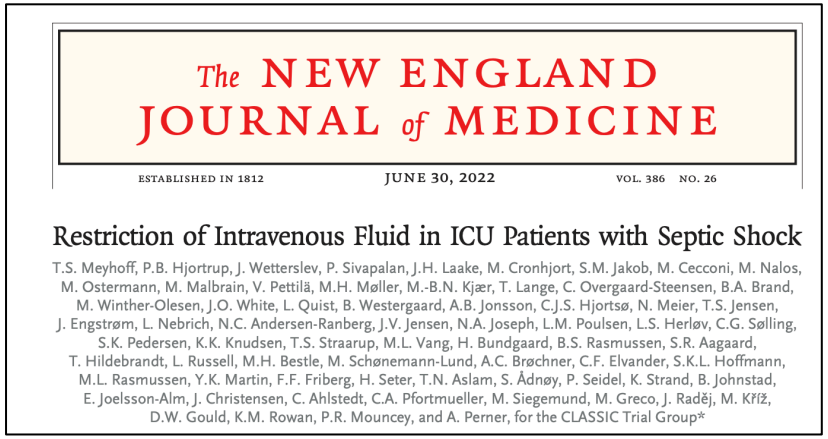
Test for overall effect: Z = 0.13 (P = 0.90)



Semler, *et al. Journal Intensive Care Med*, 2020.
Chen, *et al. Chest*, 2015.
Hjortrup, *et al. Intensive Care Med*, 2016.
MacDonald, *et al. Intensive Care Med*, 2018.
Corl, *et al. Crit Care Med.* 2019.

Update 1: CLASSIC and CLOVER Trials

"Fluid-heavy" vs "fluid-restrictive" approaches to resuscitation beyond 30ml/kg are equivalent



The NEW ENGLAND JOURNAL of MEDICINE

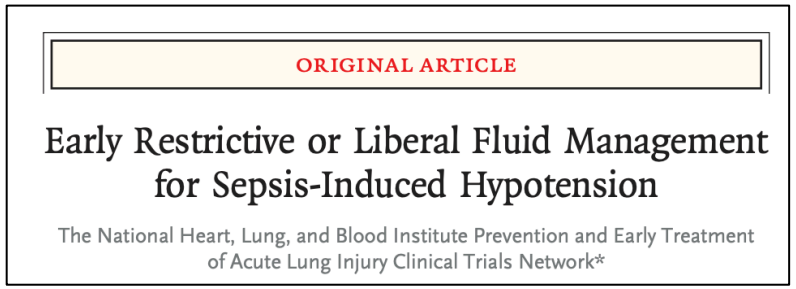
ESTABLISHED IN 1812 JUNE 30, 2022 VOL. 386 NO. 26

Restriction of Intravenous Fluid in ICU Patients with Septic Shock

T.S. Meyhoff, P.B. Hjortrup, J. Wetterslev, P. Sivapalan, J.H. Laake, M. Cronhjort, S.M. Jakob, M. Cecconi, M. Nalos, M. Ostermann, M. Malbrain, V. Pettilä, M.H. Møller, M.-B.N. Kjær, T. Lange, C. Overgaard-Steensen, B.A. Brand, M. Winther-Olesen, J.O. White, L. Quist, B. Westergaard, A.B. Jonsson, C.J.S. Hjortsø, N. Meier, T.S. Jensen, J. Engstrøm, L. Nebrich, N.C. Andersen-Ranberg, J.V. Jensen, N.A. Joseph, L.M. Poulsen, L.S. Herløv, C.G. Sølling, S.K. Pedersen, K.K. Knudsen, T.S. Straarup, M.L. Vang, H. Bundgaard, B.S. Rasmussen, S.R. Aagaard, T. Hildebrandt, L. Russell, M.H. Bestle, M. Schønemann-Lund, A.C. Brøchner, C.F. Elvander, S.K.L. Hoffmann, M.L. Rasmussen, Y.K. Martin, F.F. Friberg, H. Seter, T.N. Aslam, S. Ådnøy, P. Seidel, K. Strand, B. Johnstad, E. Joelsson-Alm, J. Christensen, C. Ahlstedt, C.A. Pfortmueller, M. Siegemund, M. Greco, J. Raděj, M. Kříž, D.W. Gould, K.M. Rowan, P.R. Mouncey, and A. Perner, for the CLASSIC Trial Group*

"Restrictive" versus "usual care" approach to fluid resuscitation (4.5L vs 6.0L)

No difference in outcomes



ORIGINAL ARTICLE

Early Restrictive or Liberal Fluid Management for Sepsis-Induced Hypotension

The National Heart, Lung, and Blood Institute Prevention and Early Treatment of Acute Lung Injury Clinical Trials Network*

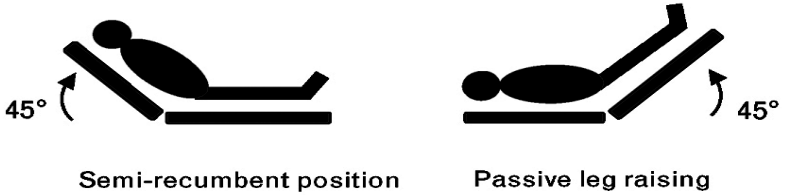
"Vasopressor early" versus "Fluid heavy" strategy (3.3L vs 5.4L)

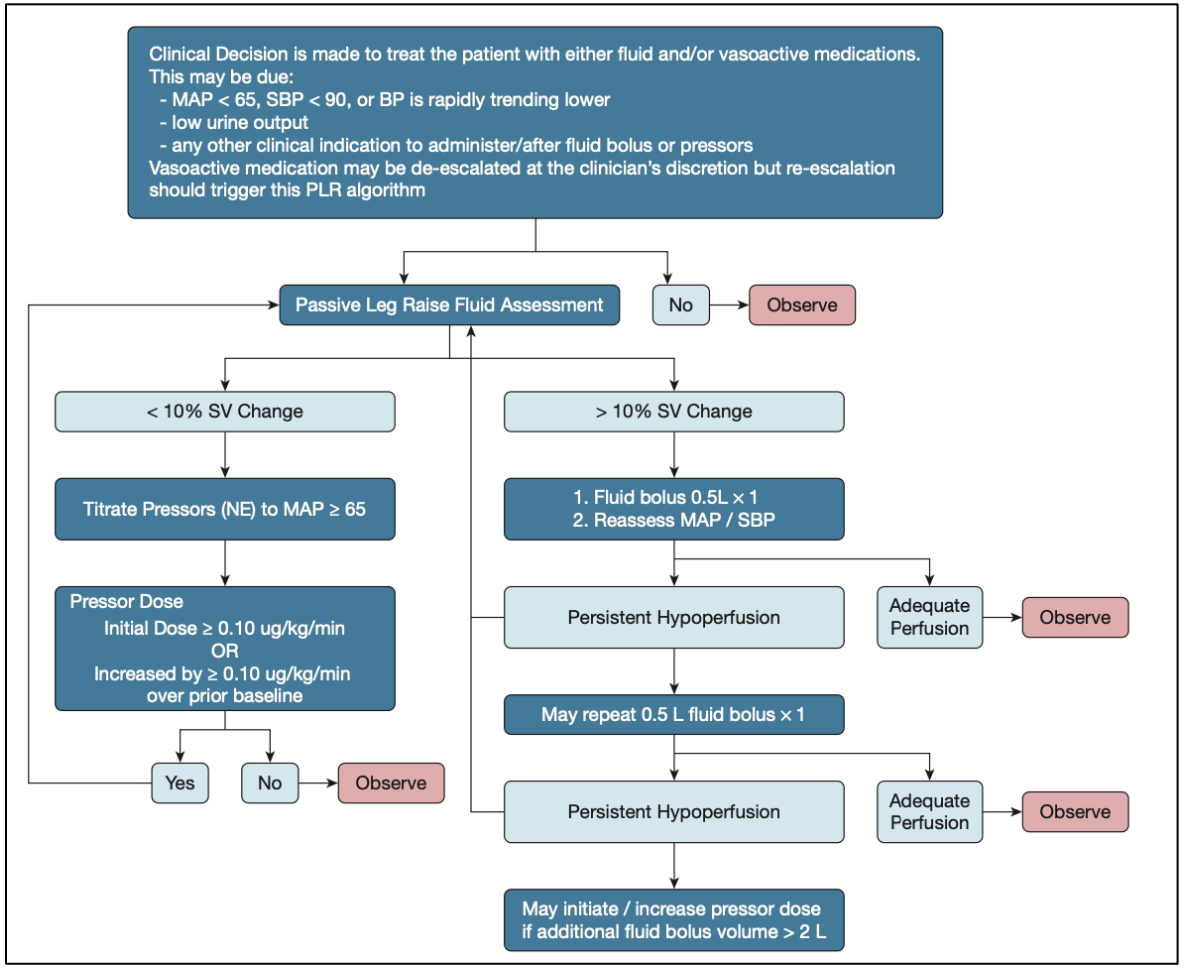
No difference in outcomes, stopped early for futility

Meyhoff, *et al. NEJM*, 2022.
Shapiro, *et al. NEJM*, 2023.

Update 2: FRESH Trial

- **Patients**:
  - 124 patients with septic shock in 13 ICUs in US and UK
  - After receiving a mean 2.3L fluid resuscitation
- **Intervention**:
  - Protocol-guided fluid and vasopressor titration based on results of a passive leg raise test to assess fluid responsiveness (>10% increase in stroke volume).
- **Comparator**: Usual care
- **Outcome**: Fluid balance (primary)





Douglas, *et al*. CHEST, 2020.

FRESH Trial Outcomes

Outcomes	Intervention (N=83)	Control (N=41)	p
Fluid balance at 72 hours or day 3, mean	0.7 L	2.0 L	0.02
Receipt of renal replacement therapy	5%	18%	0.04
Receipt of invasive mechanical ventilation	18%	34%	0.04
Length of ICU stay, mean	3.3 day	6.2 day	0.11

INTERPRETATION: Physiologically informed fluid and vasopressor resuscitation with the use of the passive leg raise-induced stroke volume change to guide management of septic shock is safe and demonstrated lower net fluid balance and reductions in the risk of renal and respiratory failure. Dynamic assessments to guide fluid administration may improve outcomes for patients with septic shock compared with usual care.

Douglas, *et al*. CHEST, 2020.

Initial and Ongoing Fluid Resuscitation Volume

5 For patients with sepsis induced hypoperfusion or septic shock we **suggest** that at least 30 mL/kg of intravenous (IV) crystalloid fluid should be given within the first 3 hours of resuscitation.

*Unchanged: virtually all patients in FRESH, CLASSIC, and CLOVERS received 30ml/kg pre-randomization.

45 There is insufficient evidence to make a recommendation on the use of restrictive versus liberal fluid strategies in the first 24 hours of resuscitation in patients with sepsis and septic shock who still have signs of hypoperfusion and volume depletion after the initial resuscitation.

*My impression: perhaps "fluid restrictive" vs "fluid liberal" is the wrong paradigm, and more personalized approaches like in FRESH trial may be better

Guideline Recommendations and Newer Data

Antimicrobial timing

Fluid resuscitation volume

Fluid type

- 2021 SSC Guideline rec(s)
- Background
- Newer literature
- Impact on Guidelines

Fluid Type

Surviving Sepsis Campaign

LOW

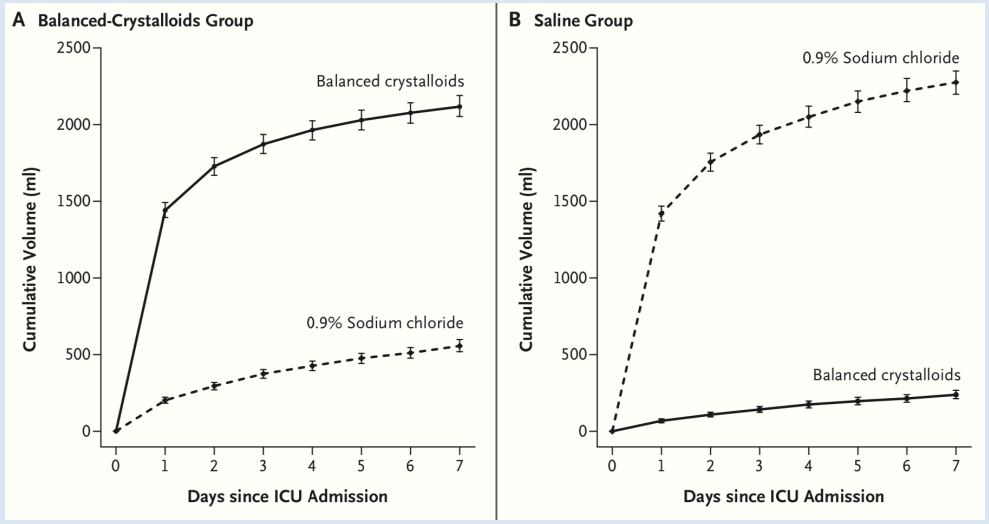
33 For adults with sepsis or septic shock, we **suggest** using balanced crystalloids instead of normal saline for resuscitation.

2016 STATEMENT

*"We **suggest** using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock"*

Background for SCC Statement

Feasible to give majority balanced fluid



Associated with mortality benefit

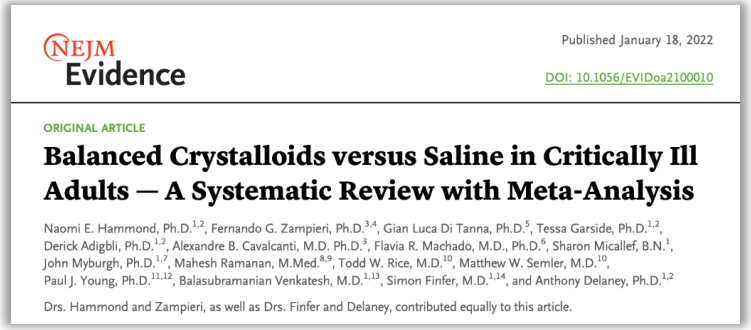
Balanced Crystalloids versus Saline in Sepsis
A Secondary Analysis of the SMART Clinical Trial

Ryan M. Brown[1], Li Wang[2], Taylor D. Coston[3], Nathan I. Krishnan[3], Jonathan D. Casey[1], Jonathan P. Wanderer[4,5], Jesse M. Ehrenfeld[4,5,6,7], Daniel W. Byrne[2], Joanna L. Stollings[8], Edward D. Siew[9], Gordon R. Bernard[1], Wesley H. Self[10], Todd W. Rice[1], and Matthew W. Semler[1]; for the SMART Investigators* and the Pragmatic Critical Care Research Group

26% vs 31% in-hospital mortality
5% absolute risk reduction
consistent across adjusted analyses
aOR 0.74 (0.59, 0.93)

Semler, *et al. NEJM*, 2018.
Brown, *et al. AJRCCM*, 2019

Background for Recommendation



NEJM Evidence

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ORIGINAL ARTICLE

Balanced Crystalloids versus Saline in Critically Ill Adults — A Systematic Review with Meta-Analysis

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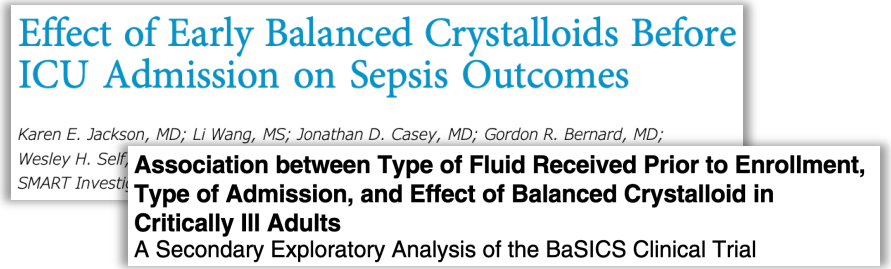
Drs. Hammond and Zampieri, as well as Drs. Finfer and Delaney, contributed equally to this article.

In meta-analysis of 13 trials (35,884 patients), there is high probability that balanced solutions **reduce mortality** in critically ill patients overall, particularly in sepsis.



Effect of Early Balanced Crystalloids Before ICU Admission on Sepsis Outcomes

Karen E. Jackson, MD; Li Wang, MS; Jonathan D. Casey, MD; Gordon R. Bernard, MD; Wesley H. Self; SMART Investi

Association between Type of Fluid Received Prior to Enrollment, Type of Admission, and Effect of Balanced Crystalloid in Critically Ill Adults

A Secondary Exploratory Analysis of the BaSICS Clinical Trial

Effect is strongest if balanced fluids are **started in ED**.

Original Investigation | Medical Education

Order Substitutions and Education for Balanced Crystalloid Solution Use in an Integrated Health Care System and Association With Major Adverse Kidney Events

An EHR-implementation program to prioritize balanced fluids over normal saline was associated with an increase in use of balanced fluid use

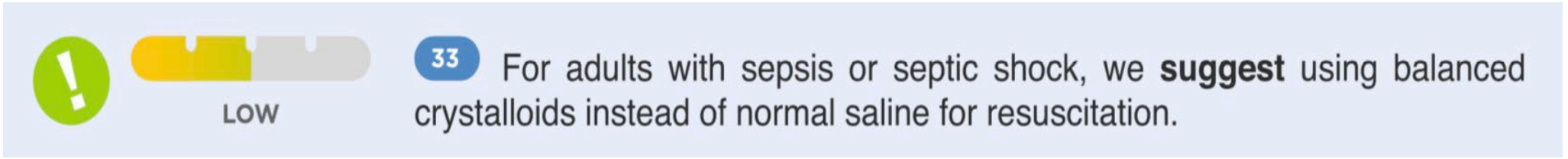
Hammond, *et al.*, *NEJM Evidence*, 2021.

Jackson, *et al. Chest*, 2021.

Zampieri, *et al.*, *AJRCCM*, 2022.

Bledsoe, *et al. JAMA Network Open*, 2022.

Fluid Type: Suggest → Recommend Balanced Fluids?



Surviving Sepsis Campaign®

Evidence supports benefit of balanced fluids in critically ill patients, particularly with sepsis, and particularly when used throughout resuscitation.

Hospital policies and structures (*e.g.*, order sets, activatable orders, stocking of fluid in ED/ICU) should prioritize balanced fluids.

Summary

Sepsis is common, deadly and costly

Hospital Sepsis Program Core Elements

- A guide to build a successful hospital sepsis program to optimize outcomes

Early identification of sepsis and rapid aggressive treatment is key to positive outcomes

Antimicrobial timing:

- Deliver ASAP in sepsis or undifferentiated shock possibly due to sepsis
- Do a rapid evaluation of possible sepsis, treatment decision in 3 hours

Fluid Type:

- Use balanced fluid (e.g. Lactated Ringers) in all or nearly all patients

Fluid resuscitation volume

- 30ml/kg actual body weight should be default, but some may need less
- Further resuscitation beyond 30ml/kg should be guided by serial clinical assessment and use of dynamic assessment for fluid responsiveness.