2026 California Thoracic Society Annual Educational Conference

& Chronic Obstructive Pulmonary Disease Symposium

Thursday March 12, 2026-Sunday March 15, 2026

Earn up to 19 CME/CEU/MOC Credits

Jointly Provided by AKH Inc., Advancing Knowledge in Healthcare and the California Thoracic Society

PORTOLA HOTEL & SPA
AT MONTEREY BAY

Thursday March 12, 2026 (6 CME/CEU/MOC Credits)
COPD Symposium
Friday March 13, 2026 (6.5 CME/CEU/MOC Credits):
Advances in Interventional Pulmonary, Remote Monitoring in Pulmonary and Sleep Medicine, Approach to Symptom Management in Chronic Lung Disease and Critical Care
Saturday March 14, 2026 (6.5 CME/CEU/MOC Credits)
Sepsis and Shock, Extracorporeal Membrane Oxygenation, Inpatient Pulmonary Complications of Cancer Care
Sunday March 15, 2026
Fellow and Resident Track Symposium

California Thoracic Society
ATS Chapter Serving California and Arizona

AKH INC.
ADVANCING KNOWLEDGE IN HEALTHCARE

California Thoracic Society
Annual Conference
March 12-15, 2026
Portola Hotel and Spa, Monterey, CA

Saturday March 14, 2026

Advances in Management of the Patient with Sepsis

8:00 am – 8:10 am: Welcome and Introduction

8:10 am – 8:55 am: Keynote Address – Phenotyping and Personalized Medicine in Sepsis

- **Angela Rogers, MD (Stanford)** - This speaker will discuss phenotyping in the patient with sepsis and septic shock and how close we are to precision medicine in managing sepsis.

8:55 am – 9:20 am: Incorporating Artificial Intelligence Decision Making in Identifying Sepsis

- **Gabriel Wardi, MD (UC San Diego)** - This speaker will describe how artificial intelligence can be used to identify the septic patient before they present with end stage symptoms to impact care earlier in the course of illness.

9:20 pm – 9:35 pm: Pro: The Severe Sepsis and Septic Shock Early Management Bundle (SEP-1) Bundle Saves Lives

- **Sean Townsend, MD (CPMC-Sutter)**- This speaker will argue the benefits of the SEP-1 Bundle/how it saves lives.

9:35 pm – 9:50 pm: Con: : The Severe Sepsis and Septic Shock Early Management Bundle (SEP-1) Bundle Does Not Save Lives

- **Natalie Achamallah, MD, MS (Cottage Health)** - This speaker will argue the against the SEP-1 Bundle/highlight its limitations.

9:50-10:00 am Question and Answer

10:00 am – 10:30 am: Break

Extracorporeal Membrane Oxygenation

10:30 am – 10:55 am: When to refer to an ECMO center and when to deploy ECMO

- **Nida Qadir, MD (UC Los Angeles)** - This speaker will discuss the evidence behind the use of ECMO in patients with respiratory failure and when providers should consider referral to an ECMO center and when centers should use ECMO.

10:55 am – 11:20 am: What about ECMO to go?

- **Mazen Odish, MD (UC San Diego)** - This speaker will discuss the advent of mobile ECMO services, how they can help improve patient care, and the use of extracorporeal cardiopulmonary resuscitation.

11:20 am – 11:45 pm: Ventilator Strategies for the patient on ECMO

- **Abirami Kumaresan, MD (Cedars-Sinai)** - This speaker will discuss the how ventilator strategies may differ in the patient on ECMO and how different ECMO configurations impact which ventilator strategy to use.

11:45 pm – 12:10 pm: What you need to know about pediatric ECMO

- **Kathleen Ryan, MD (Stanford)** - This speaker will discuss the utility of ECMO in neonates and children, and the complexities of management in children who needs mechanical support.

12:10 pm – 12:20 pm: Question and Answer

12:20 pm – 1:20 pm: Lunch

Hands-On Session:

1:20 pm – 2:20 pm: Non-Invasive Cardiac Output Monitors **Speaker Abirami Kumaresan, MD (Cedars-Sinai)** ECMO Machines **Mazen Odish, MD (UC San Diego)** ECMO Placement **David Gordon, DNP (UC San Francisco) & Brianna Zuckerman, NP (UC San Francisco)** Ventilator Settings and Portable ventilators **Joe Van Vleet, RT (UC Los Angeles) & Theresa Cantu, RT (Valley Children's)**

2:20 pm – 2:45 pm: Break

Inpatient and Pulmonary Complications of Cancer Care

2:45 pm – 3:10 pm: Pulmonary Complications of Hematopoietic Stem Cell Transplantation

- **Husham Sharifi, MD (Stanford)** - This speaker will discuss the pulmonary complications that arise after HCT, in particular the development of bronchiolitis obliterans syndrome and approaches to management.

3:10 pm – 3:35 pm: Pulmonary Vascular Complications of Malignancy

- **Naomi Habib, MD (Norton Thoracic Institute)**- This speaker will discuss the Pulmonary Vascular Disease complications of malignancy including PA sarcoma, pulmonary tumor thrombotic microangiopathy, and medications that can cause PAH.

3:35 pm – 4:00 pm: Drug induced Interstitial Lung Disease and Pneumonitis During Cancer Therapy

- **Weijia Chua, MD (Stanford)** - This speaker will discuss the pulmonary complications of interstitial lung disease and pneumonitis that develop after chemotherapy and targeted immunotherapy

4:00 pm – 4:25 pm: Respiratory Complications of Acute Leukemia

- **Hugh Davis, MD (City of Hope)** - The speaker will discuss various oncologic emergencies, how they are recognized, and how they are managed in the acute setting.

4:25 pm – 4:35 pm: Question and Answer

5:30 pm – 7:30 pm: Trainee Poster Competition (NON-CME) – Food and beverages will be served

Dr. Natalie Achamallah is the Director of Critical Care Education for the Internal Medicine Residency at Santa Barbara Cottage Hospital and a Clinical Assistant Professor at USC Keck School of Medicine.

After completing her undergraduate degree at UCLA she spent two years coordinating clinical trials at the West Los Angeles VA. She returned to school to obtain her MA in Medical Humanities and Bioethics at Northwestern University prior to attending medical school at the Royal College of Surgeons in Dublin, Ireland. She then completed her Internal Medicine residency at Santa Barbara Cottage Hospital. Her Pulmonary and Critical Care fellowship at Cedars-Sinai Medical Center in Los Angeles coincided with the height of the COVID pandemic.

At Santa Barbara Cottage Hospital, she is the Director of the Sepsis Committee, the Chair of the Pulmonary and Critical Care department, the Medical Director of Respiratory therapy and serves on the bioethics and CPR committees. Dr. Achamallah remains active in research and quality improvement, including clinical trials of novel therapies for venous thromboembolism. Among her specific interests within medical education are the development of clinical intuition and decision-making skills.

Outside of the hospital her favorite activities are painting Santa Barbara sunsets and cooking for exceptionally large groups of people.

SEP-1 DOES NOT SAVE LIVES

Natalie Achamallah MD, MA, MS, FCCP

Chair, Pulmonary and Critical Care Department

Director of Critical Care, Internal Medicine Residency

Santa Barbara Cottage Hospital

Clinical Adjunct Associate Professor

Keck School of Medicine, University of Southern California

DISCLOSURES

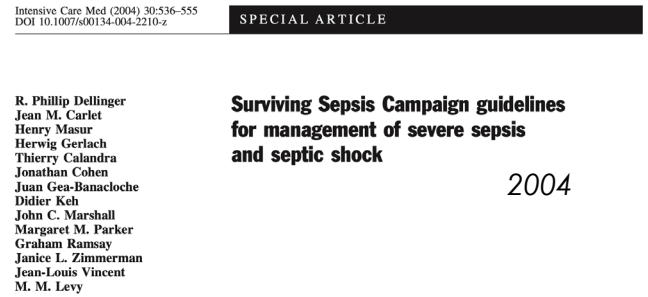
- I am the Medical Director of the Sepsis Committee at Santa Barbara Cottage Hospital
- I get paid to review and maximize SEP-1 bundle compliance at our organization

OBJECTIVES

- Explore the background of the SEP-1 measure
- Challenge the “rationale” for its ongoing use
- Understand post-implementation data regarding the clinical benefit of sepsis bundles

WHERE DID SEP-1 COME FROM ANYWAY?

- In the first 6 hours, goal is to maintain:
  - Central venous pressure (CVP) 8-12mmHg
  - Mean arterial pressure (MAP) ≥65
  - Urine output ≥0.5cc/kg/hr
  - Central venous or mixed venous O2 saturation ≥70%



Intensive Care Med (2004) 30:536–555
DOI 10.1007/s00134-004-2210-z

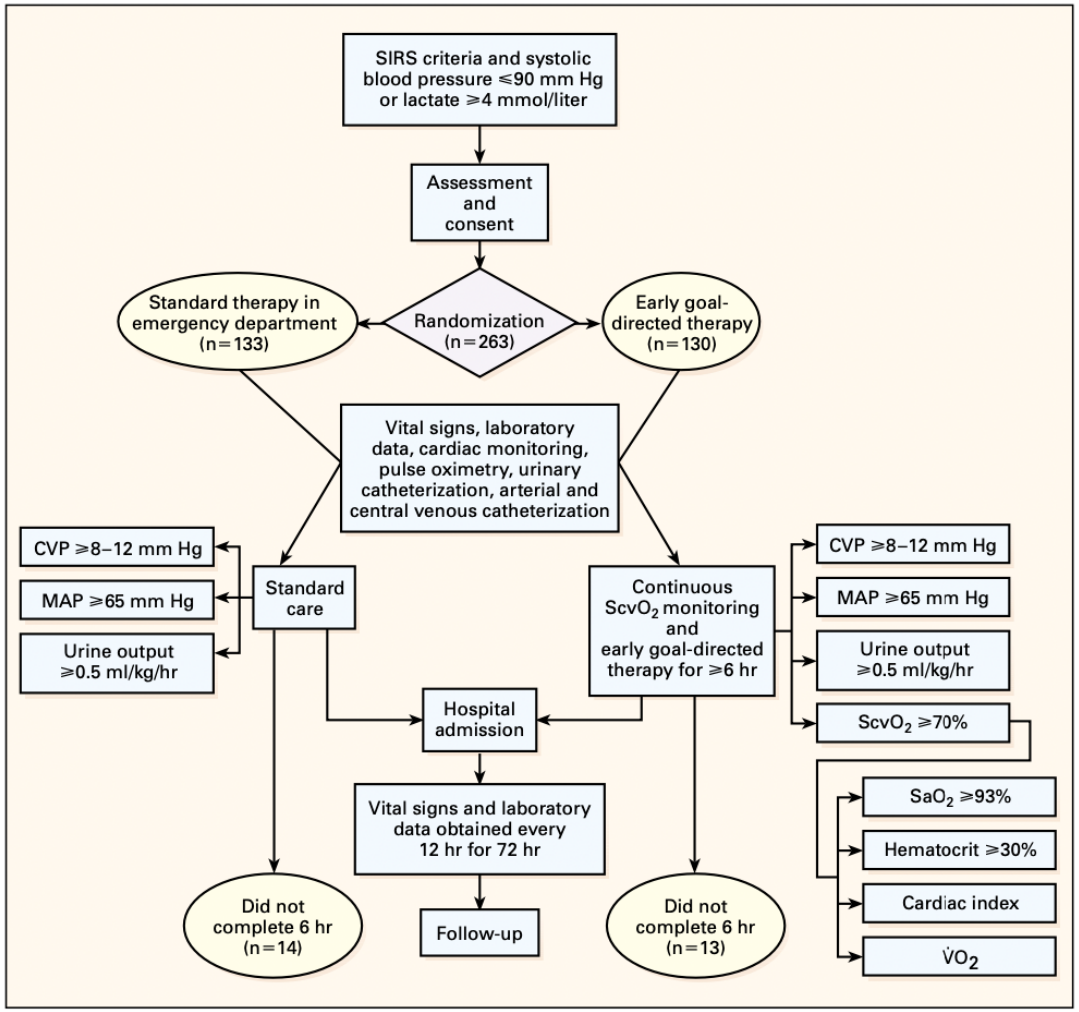
SPECIAL ARTICLE

R. Phillip Dellinger
Jean M. Carlet
Henry Masur
Herwig Gerlach
Thierry Calandra
Jonathan Cohen
Juan Gea-Banacloche
Didier Keh
John C. Marshall
Margaret M. Parker
Graham Ramsay
Janice L. Zimmerman
Jean-Louis Vincent
M. M. Levy

Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock

2004

WHERE DID SEP-1 COME FROM ANYWAY?



The NEW ENGLAND JOURNAL of MEDICINE

EARLY GOAL-DIRECTED THERAPY IN THE TREATMENT OF SEVERE SEPSIS AND SEPTIC SHOCK

EMANUEL RIVERS, M.D., M.P.H., BRYANT NGUYEN, M.D., SUZANNE HAVSTAD, M.A., JULIE RESSLER, B.S., ALEXANDRIA MUZZIN, B.S., BERNHARD KNOBLICH, M.D., EDWARD PETERSON, PH.D., AND MICHAEL TOMLANOVICH, M.D., FOR THE EARLY GOAL-DIRECTED THERAPY COLLABORATIVE GROUP*

WHERE DID SEP-1 COME FROM ANYWAY?

- In the first 6 hours, goal is to maintain:
  - Central venous pressure (CVP) 8-12mmHg
  - Mean arterial pressure (MAP) ≥65
  - Urine output ≥0.5cc/kg/hr
  - Central venous or mixed venous O2 saturation ≥70%

Intensive Care Med (2004) 30:536–555
DOI 10.1007/s00134-004-2210-z

SPECIAL ARTICLE

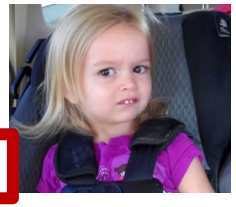
R. Phillip Dellinger
Jean M. Carlet
Henry Masur
Herwig Gerlach
Thierry Calandra
Jonathan Cohen
Juan Gea-Banacloche
Didier Keh
John C. Marshall
Margaret M. Parker
Graham Ramsay
Janice L. Zimmerman
Jean-Louis Vincent
M. M. Levy

Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock

2004

- Additional recommendations regarding cultures, antibiotics, source control, steroids, tight glucose control, recombinant human activated protein C (rhAPC)…

The Surviving Sepsis Campaign is administered jointly by the European Society of Intensive Care Medicine, International Sepsis Forum, and the Society of Critical Care Medicine, and is supported in part by unrestricted educational grants from Baxter Bioscience, Edwards Lifesciences, and Eli Lilly and Company (majority sponsor).



SEPSIS BUNDLES WILL SAVE US

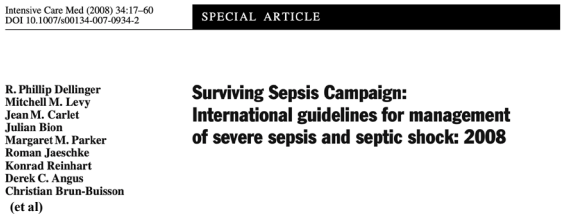
Sepsis change bundles: Converting guidelines into meaningful change in behavior and clinical outcome

Mitchell M. Levy, MD; Peter J. Pronovost, MD, PhD; R. Phillip Dellinger, MD, FCCM; Sean Townsend, MD; Roger K. Resar, MD; Terry P. Clemmer, MD, FCCM; Graham Ramsay, MD

2004

"***Figure 1.*** *A clinician, now armed with a sepsis change bundle, attacks the three heads of sepsis (hypotension, hypoperfusion, and organ dysfunction). Inspired by* 'Hercules Kills Cerebrus,'*Renato Pettinato, 2001, in Zuccary Palace Agira, Sicily, Italy.*"

WHERE DID SEP-1 COME FROM ANYWAY?



Intensive Care Med (2008) 34:17–60
DOI 10.1007/s00134-007-0934-2

SPECIAL ARTICLE

R. Phillip Dellinger
Mitchell M. Levy
Jean M. Carlet
Julian Bion
Margaret M. Parker
Roman Jaeschke
Konrad Reinhart
Derek C. Angus
Christian Brun-Buisson
(et al)

Surviving Sepsis Campaign: International guidelines for management of severe sepsis and septic shock: 2008

- 2008 guidelines more structured (…kinda)
  - Same initial resuscitation goals (CVP, MAP, UOP, SVO2/ScVO2, including vasopressors, inotropes, or blood transfusion if needed to achieve)
  - Cultures before antibiotics
  - Source identification and control
  - Steroids
  - Recombinant activated protein C (rhAPC)

- 2012 guidelines began to look more like the current iteration, but still heavily emphasized EGDT (though they removed rhAPC)

WHERE DID SEP-1 COME FROM ANYWAY?

ORIGINAL ARTICLE

A Randomized Trial of Protocol-Based Care for Early Septic Shock

Author: The ProCESS Investigators* Author Info & Affiliations

Published May 1, 2014 | N Engl J Med 2014;370:1683-1693 | DOI: 10.1056/NEJMoa1401602 | VOL. 370 NO. 18

ORIGINAL ARTICLE

Trial of Early, Goal-Directed Resuscitation for Septic Shock

Authors: Paul R. Mouncey, M.Sc., Tiffany M. Osborn, M.D., G. Sarah Power, M.Sc., David A. Harrison, Ph.D., M. Zia Sadique, Ph.D., Richard D. Grieve, Ph.D., Rahi Jahan, B.A., +7 , for the ProMISe Trial Investigators* Author Info & Affiliations

Published April 2, 2015 | N Engl J Med 2015;372:1301-1311 | DOI: 10.1056/NEJMoa1500896 | VOL. 372 NO. 14

ORIGINAL ARTICLE

Goal-Directed Resuscitation for Patients with Early Septic Shock

Author: The ARISE Investigators and the ANZICS Clinical Trials Group* Author Info & Affiliations

Published October 16, 2014 | N Engl J Med 2014;371:1496-1506 | DOI: 10.1056/NEJMoa1404380
VOL. 371 NO. 16 | Copyright © 2014

The “usual care” paradox?

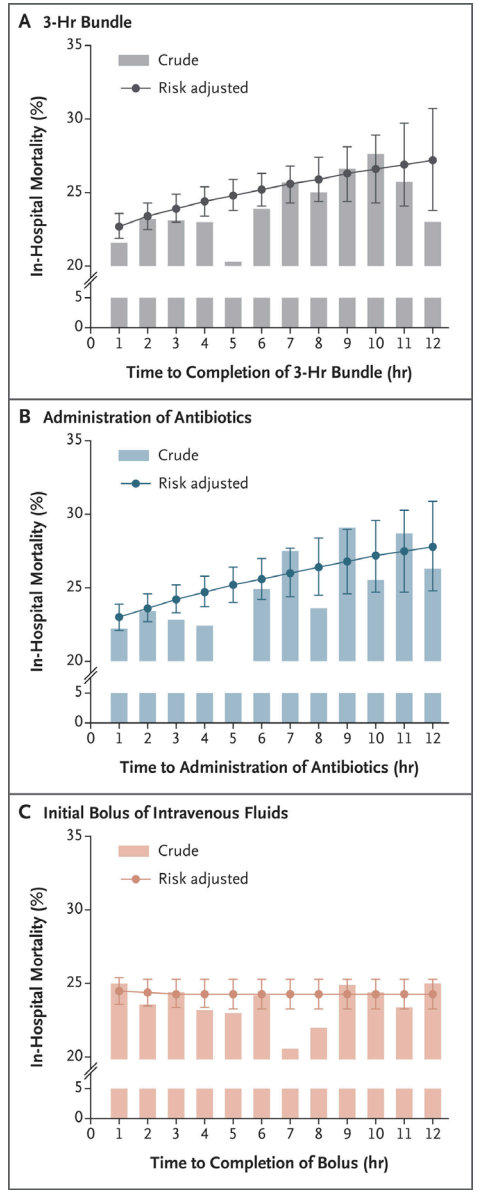
California Thoracic Society
ATS Chapter Serving California and Arizona

SO, BASED ON ALL OF THIS DATA…

- In 2015 CMS endorses SEP-1 (a bundle heavily based on largely debunked EGDT concepts) as a core quality measure anyway
- Cite the need for a mandatory checklist to standardize care
- Point to retrospective data from NY hospitals showing lower in-hospital mortality with faster completion of sepsis bundles

WHAT BUNDLE THOUGH?

- Data from patients with sepsis and septic shock reported to the NY State Department of Health over 2 years
- 149 hospitals with their own sepsis protocols
  - All required to include 3-hour and 6-hour bundles
- Each hour to time of completion of the 3-hour bundle was associated with higher mortality
- Time to completion of fluid bolus was not associated with mortality
- ~45% of patients met criteria for septic shock



ORIGINAL ARTICLE

Time to Treatment and Mortality during Mandated Emergency Care for Sepsis

Authors: Christopher W. Seymour, M.D., Foster Gesten, M.D., Hallie C. Prescott, M.D., Marcus E. Friedrich, M.D., Theodore J. Iwashyna, M.D., Ph.D., Gary S. Phillips, M.A.S., Stanley Lemeshow, Ph.D., Tiffany Osborn, M.D., M.P.H., Kathleen M. Terry, Ph.D., and Mitchell M. Levy, M.D. Author Info & Affiliations

Published June 8, 2017 | N Engl J Med 2017;376:2235-2244 | DOI: 10.1056/NEJMoa1703058 | VOL. 376 NO. 23

California Thoracic Society
ATS Chapter Serving California and Arizona

CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES
CENTER FOR MEDICARE & MEDICAID INNOVATION

Severe Sepsis and Septic Shock: Management Bundle Measure (NQF #0500)

National Quality Strategy Domain: Patient Safety

- severe sepsis
  - within three hours of presentation:
    - measure initial lactate level
    - draw blood cultures prior to antibiotics
    - administer broad spectrum or other antibiotics
  - within six hours of presentation:
    - repeat lactate level (if initial lactate > 2 mmol/L)
- septic shock
  - within three hours of presentation:
    - administer 30 ml/kg crystalloid for hypotension or lactate = 4 mmol/L
  - within six hours of presentation:
    - apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) = 65 mm Hg
    - reassess volume status and tissue perfusion in the event of persistent hypotension (MAP < 65 mm Hg) after initial fluid administration or initial lactate level = 4 mmol/L

9/10 DENTISTS RECOMMEND RETIRING SEP-1

Improving Sepsis Outcomes in the Era of Pay-for-Performance and Electronic Quality Measures: A Joint IDSA/ACEP/PIDS/SHEA/SHM/SIDP Position Paper

Chanu Rhee,[1,2] Jeffrey R. Strich,[3] Kathleen Chiotos,[4,a] David C. Classen,[5] Sara E. Cosgrove,[6,b] Ron Greeno,[7,c] Emily L. Heil,[8,d] Sameer S. Kadri,[3] Andre C. Kalil,[9] David N. Gilbert,[10] Henry Masur,[3] Edward J. Septimus,[1,11] Daniel A. Sweeney,[12] Aisha Terry,[13,e] Dean L. Winslow,[14] Donald M. Yealy,[15,e] and Michael Klompas[1,2,f]

IDSA Infectious Diseases Society of America

SIDP SOCIETY OF INFECTIOUS DISEASES PHARMACISTS

PEDIATRIC INFECTIOUS DISEASES SOCIETY

American College of Emergency Physicians®

shm Society of Hospital Medicine

SHEA The Society for Healthcare Epidemiology of America

California Thoracic Society
ATS Chapter Serving California and Arizona

9/10 DENTISTS RECOMMEND RETIRING SEP-1

Improving Sepsis Outcomes in the Era of Pay-for-Performance and Electronic Quality Measures: A Joint IDSA/ACEP/PIDS/SHEA/SHM/SIDP Position Paper

Chanu Rhee,[1,2,*] Jeffrey R. Strich,[3] Kathleen Chiotos,[4,a] David C. Classen,[5] Sara E. Cosgrove,[6,b] Ron Greeno,[7,c] Emily L. Heil,[8,d] Sameer S. Kadri,[3] Andre C. Kalil,[9] David N. Gilbert,[10] Henry Masur,[3] Edward J. Septimus,[1,11] Daniel A. Sweeney,[12] Aisha Terry,[13,e] Dean L. Winslow,[14] Donald M. Yealy,[15,e] and Michael Klompas[1,2,f]

Rhee 2021	114 Cerner hospitals	117,510 adults with suspected sepsis	Increases in lactate measurements and empiric anti-MRSA (25%) and anti-pseudomonal (45%) antibiotics No change in death or discharge to hospice
Barbash 2021	11 UPMC hospitals	54,225 adults with suspected sepsis	Increases in lactate measurement, fluid administration, and broad spectrum antibiotic use (10%) No change in in-hospital mortality
Anderson 2022	26 hospitals in 7 states	31,013 adults with suspected sepsis	Increased antibiotic utilization (25%) No change in mortality rates
Pakyz 2021	111 hospitals participating in Vizient	293,665 with sepsis-related diagnosis codes at discharge	Significant increase in antibiotic use Did not address mortality rates

THEN WHERE DOES ANY POSITIVE DATA COME FROM?

Effects of Compliance With the Early Management Bundle (SEP-1) on Mortality Changes Among Medicare Beneficiaries With Sepsis

A Propensity Score Matched Cohort Study

Sean R. Townsend, MD, FCCP; Gary S. Phillips, MAS; Reena Duseja, MD; Lemeneh Tefera, MD; Derek Cruikshank, PSM; Robert Dickerson, RRT, MSHSA; H. Bryant Nguyen, MD; Christa A. Schorr, DNP, RN; Mitchell M. Levy, MD, FCCP; R. Phillip Dellinger, MD, FCCP; William A. Conway, MD; Warren S. Browner, MD, MPH; and Emanuel P. Rivers, MD, MPH, FCCP

INTERPRETATION: Compliance with SEP-1 was associated with lower 30-day mortality. Rendering SEP-1 compliant care may reduce the incidence of avoidable deaths.

CHEST 2022; 161(2):392-406

THEN WHERE DOES ANY POSITIVE DATA COME FROM?

- Only includes Medicare beneficiaries discharged with sepsis diagnosis codes and met specific SEP-1 time zero criteria

- Ignores, among others, patients who were treated with bundle elements but for whom sepsis was later ruled out

Effects of Compliance With the Early Management Bundle (SEP-1) on Mortality Changes Among Medicare Beneficiaries With Sepsis

A Propensity Score Matched Cohort Study

Sean R. Townsend, MD, FCCP; Gary S. Phillips, MAS; Reena Duseja, MD; Lemeneh Tefera, MD; Derek Cruikshank, PSM; Robert Dickerson, RRT, MSHSA; H. Bryant Nguyen, MD; Christa A. Schorr, DNP, RN; Mitchell M. Levy, MD, FCCP; R. Phillip Dellinger, MD, FCCP; William A. Conway, MD; Warren S. Browner, MD, MPH; and Emanuel P. Rivers, MD, MPH, FCCP

THEN WHERE DOES ANY POSITIVE DATA COME FROM?

- Patients who received non-compliant care were much more likely to be in septic shock

Effects of Compliance With the Early Management Bundle (SEP-1) on Mortality Changes Among Medicare Beneficiaries With Sepsis

A Propensity Score Matched Cohort Study

Sean R. Townsend, MD, FCCP; Gary S. Phillips, MAS; Reena Duseja, MD; Lemeneh Tefera, MD; Derek Cruikshank, PSM; Robert Dickerson, RRT, MSHSA; H. Bryant Nguyen, MD; Christa A. Schorr, DNP, RN; Mitchell M. Levy, MD, FCCP; R. Phillip Dellinger, MD, FCCP; William A. Conway, MD; Warren S. Browner, MD, MPH; and Emanuel P. Rivers, MD, MPH, FCCP

Bundle: Treatment Section and Elements	No. of Eligible Cases	Pass Rate (%)
Complete SEP-1 bundle[a]	333,770	42.1
Severe sepsis 3 h: initial lactate level	159,646	86.0
Severe sepsis 3 h: antibiotic administration	137,252	88.5
Severe sepsis 3 h: blood culture	121,454	90.0
Severe sepsis 3-h bundle	159,646	68.5
Severe sepsis 6-h bundle: repeat lactate level	74,349	62.6
Shock 3-h bundle: crystalloid fluid administration	24,357	62.2
Shock 6 h: vasopressors	5,332	77.3
Shock 6 h: reassessment	9,931	38.1
Shock 6 h: vasopressors and reassessment	4,122	42.5
Shock 6-h bundle	11,141	34.0

THE "NPOA" PROBLEM

- Hospital-onset sepsis is at least 2x deadlier than community-onset sepsis, even after risk-adjustment for baseline illness
- These patients are also less likely to receive bundle-compliant care

Epidemiology of Hospital-Onset versus Community-Onset Sepsis in U.S. Hospitals and Association with Mortality: A Retrospective Analysis Using Electronic Clinical Data

Chanu Rhee, MD, MPH[1,2], Rui Wang, PhD[1], Zilu Zhang, BS[1], David Fram, BA[3], Sameer S. Kadri, MD, MSc[4], Michael Klompas, MD, MPH[1,2] CDC Prevention Epicenters Program

- Younger, healthier patients tend to have clearer presentations of sepsis and fewer barriers to completion of bundle elements
- Patients with greater baseline risk of death are more likely to have ambiguous or complex manifestations of sepsis

Original Investigation | Health Policy

Complex Sepsis Presentations, SEP-1 Compliance, and Outcomes

Chanu Rhee, MD, MPH; Sarah E. Train, MD, PharmD; Michael R. Filbin, MD, MS; Steven T. Park, MD; Nicholas M. Mohr, MD, MS; Anne Zepeski, PharmD; Brett A. Faine, PharmD; David J. Roach, MD; Emily Porter, PharmD; Claire N. Shappell, MD, MPH; Kamryn Plechot, PharmD; Laura DelloStritto, MPH; Tingting Yu, PhD; Michael Klompas, MD, MPH

THE AMBIGUOUS PATIENT

Original Investigation | Health Policy

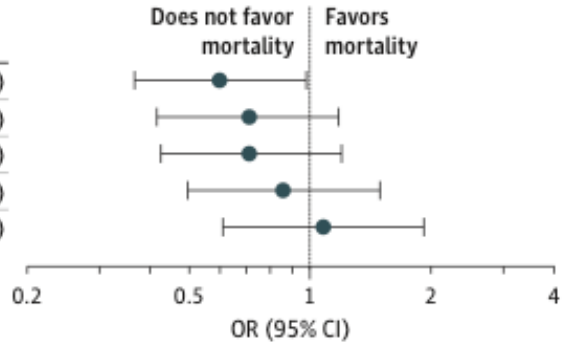
Complex Sepsis Presentations, SEP-1 Compliance, and Outcomes

Chanu Rhee, MD, MPH; Sarah E. Train, MD, PharmD; Michael R. Filbin, MD, MS; Steven T. Park, MD; Nicholas M. Mohr, MD, MS; Anne Zepeski, PharmD; Brett A. Faine, PharmD; David J. Roach, MD; Emily Porter, PharmD; Claire N. Shappell, MD, MPH; Kamryn Plechot, PharmD; Laura DelloStritto, MPH; Tingting Yu, PhD; Michael Klompas, MD, MPH

- Patients who did not receive compliant care were:
  - Older with more comorbidities
  - Septicemic without clear source
  - Less likely to be febrile
  - Encephalopathic
  - In need of procedures like intubation or central venous access

Figure 4. Association Between SEP-1 Compliance and In-Hospital Death in Multivariable Models Incorporating Successively Detailed Sets of Covariates

	OR (95% CI)
Unadjusted	0.60 (0.37-0.98)
Plus baseline characteristics	0.71 (0.42-1.18)
Plus infection source	0.71 (0.43-1.20)
Plus severity of illness	0.86 (0.50-1.49)
Plus clinical markers of complexity	1.08 (0.61-1.91)



CONFOUND IT ALL…

- In order to treat sepsis, we must notice that it is happening
  - Early recognition saves lives
- Many of the bundle elements really do improve outcomes in the right patients
- CMS incentivizes statistical distortion

The Timing of Early Antibiotics and Hospital Mortality in Sepsis

Vincent X. Liu[1], Vikram Fielding-Singh[2], John D. Greene[1], Jennifer M. Baker[1], Theodore J. Iwashyna[3,4], Jay Bhattacharya[5], and Gabriel J. Escobar[1]

[1]Kaiser Permanente Division of Research, Oakland, California; [2]Department of Anesthesia and Perioperative Care, University of California San Francisco, San Francisco, California; [3]Center for Clinical Management Research, VA Ann Arbor Health System, Ann Arbor, Michigan; [4]Division of Pulmonary and Critical Care, Department of Internal Medicine, University of Michigan, Ann Arbor, Michigan; and [5]Primary Care and Outcomes Research, Stanford University, Stanford, California

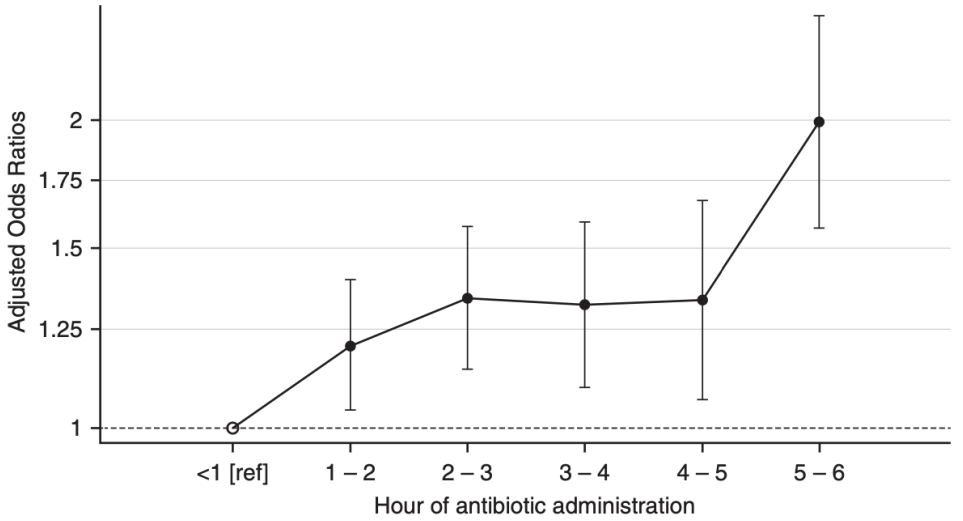


Figure 2. Adjusted odds ratios for hospital mortality comparing patients within each hourly antibiotic administration group with the reference group of patients given antibiotics in <1 hour. The *y-axis* is on logarithmic scale and the *error bars* represent 95% confidence intervals.

CONFOUND IT ALL…

- In order to treat sepsis, we must notice that it is happening
  - Early recognition saves lives
- Many of the bundle elements really do improve outcomes in the right patients
- CMS incentivizes statistical distortion

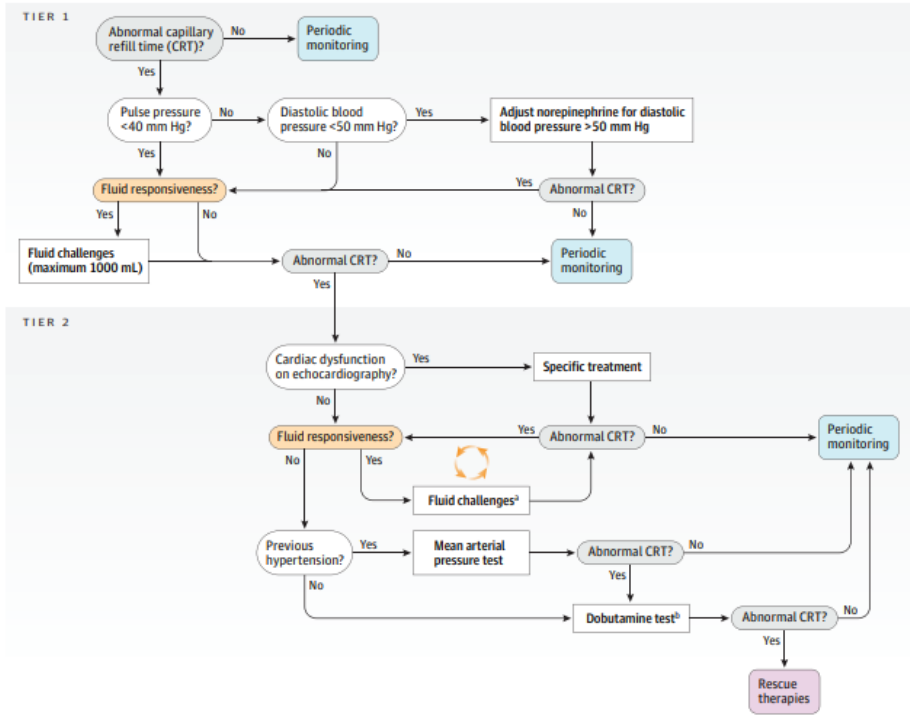
JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Personalized Hemodynamic Resuscitation Targeting Capillary Refill Time in Early Septic Shock

The ANDROMEDA-SHOCK-2 Randomized Clinical Trial

The ANDROMEDA-SHOCK-2 Investigators for the ANDROMEDA Research Network, Spanish Society of Anesthesiology, Reanimation and Pain Therapy (SEDAR), and Latin American Intensive Care Network (LIVEN)

Figure 2. Capillary Refill Time Personalized Hemodynamic Resuscitation (CRT-PHR) Algorithm



WHO IS THE REMAINING DENTIST?

ATS

CHEST
AMERICAN COLLEGE
of CHEST PHYSICIANS

Society of
Critical Care Medicine
The Intensive Care Professionals

CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES
CENTER FOR MEDICARE & MEDICAID INNOVATION

Severe Sepsis and Septic Shock: Management Bundle Measure (NQF #0500)

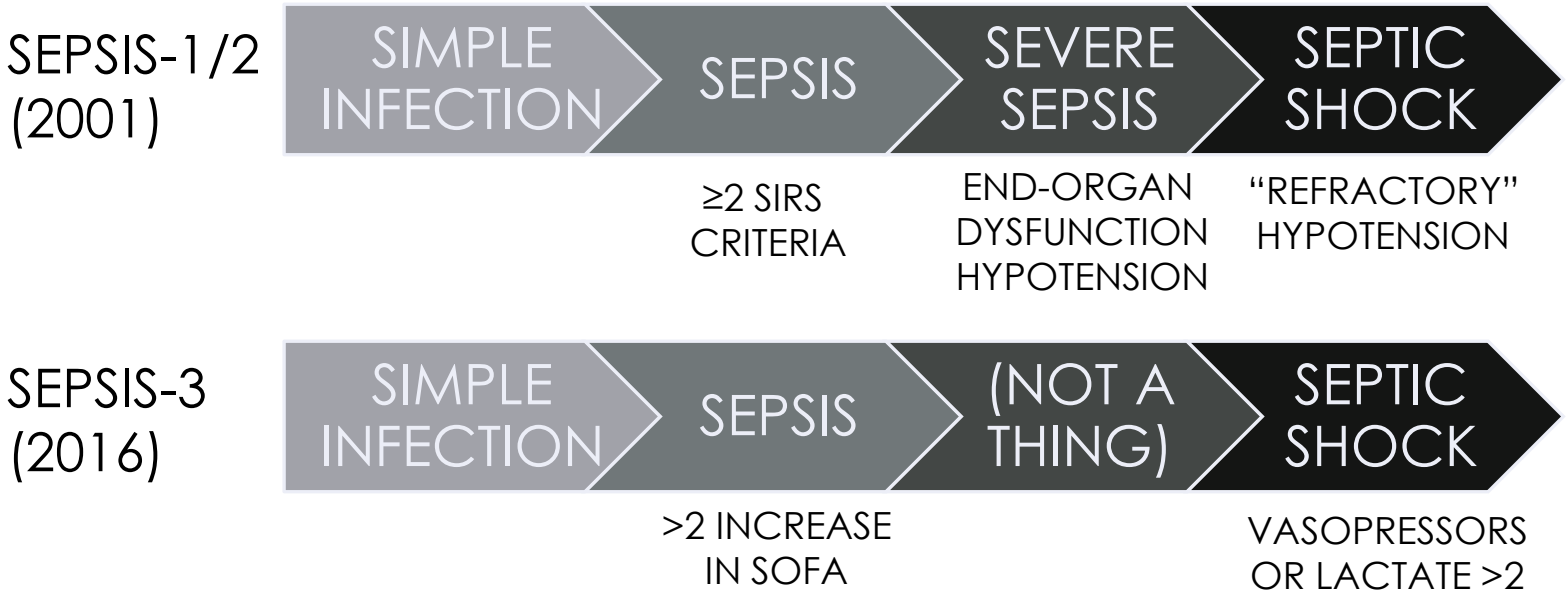
National Quality Strategy Domain: Patient Safety

GUIDELINE INERTIA?

- severe sepsis
  - within three hours of presentation:
    - measure initial lactate level
    - draw blood cultures prior to antibiotics
    - administer broad spectrum antibiotics
  - within six hours of presentation:
    - re-measure lactate level (if initial lactate > 2 mmol/L)
- septic shock
  - within three hours of presentation:
    - administer 30 ml/kg crystalloid for hypotension or lactate = 4 mmol/L
  - within six hours of presentation:
    - apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) = 65 mm Hg
    - reassess volume status and tissue perfusion in the event of persistent hypotension (MAP < 65 mm Hg) after initial fluid administration or initial lactate level = 4 mmol/L

California Thoracic Society
ATS Chapter Serving California and Arizona

CORE MEASURE INERTIA



WE SHOULD KNOW BETTER

- All studies of adults with sepsis, severe sepsis, or septic shock
- Primary outcome was mortality
- 17 studies met inclusion criteria, all observational
  - 12 assessed the effect of SEP-1 compliance on mortality
  - 7 found no association
  - 5 showed benefit in at least one subgroup
    - 2 in septic shock only, one in patients without septic shock
    - Includes Townsend et al
- No study was assessed as having low risk of bias

Reviews | 18 February 2025

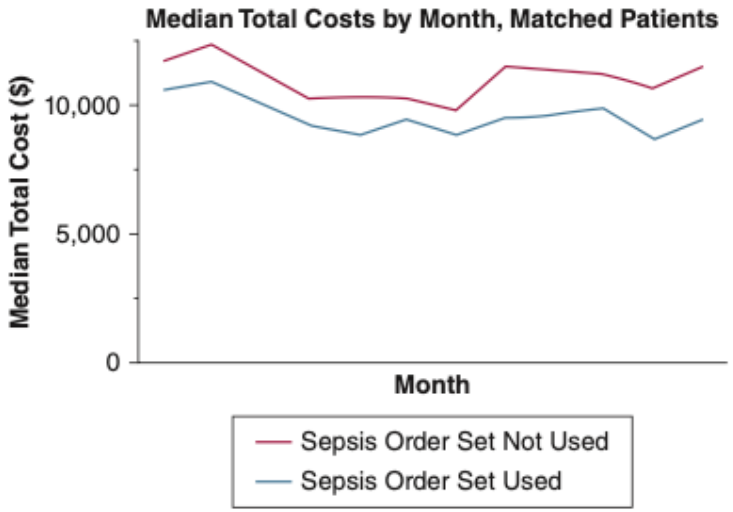
The Effect of Severe Sepsis and Septic Shock Management Bundle (SEP-1) Compliance and Implementation on Mortality Among Patients With Sepsis: A Systematic Review

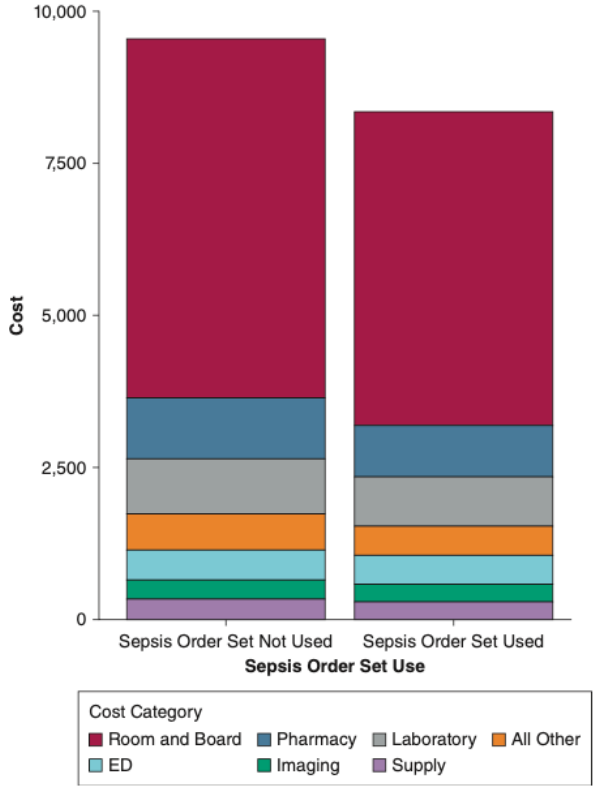
Authors: James S. Ford, MD, MAS, Joseph C. Morrison, May Kyaw, MD, Meghan Hewlett, MD, MS, MPH, Peggy Tahir, MLIS, MA, Sonia Jain, PhD, Shamim Nemati, PhD, Atul Malhotra, MD, and Gabriel Wardi, MD, MPH | AUTHOR, ARTICLE, & DISCLOSURE INFORMATION

Publication: Annals of Internal Medicine • Volume 178, Number 4 • https://doi.org/10.7326/ANNALS-24-02426

WHO DOES BENEFIT FROM BUNDLE COMPLIANCE?

- Sepsis care is expensive, bundles may make it slightly less expensive





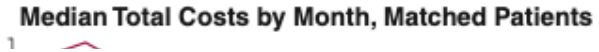
Sepsis Order Set Use Associated With Increased Care Value

Christopher R. Dale, MD, MPH; Shih-Ting Chiu, PhD; Shelley Schoepflin Sanders, MD, MTS; Caleb J. Stowell, MD; Tessa L. Steel, MD, MPH; Joshua M. Liao, MD; and James I. Barnes, MD

California Thoracic Society
ATS Chapter Serving California and Arizona

WHO DOES BENEFIT FROM BUNDLE COMPLIANCE?

- Sepsis care is expensive, bundles may make it slightly less expensive



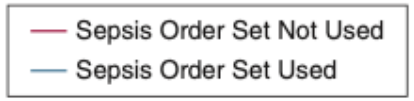
CRITICAL CARE COMMENTARY

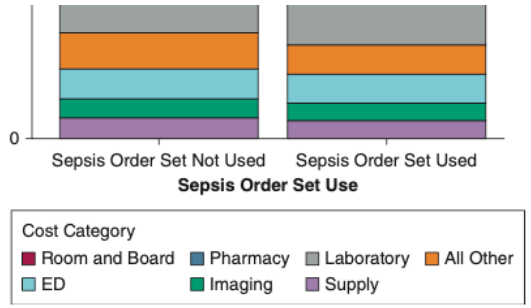
Sepsis order sets good for patients, hospital bottom lines

Is this the future of sepsis treatment?

Greg J. Eisinger, MD, MSSW

April 2, 2025 | Estimated time to read: 9 minutes





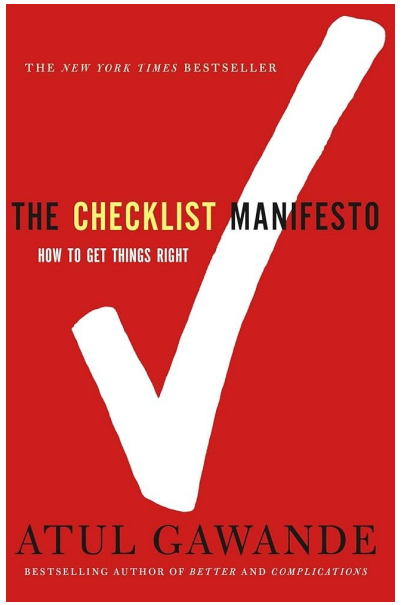
Sepsis Order Set Use Associated With Increased Care Value

Christopher R. Dale, MD, MPH; Shih-Ting Chiu, PhD; Shelley Schoepflin Sanders, MD, MTS; Caleb J. Stowell, MD; Tessa L. Steel, MD, MPH; Joshua M. Liao, MD; and James I. Barnes, MD

California Thoracic Society
ATS Chapter Serving California and Arizona

WE LOVE CHECKLISTS THOUGH… WHAT'S THE BIG DEAL?

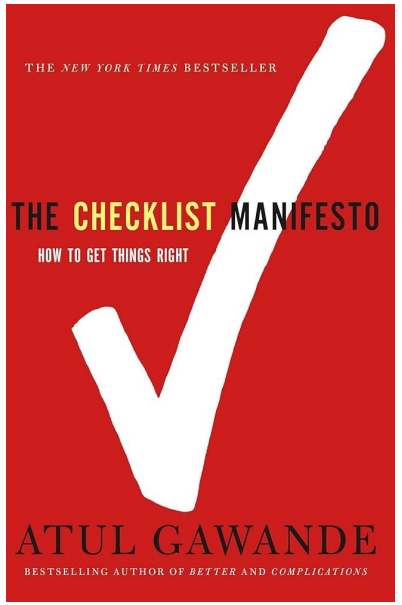
- The CMS bundle rewards "box ticking" rather than clinical excellence



WE LOVE CHECKLISTS THOUGH… WHAT'S THE BIG DEAL?

- The CMS bundle rewards "box ticking" rather than clinical excellence

- Desire to meet a "compliance deadline" leads to diagnostic anchoring and inappropriate care
  - Fluids may worsen some sepsis mimics
  - Unabashed use of broad-spectrum antibiotics
  - Clinicians are penalized for delaying interventions to gather data



WE LOVE CHECKLISTS THOUGH… WHAT'S THE BIG DEAL?

- The CMS bundle rewards "box ticking" rather than clinical excellence

- Desire to meet a "compliance deadline" leads to diagnostic anchoring and inappropriate care
  - Fluids may worsen some sepsis mimics
  - Unabashed use of broad-spectrum antibiotics
  - Clinicians are penalized for delaying interventions to gather data

- Bundles encourage a "one size fits all" approach to sepsis care

“SEPSIS” IS NOT ONE ENTITY

Precision in Pulmonary, Critical Care, and Sleep Medicine. 2019 Sep 28:267–288. doi: 10.1007/978-3-030-31507-8_18

Precision Medicine in Critical Illness: Sepsis and Acute Respiratory Distress Syndrome

Angela J Rogers [7], Nuala J Meyer [8,✉]

- So why are we treating it like one?

WHERE DOES THAT LEAVE US?

- SEPSIS IS AN EMERGENCY!
- Early recognition and intervention save lives
- SEP-1 was an early tool – now it is a relic of how we "used to" manage sepsis
  - It is outdated
  - It creates anchoring
  - It relies on skewed data
- Instead, the right treatment for the right patient at the right time

- Anderson, D. J., Moehring, R. W., Parish, A., David, M. Z., Hsueh, K., Cressman, L., ... & Dodds Ashley, E. (2022). The impact of Centers for Medicare & Medicaid Services SEP-1 core measure implementation on antibacterial utilization: a retrospective multicenter longitudinal cohort study with interrupted time-series analysis. *Clinical Infectious Diseases*, *75*(3), 503-511.
- ANDROMEDA-SHOCK-2 Investigators for the ANDROMEDA Research Network, Spanish Society of Anesthesiology, Reanimation and Pain Therapy (SEDAR), and Latin American Intensive Care Network (LIVEN), Hernandez, G., Ospina-Tascón, G. A., Kattan, E., Ibarra-Estrada, M., Ramasco, F., ... & Biasi Cavalcanti, A. (2025). personalized hemodynamic resuscitation targeting capillary refill time in early septic shock: the ANDROMEDA-SHOCK-2 randomized clinical trial. JAMA, 334(22), 1988-1999.
- ARISE Investigators and the ANZICS Clinical Trials Group. (2014). Goal-directed resuscitation for patients with early septic shock. *New England Journal of Medicine*, *371*(16), 1496-1506.
- Barbash, I. J., Davis, B. S., Yabes, J. G., Seymour, C. W., Angus, D. C., & Kahn, J. M. (2021). Treatment patterns and clinical outcomes after the introduction of the Medicare sepsis performance measure (SEP-1). Annals of internal medicine, 174(7), 927-935.
- Dale, C. R., Chiu, S. T., Sanders, S. S., Stowell, C. J., Steel, T. L., Liao, J. M., & Barnes, J. I. (2024). Sepsis order set use associated with increased care value. Chest, 166(5), 1046-1055.
- Dellinger, R. P., Levy, M. M., Carlet, J. M., Bion, J., Parker, M. M., Jaeschke, R., ... & International Surviving Sepsis Campaign Guidelines Committee. (2008). Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock: 2008. *Critical care medicine*, *36*(1), 296-327.
- Ford, J. S., Morrison, J. C., Kyaw, M., Hewlett, M., Tahir, P., Jain, S., ... & Wardi, G. (2025). The effect of severe sepsis and septic shock management bundle (SEP-1) compliance and implementation on mortality among patients with sepsis: a systematic review. Annals of internal medicine, 178(4), 543-557.
- Levy, M. M., Pronovost, P. J., Dellinger, R. P., Townsend, S., Resar, R. K., Clemmer, T. P., & Ramsay, G. (2004). Sepsis change bundles: converting guidelines into meaningful change in behavior and clinical outcome. *Critical care medicine*, *32*(11), S595-S597.
- Liu, V. X., Fielding-Singh, V., Greene, J. D., Baker, J. M., Iwashyna, T. J., Bhattacharya, J., & Escobar, G. J. (2017). The timing of early antibiotics and hospital mortality in sepsis. American journal of respiratory and critical care medicine, 196(7), 856-863.
- Mouncey, P. R., Osborn, T. M., Power, G. S., Harrison, D. A., Sadique, M. Z., Grieve, R. D., ... & Rowan, K. M. (2015). Trial of early, goal-directed resuscitation for septic shock. *New England Journal of Medicine*, *372*(14), 1301-1311.
- Pakyz, A. L., Orndahl, C. M., Johns, A., Harless, D. W., Morgan, D. J., Bearman, G., ... & Stevens, M. P. (2021). Impact of the Centers for Medicare and Medicaid Services sepsis core measure on antibiotic use. *Clinical Infectious Diseases*, *72*(4), 556-565.
- ProCESS Investigators. (2014). A randomized trial of protocol-based care for early septic shock. *New England Journal of Medicine*, *370*(18), 1683-1693.
- Rhee, C., Wang, R., Zhang, Z., Fram, D., Kadri, S. S., & Klompas, M. (2019). Epidemiology of hospital-onset versus community-onset sepsis in US hospitals and association with mortality: a retrospective analysis using electronic clinical data. *Critical care medicine*, *47*(9), 1169-1176.
- Rhee, C., Yu, T., Wang, R., Kadri, S. S., Fram, D., Chen, H. C., & Klompas, M. (2021). Association between implementation of the severe sepsis and septic shock early management bundle performance measure and outcomes in patients with suspected sepsis in US hospitals. *JAMA network open*, *4*(12), e2138596.
- Rhee, C., Strich, J. R., Chiotos, K., Classen, D. C., Cosgrove, S. E., Greeno, R., ... & Klompas, M. (2024). Improving sepsis outcomes in the era of pay-for-performance and electronic quality measures: a joint IDSA/ACEP/PIDS/SHEA/SHM/SIDP position paper. Clinical Infectious Diseases, 78(3), 505-513.
- Rhee, C., Train, S. E., Filbin, M. R., Park, S. T., Mohr, N. M., Zepeski, A., ... & Klompas, M. (2025). Complex sepsis presentations, SEP-1 compliance, and outcomes. *JAMA network open*, *8*(3), e251100.
- Rivers, E., Nguyen, B., Havstad, S., Ressler, J., Muzzin, A., Knoblich, B., ... & Tomlanovich, M. (2001). Early goal-directed therapy in the treatment of severe sepsis and septic shock. New England journal of medicine, 345(19), 1368-1377.
- Seymour, C. W., Gesten, F., Prescott, H. C., Friedrich, M. E., Iwashyna, T. J., Phillips, G. S., ... & Levy, M. M. (2017). Time to treatment and mortality during mandated emergency care for sepsis. *New England Journal of Medicine*, *376*(23), 2235-2244.
- Townsend, S. R., Phillips, G. S., Duseja, R., Tefera, L., Cruikshank, D., Dickerson, R., ... & Rivers, E. P. (2022). Effects of compliance with the early management bundle (SEP-1) on mortality changes among Medicare beneficiaries with sepsis: a propensity score matched cohort study. *Chest*, *161*(2), 392-406.