NATIONAL QUALITY FORUM

Measure Submission and Evaluation Worksheet 5.0

This form contains the information submitted by measure developers/stewards, organized according to NQF's measure evaluation criteria and process. The evaluation criteria, evaluation guidance documents, and a blank online submission form are available on the submitting standards web page.

NQF #: 0500 NQF Project: Infectious Disease Project

(for Endorsement Maintenance Review)
Original Endorsement Date: Most Recent Endorsement Date: Last Updated Date: Oct 05, 2012

BRIEF MEASURE INFORMATION

De.1 Measure Title: Severe Sepsis and Septic Shock: Management Bundle

Co.1 Measure Steward: Henry Ford Hospital

De.2 Brief Description of Measure: This measure will focus on patients aged 18 years and older who present with symptoms of severe sepsis or septic shock. These patients will be eligible for the 3 hour (severe sepsis) and/or 6 hour (septic shock) early management bundle.

2a1.1 Numerator Statement: If:

A. measure lactate level
B. obtain blood cultures prior to antibiotics
C. administer broad spectrum antibiotics
D. administer 30 ml/kg crystalloid for hypotension or lactate >=4 mmol/L
E. apply vasopressors (for hypotension that does not respond to initial fluid resuscitation to maintain a mean areterial pressure >= 65)
F. In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate >=4 mmol/L (36 mg/dl) measure central venous pressure and central venous oxygen saturation
G. remeasure lactate if initial lactate is elevated

represent processes of care:

Numerator statement: Patients from the denominator who received all the following: A, B, and C within 3 hours of time of presentation† AND IF septic shock is present (as either defined as hypotension* or lactate >=4 mmol/L) who also received D and E and F and G within 6 hours of time of presentation.

† "time of presentation" is defined as the time of triage in the Emergency Department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements severe sepsis or septic shock ascertained through chart review.

* "hypotension" is defined as systolic blood pressure (SBP) <90 mm Hg or mean arterial pressure (MAP) <70 mm Hg or a SBP decrease >40 mm Hg or <2 SD below normal for age or known baseline.

2a1.4 Denominator Statement: Number of patients presenting with severe sepsis or septic shock.

2a1.8 Denominator Exclusions: A) Patients with advanced directives for comfort care are excluded.

B) Clinical conditions that preclude total measure completion should be excluded (e.g. mortality within the first 6 hours of presentation as defined above in 2a1.1).

C) Patients for whom a central line is clinically contraindicated (e.g. coagulopathy that cannot be corrected, inadequate internal jugular or subclavian central venous access due to repeated cannulations).

D) Patients for whom a central line was attempted but could not be successfully inserted.

E) Patient or surrogate decision maker declined or is unwilling to consent to such therapies or central line placement.

1.1 Measure Type: Composite
2a1. 25-26 Data Source: Electronic Clinical Data, Electronic Clinical Data : Electronic Health Record, Electronic Clinical Data : Registry, Paper Medical Records
2a1.33 Level of Analysis: Facility, Integrated Delivery System

1.2-1.4 Is this measure paired with another measure? No

De.3 If included in a composite, please identify the composite measure (*title and NQF number if endorsed*): NQF #0500: Severe Sepsis and Septic Shock: Early Management Bundle

STAFF NOTES (*issues or questions regarding any criteria*)

Comments on Conditions for Consideration:

E.4 If component measures of the composite are aggregate-level measures, all must be either NQF-endorsed or submitted for consideration for NQF endorsement All component measures are NQF-endorsed measures

Is the measure untested? Yes☐ No☐ If untested, explain how it meets criteria for consideration for time-limited endorsement:

1a. Specific national health goal/priority identified by DHHS or NPP addressed by the measure (*check De.5*):
5. Similar/related endorsed or submitted measures (*check 5.1*):
Other Criteria:

Staff Reviewer Name(s):

1. IMPACT, OPPORTUITY, EVIDENCE - IMPORTANCE TO MEASURE AND REPORT

Extent to which the specific measure focus is important to making significant gains in health care quality (safety, timeliness, effectiveness, efficiency, equity, patient-centeredness) and improving health outcomes for a specific high impact aspect of healthcare where there is variation in or overall poor performance.
Measures must be judged to be important to measure and report in order to be evaluated against the remaining criteria. (composite measure evaluation criteria)

(for NQF staff use) Specific NPP goal:

1d.1 Describe the purpose/objective of the composite measure: The purpose of Henry Ford Hospital´s severe sepsis and septic shock early management bundle is to support the efficient, effective, and timely delivery of high quality sepsis care in support of the IOM´s aims for improvement. This is consistent with the HHS National Quality Strategy´s priorities directed at one of the leading causes of mortality. By providing timely patient-centered care, and making sepsis care more affordable through early intervention, reduced resource use and complication rates can result. The Severe Sepsis and Septic Shock Early Management Bundle provides a standard operating procedure for the early risk stratification and management of a patient with severe infection. Through applying this standard operating procedure a clinically and statistically significant decrease in organ failure, mortality, and the utlization of health care resources has been demonstrated for over ten years. The current measure project aimed to review and update the existing NQF #0500 Severe Sepsis and Septic Shock Management Bundle to ensure it reflects the latest guideline recommendations, address areas most in need of performance improvement, and incorporate results of worldwide data collection and quality improvement initiatives. Henry Ford Hospital consulted with leadership and representatives from critical care medicine (Society of Critical Care Medicine), infectious diseases (Infectious Diseases Society of America), and emergency physicians to review and update the Severe Sepsis and Septic Shock Early Management Bundle.
1d.2 Describe the quality construct used in developing the composite: Over the last 25 years, diseases such as stroke, acute myocardial infarction and trauma have resulted in lowered mortality rates through a continuous quality improvement (CQI) and

standardized protocols for early intervention. The Surviving Sepsis Campaign (SSC), the GENeralized Early Sepsis Intervention Strategies (GENESIS) Project, and other sepsis quality initiatives are multifaceted continuous quality improvement (CQI) initiatives which includes: 1)early identification of high risk patients; 2)mobilization of resources for evidence based early interventions; 3)timely initiation of life-saving processes of care 4) a reduction of health care resource consumption and 5) reduced mortality, decreased organ failure, and reduced length of stay. Compliance with the bundle saves 1 in 6 patients who would otherwise die. The current mortality of severe sepsis and septic shock over 5 times higher than any of these aforementioned diseases. Only in the last decade has there been a similar approach to severe sepsis and septic shock.

1e.1 Describe how the component measures/items are consistent with and representative of the quality construct: The sepsis quality initiative is a multifaceted continuous quality improvement (CQI) initiative which includes: 1)early identification of high risk patients; 2)performance of the quality measures appropriate cultures, antibiotics and aggressive reversal of early hemodynamic abnormalities using available best practice; 3) assessment of compliance; 4) dedicated education and feedback to health care providers 5) quantification of health care resource consumption and 6)assessment of outcomes.

If the component measures are combined at the patient level, complete 1a, 1b, and 1c.

If the component measures are combined at the aggregate level, skip to criterion 2, Scientific Acceptability of Measure Properties (individual measures are either NQF-endorsed or submitted individually).

1a. High Impact: H☐ M☐ L☐ I ☐
(*The measure directly addresses a specific national health goal/priority identified by DHHS or NPP, or some other high impact aspect of healthcare.*)

De.4 Subject/Topic Areas *(Check all the areas that apply)*: Infectious Diseases, Infectious Diseases : Respiratory, Pulmonary/Critical Care, Pulmonary/Critical Care : Critical Care, Pulmonary/Critical Care : Pneumonia
De.5 Cross Cutting Areas (*Check all the areas that apply)*: Disparities, Safety, Safety : Healthcare Associated Infections

1a.1 Demonstrated High Impact Aspect of Healthcare: Affects large numbers, A leading cause of morbidity/mortality, Frequently performed procedure, High resource use, Patient/societal consequences of poor quality, Severity of illness

1a.2 If "Other," please describe:

1a.3 Summary of Evidence of High Impact *(Provide epidemiologic or resource use data)*:
Sepsis, severe sepsis and septic shock can arise from a simple infection such as pneumonia, insect bite or urinary tract infection. Although it can affect anyone at any age, it is more common in infants, the elderly and patients with chronic health conditions such as diabetes and immunosuppressive disorders such as transplant patients. This condition is associated with a mortality rates of over 16-49%, which is over eight times higher than the rate for inpatient stays for other hospital admission.[1] Findings from the National Hospital Discharge Survey indicate that the number of hospital stays for septicemia more than doubled between 2000 and 2008, and patients with this conditions were more severely ill than patients hospitalized for other conditions.[3] Severe sepsis and septic shock is a frequent cause of re-hospitalizations, especially during the first year after the initial hospitalization.[4] From 1997 to 2008, costs related to septicemia grew at almost three times the rate of costs for overall hospital stays related to other conditions. The national bill for sepsis, pneumonia (sepsis caused by a lung infection) grew twice as fast as the overall growth in hospital charges—about a 180 percent increase from 1997 to 2005, accounting for over $54 Billion per year. When combined with pneumonia, sepsis is the 3rd largest consumer of Medicare, 4th largest consumer of Medicaid and 5th largest consumer of private insurance financial resources and total hospital days. This figure is expected to increase as over 50% of the U.S. population will be over 60 years of age within the next 20 years. Thus, sepsis is also one of the top 5 most costly diseases treated in hospitals in the U.S.

Based on national discharge data reported by AHRQ (1), sepsis was the sixth most common principal reason for hospitalization in the United States in 2009, accounting for 836,000 hospital stays. There were an additional 829,500
stays with a secondary diagnosis of sepsis for a total of 1,665,400 inpatient stays and 258,000 deaths. From 1993 to 2009, sepsis-related hospital stays increased by 153%, with an average annual increase of 6%. Medicare was the predominant payer for sepsis-related hospital stays, covering 58.1% of patients. Sepsis cases and sepsis-related deaths are expected to continue to increase with the aging of the population.

Improvements in survival for acute myocardial infarctions or heart attacks (mortality 10%), trauma (mortality 5%), and stroke (mortality 15-20%) which are in the top 20 most expensive disease have been realized through early identification and implementation of time-sensitive therapies at the most proximal stage of disease presentation in the Emergency Department (ED). However, similar approaches to patients with severe sepsis and septic shock have been lacking. In a landmark study by Rivers et. al., it has been shown that an absolute and relative reduction in mortality from sepsis can be reduced 16 and 30%, respectively, when aggressive care is provided within 6 hours of hospital arrival. Furthermore, a recent study of a large national inpatient sample determined that patients admitted through the Emergency Department had a 17% lower likelihood of dying from sepsis than when directly admitted.[5]

From 2007 to 2009, over 2,047,038 patients were admitted with a sepsis-related illness.(6) For sepsis patients presenting to the hospital, 52.4% are diagnosed in the ED, 12.8% in the ICU and 34.8% on the hospital wards. The mortality is 27.6%, 41.3% and 46.8% for each of these respective locations.(7) Over 825,300 cases of sepsis present to Emergency Departments (ED) yearly and is the most common diagnosis resulting in hospital stays.(3) It is critically important that patients are diagnosed as soon as possible as mortality can almost 20% higher if a patient is sent the general floors instead of the ICU from the ED. It has also been shown that 12.8% of in-hospital cardiac arrests admitted from home have an admitting diagnosis of pneumonia.(8) This speaks to the fact that these patients are misdiagnosed and sent to the hospital wards to later deteriorate into cardiac arrest.

In contrast, other common diseases such as stroke, acute myocardial infarction and trauma have even lower mortalities because of standard operating procedures or quality measures for early diagnosis and management. Only in the last decade has there been a similar approach to severe sepsis and septic shock which occurs just as frequent and is 5 times more deadly.(9)

The incidence of sepsis increased 83% over the last decade and two-thirds of the patients affected were over the age of 65 years.(10) It is projected that over 50% of the U.S. population will be over 50 years of age by 2020.(2, 12 These observations speak to the inordinate burden on Medicare and Medicaid resources both present and future that make this proposal highly relevant. Interventions to improve sepsis care would lead to significant reduction in morbidity, mortality, and health care resource consumption.(4, 13-20)

1a.4 Citations for Evidence of High Impact cited in 1a.3:

1. Elixhauser, A., Friedman, B., and Stranges, E. Septicemia in U.S. Hospitals, 2009. HCUP Statistical Brief #122. October 2011
2. Wang, H.E., et al., National estimates of severe sepsis in United States emergency departments. Crit Care Med, 2007
3. Hall, M.J., Williams, S.N., DeFrances, C.J., Golosinskiy, A. Inpatient care for septicemia or sepsis: A challenge for patients and hospitals. NCHS data brief, no 62. Hyattsville, MD: National Center for Health Statistics. 2011
4. Lee H, Doig CJ, Ghali WA, Donaldson C, Johnson D, Manns B. Detailed cost analysis of care for survivors of severe sepsis. Crit Care Med. Apr 2004;32(4):981-985.
5. Powell, ES, Khare, RK, Courtney, DM, Feinglass, J. Lower mortality in sepsis patients admitted through the ED vs direct admission. Am J Emerg Med, 2011. 30(3): p. 432-439 .
6. Reed K, McBratney S, Thompson D, Nicholas C. Healthgrades emergency medicine in american hospitals study. Health Grades. June, 2010 2011;The First Annual Report(1):1-28.
7. Levy MM, Dellinger RP, Townsend SR, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Critical Care Medicine. Feb 2010;38(2):367-374.
8. Carr GE, Edelson DP, Yuen TC, et al. In-Hospital cardiac arrest among patients with coexisting pneumonia: a report from the american heart association´s get with the guidelines - resuscitation program. Am. J. Respir. Crit. Care Med. May 1, 2011 2011;183(Meeting Abstracts):A6339.
9. Rivers E, Nguyen B, Havstad S, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med. Nov 8 2001;345(19):1368-1377.
10. Burt CW, McCaig LF, Rechtsteiner EA. Ambulatory medical care utilization estimates for 2005. Adv Data. Jun 29 2007(388):1-15.
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12. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001;29(7):1303-1310.
13. Barnato AE, Alexander SL, Linde-Zwirble WT, Angus DC. Racial variation in the incidence, care, and outcomes of severe sepsis: analysis of population, patient, and hospital characteristics. Am J Respir Crit Care Med. Feb 1 2008;177(3):279-284.

14. http://www.hcup-us.ahrq.gov/reports/factsandfigures/2008/pdfs/FF_report_2008.pdf. HCUP Facts and Figures: Statistics on Hospital-Based Care in the United States. 2008.
15. Kumar G, Kumar N, Taneja A, et al. Nationwide trends of severe sepsis in the 21st century (2000-2007). Chest. Nov 2011;140(5):1223-1231.
16. Martin GS, Mannino DM, Eaton S, Moss M. The epidemiology of sepsis in the United States from 1979 through 2000. N Engl J Med. Apr 17 2003;348(16):1546-1554.
17. Thompson D, Nicholas C, M.S., T.C., May R, MD, et al. The Second Annual HealthGrades Emergency Medicine in American Hospitals Study April 2011. HealthGrades. 2010;2:1-32.
18. Reed K, May R. Healthgrades emergency medicine in american hospitals study. Health Grades. June, 2010 2010;The First Annual Report(1):1-28.
19. Rogers FB, Osler T, Lee JC, et al. In a mature trauma system, there is no difference in outcome (survival) between Level I and Level II trauma centers. J Trauma. Jun 2011;70(6):1354-1357.
20. Bennett KM, Vaslef S, Pappas TN, Scarborough JE. The volume-outcomes relationship for United States Level I trauma centers. J Surg Res. May 1 2011;167(1):19-23.

1b. Opportunity for Improvement: H☐ M☐ L☐ I ☐
(*There is a demonstrated performance gap - variability or overall less than optimal performance*)

1b.1 Briefly explain the benefits (improvements in quality) envisioned by use of this measure:
The benefits of the improvement in quality of care delivered to patients with severe sepsis and septic shock is improved mortality, decreased organ failure and decreases in the utlization of health care resources such as hosptial length of stay, total costs of hospitalization, mechanical ventilation, hemodialysis and time spent in long term care facilities.

1b.2 Summary of Data Demonstrating Performance Gap *(Variation or overall less than optimal performance across providers)*:
[*For Maintenance – Descriptive statistics for performance results for this measure - distribution of scores for measured entities by quartile/decile, mean, median, SD, min, max, etc.*]
MEASURE LACTATE:
Measurement of lactate levels has been specifically associated with improved outcomes in sepsis, and an elevated lactate value identifies patients at higher risk for poor outcomes.(1,2) Up to 10% of inhospital cardiac arrest in the US per year is secondary to sepsis (pneumonia). These patients are often misdiagnosed and sent to the medical floors only to suffer acute hemodynamic deterioration. These outcomes could be potentially avoided with lactate measurement upon admission providing risk stratification triggering alternative dispositions.

In the first quarter of a multicenter quality improvement program for sepsis care, only 61.0% of patients had lactate values measured consistent with guidelines.(3) In addition, prior studies have shown that care prompted by measurement of lactate levels in sepsis patients reduces resource utilization and cost.(4) This leads to lower likelihood of hospital-acquired conditions. This performance measure has been previously used as a core component of multicenter (5) and national quality improvement initiatives.(3) Formalizing it as a national performance measure will provide direct targets for intervention that are closely linked with improvements in mortality and cost.

BLOOD CULTURES:
In the first quarter of a multicenter quality improvement program for sepsis care, only 64.5% of patients had blood cultures collected.(3) Collecting blood cultures has been specifically associated with improved outcomes in sepsis, and pathogens identified by blood cultures allow for customized therapy. As a result, this is a recommendation of the current Surviving Sepsis Guidelines.(5) By obtaining blood cultures, antibiotic regimens can be customized to treat the specific infecting organism. This will result in less unneeded exposure to antibiotics, reducing complications associated with antibiotic use, including drug reactions, allergies and 5 adverse events, the development of drug-resistant organisms, and the occurrence of Clostridium difficile colitis. The performance measure for collecting blood cultures for suspected sepsis has been previously used as a core component of multicenter and national quality improvement initiatives.(3,5-6)

TIMELY ANTIBIOTICS:
In a multicenter observational study of antibiotics in septic shock, the median time to appropriate antibiotics was 6 h after shock.(7) In the first quarter of a multicenter quality improvement program for sepsis care, only 60.4% of patients received timely

antibiotics.(3) Multiple studies have demonstrated that delays in administration of appropriate antibiotics in patients with sepsis and other severe infections are associated with longer lengths of stay, higher costs, and higher mortality.(6) In septic shock, a multicenter cohort study demonstrated that every hour in delay of appropriate antibiotics was associated with a 7.6% higher mortality. In a multicenter quality improvement project, the timely administration of broad-spectrum antibiotics was associated with significantly higher risk adjusted survival.(3) Based on a preponderance of data, the current recommendations in the international guidelines for the management of severe sepsis and septic shock includes the administration of broad-spectrum antibiotic therapy within 1 h of diagnosis of septic shock and severe sepsis.(5)

FLUID RESUSCITATION:
A common finding in patients with septic shock, manifested by low blood pressure and/or other signs of organ hypoperfusion, such as elevated serum lactate levels, is intravascular volume depletion. The degree of the intravascular volume deficit in sepsis varies, yet nearly all patients require initial volume resuscitation and many patients require continuing fluid resuscitation over the first 24 h. Early fluid resuscitation is associated with improved outcomes for patients with ALI due to septic shock.(8) International guidelines recommend that patients with suspected hypovolemia be initially treated with at least 1,000 mL of crystalloid over 30 min to determine clinical response.(5) In the first quarter of a multicenter quality improvement program for sepsis care, only 59.8% of patients received fluid resuscitation consistent with guidelines.(3) Timely fluid resuscitation avoids an error of omission in which indicated therapy is delayed or omitted. By improving outcomes, length of stay is reduced. This leads to lower likelihood of hospital-acquired conditions. This performance measure has been previously used as a core component of multicenter and national quality improvement initiatives.(3,9) Formalizing it as a national performance measure will provide direct targets for intervention that are closely linked with improvements in mortality and cost.

LACTATE CLEARANCE:
Elevated lactate levels prompt the consideration of specific care practices toward hemodynamic optimization guided by either central venous oxygen saturation (10) or lactate clearance.(11) International guidelines(5) recommend that patients with sepsis and continued elevated lactate values have additional therapies until lactate levels are normalized. However, normal lactate levels can be seen in septic shock.

VASOPRESSORS, CVP, and ScvO2:
Performance gaps in individual bundle elements can range from 79% (CI 69-89%) for vasopressors, to 27% (CI 18-36%) for CVP measurement, and as low as 15% (CI 7-23%) for ScvO2 in some community emergency departments.(12) These numbers increase (50-75%) in larger hospital settings. CVP has been shown to have a significant association with mortality (20) and multiple studies and meta-analysis have shown a significant association with reaching an ScvO2 of 70% and improved mortality.(20-26).

OVERALL BUNDLE COMPLIANCE:
Multicenter efforts to promote bundles of care for severe sepsis and septic shock was associated with improved guideline compliance and lower hospital mortality.(6) Even with compliance rates of less than 30%, absolute reductions in mortality of 4-6% has been noted.(3,6) Absolute reductions in mortality of over 20% has been seen with compliance rates of 52%.3 Coba et al has shown that when all bundle elements are completed and compared to patients who do not have bundle completion, the mortality difference is 14%.(27) Thus, there is a direct association between bundle compliance and improved mortality. Without a continuous quality initiative (CQI), even these compliance rates will not improve and will decrease over time.(6) Multiple studies have shown that standardized order sets, enhanced bedside monitor display, telemedicine and comprehensive CQI feedback is feasible, modifies clinician behavior and is associated with decreased hospital mortality.(14-19)

1b.3 Citations for Data on Performance Gap: [*For Maintenance – Description of the data or sample for measure results reported in 1b.2 including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included*]

1. Trzeciak S, Dellinger RP, Abate NL, Cowan RM, et al. Translating research to clinical practice: a 1-year experience with implementing early goal-directed therapy for septic shock in the emergency department. CHEST.2006 Feb; 129(2):225-32.
2. Drumheller B, Goyal M, Pines J et al. Elevated point-of-care lactate at triage is predictive of admission among sepsis patients presenting to the emergency department. Ann Emerg Med 2007; 50: S21–2.
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6. Ferrer R, Artigas A, et al. Improvement in Process of Care and Outcome After a Multicenter Severe Sepsis Education Program. JAMA 2008;299(19):2294-2303
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8. Murphy C, Schramm G, Doherty J, et al. The Importance of Fluid Management in Acute Lung Injury Secondary to Septic Shock. CHEST . 2009 July; vol 136, no. 1;102-109
9. Suarez D, Ferrer R, Artigas A. et al. Cost-effectiveness of the Surviving Sepsis Campaign protocol for severe sepsis. Intensive Care Med. 2011 Mar;37(3):444-52
10. Rivers E, Nguyen B, Havstad S et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med 2001; 345: 1368–77.
11. Jones AE, Shapiro NI, Trzeciak S et al. for the Emergency Medicine Shock Research Network (EMShockNet) Investigators. Lactate clearance vs central venous oxygen saturation as goals of early sepsis therapy. JAMA 2010; 303: 739–46.
12. O´Neill R, Morales J, and Jule M. Early goal directed therapy for severe sepsis and septic shock: which components of treatment are more difficult to implement in a community-based emergency department. Journal of Emergency Medicine 2011. 1-8.
13. Nguyen HB, Corbett SW, Clark RT, Cho T, Wittlake WA. Improving the Uniformity of Care with a Sepsis Bundle in the Emergency Department. Ann Emerg Med. 2005;46(3, Supplement 1):83-83.
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15. Micek ST, Roubinian N, Heuring T, et al. Before-after study of a standardized hospital order set for the management of septic shock. Crit Care Med. Nov 2006;34(11):2707-2713.
16. Winterbottom F, Seoane L, Sundell E, Niazi J, Nash T. Improving Sepsis Outcomes for Acutely Ill Adults Using Interdisciplinary Order Sets. Clin Nurse Spec. July/August 2011;25(4):180-185.
17. Schramm GE, Kashyap R, Mullon JJ, Gajic O, Afessa B. Septic shock: A multidisciplinary response team and weekly feedback to clinicians improve the process of care and mortality. Crit Care Med. Feb 2011;39(2):252-258.
18. Nguyen HB, Corbett SW, Steele R, et al. Implementation of a bundle of quality indicators for the early management of severe sepsis and septic shock is associated with decreased mortality. Crit Care Med. Apr 2007;35(4):1105-1112.
19. Loyola S, Wilhelm J, Fornos J. An innovative approach to meeting early goal-directed therapy using telemedicine. Crit Care Nurs Q. Jul-Sep 2011;34(3):187-199.
20. Varpula M, Tallgren M, Saukkonen K, Voipio-Pulkki LM, Pettila V. Hemodynamic variables related to outcome in septic shock. Intensive Care Med. Jun 23 2005;31:1066-1071.
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22. Castellanos-Ortega A, Suberviola B, Garcia-Astudillo LA, et al. Impact of the surviving sepsis campaign protocols on hospital length of stay and mortality in septic shock patients: Results of a 3-year follow-up quasi-experimental study. Crit Care Med. Feb 11 2010.
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25. Chamberlain DJ, Willis EM, Bersten AB. The severe sepsis bundles as processes of care: A meta-analysis. Aust Crit Care. Feb 14 2011.
26. Grissom CK, Morris AH, Lanken PN, et al. Association of physical examination with pulmonary artery catheter parameters in acute lung injury. Crit Care Med. Oct 2009;37(10):2720-2726.
27. Coba V, Whitmill M, Mooney R, et al. Resuscitation Bundle Compliance in Severe Sepsis and Septic Shock: Improves Survival, Is Better Late than Never. J Intensive Care Med. Jan 10 2011.

1b.4 Summary of Data on Disparities by Population Group: [*For **Maintenance** –Descriptive statistics for performance results for this measure by population group*]

Although it can affect anyone at any age, it is more common in infants, elderly, minorities and patients with chronic health conditions. Patients, particularly the elderly, who present with sepsis can have symptoms for over 24 before presenting to the hospital. Medicaid and Medicare beneficiaries also suffer disproportionately compared to those with private insurance or self-

payers.[1-4] It is projected that over 50% of the U.S. population will be over 50 years of age by 2020.[5] This makes it imperative to examine quality initiatives that will not only improve care but also ameliorate the increasing pressure on Medicare Trust Fund which is projected to be insolvent by 2024. Because of diminished access to health care, minorities have a disproportionate greater use of the ED and are thus affected in greater numbers and of higher illness severity upon presentation.[6] These disparities can be partially ameliorated by focused interventions directed at these high risk patient populations.[7,8,9]

1b.5 Citations for Data on Disparities Cited in 1b.4: [*For Maintenance – Description of the data or sample for measure results reported in 1b.4 including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included*]

1. National Healthcare Disparities Report 2011. Agency for Healthcare Research and Quality. March 2012: p. 146-147.
2. Wilper, A.P., et al., Waits to see an emergency department physician: U.S. trends and predictors, 1997-2004. Health Aff (Millwood), 2008. 27(2): p. w84-95.
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4. Rodriguez RM, Passanante M, Phelps MA, et al. Delayed emergency department presentation in critically ill patients. Crit Care Med. Dec 2001;29(12):2318-2321.
5. Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001;29(7):1303-1310.
6. Burt CW, McCaig LF, Rechtsteiner EA. Ambulatory medical care utilization estimates for 2005. Adv Data. Jun 29 2007(388):1-15.
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8. Barnato AE, Alexander SL, Linde-Zwirble WT, Angus DC. Racial variation in the incidence, care, and outcomes of severe sepsis: analysis of population, patient, and hospital characteristics. Am J Respir Crit Care Med. Feb 1 2008;177(3):279-284.
9. El Solh AA, Akinnusi ME, Alsawalha LN, Pineda LA. Outcome of Septic Shock in Older Adults After Implementation of the Sepsis "Bundle". J Am Geriatr Soc. Nov 27 2007.

1c. Evidence (*Measure focus is a health outcome OR meets the criteria for quantity, quality, consistency of the body of evidence.*)
Is the measure focus a health outcome? Yes☐ No☐ If not a health outcome, rate the body of evidence.

Quantity: H☐ M☐ L☐ I☐ Quality: H☐ M☐ L☐ I☐ Consistency: H☐ M☐ L☐ I☐

Quantity	Quality	Consistency	Does the measure pass subcriterion1c?
M-H	M-H	M-H	Yes☐
L	M-H	M	Yes☐ IF additional research unlikely to change conclusion that benefits to patients outweigh harms
M-H	L	M-H	Yes☐ IF potential benefits to patients clearly outweigh potential harms
L-M-H	L-M-H	L	No ☐

Health outcome – rationale supports relationship to at least one healthcare structure, process, intervention, or service	Does the measure pass subcriterion1c? Yes☐ IF rationale supports relationship

1c.1 Structure-Process-Outcome Relationship *(Briefly state the measure focus, e.g., health outcome, intermediate clinical outcome, process, structure; then identify the appropriate links, e.g., structure-process-health outcome; process- health outcome; intermediate clinical outcome-health outcome)*:
The foci of this composite are the processes of early management for patients with severe sepsis and septic shock. All bundle elements are associated with improved outcomes for severe sepsis and septic shock patients including mortality and length of stay and have been consistently observed with implementation of early best practice intervention strategies.

1c.2-3 Type of Evidence *(Check all that apply)*:
Clinical Practice Guideline, Selected individual studies (rather than entire body of evidence), Systematic review of body of evidence (other than within guideline development)

1c.4 Exclusions Justified A) Patients with advanced directives for comfort care are excluded.
B) Clinical conditions that preclude total measure completion should be excluded (e.g. mortality within the first 6 hours of presentation as defined above in 2a1.1).
C) Patients for whom a central line is clinically contraindicated (e.g. coagulopathy that cannot be corrected, inadequate internal jugular or subclavian central venous access due to repeated cannulations).
D) Patients for whom a central line was attempted but could not be successfully inserted.
E) Patient or surrogate decision maker declined or is unwilling to consent to such therapies or central line placement.

Please note that the exclusions are highly intuitive and reasonable. Thus, imagining a world for testing purposes, where patients who did not consent for lines received them or who wished to be made comfort measures were treated aggressively is wholly unlikely. Such a study most likely could not be conducted due to appropriate IRB constraints.

1c.5 Directness of Evidence to the Specified Measure *(State the central topic, population, and outcomes addressed in the body of evidence and identify any differences from the measure focus and measure target population)*:
The measure focus is on adults 18 years and older with a diagnosis of severe sepsis and septic shock. Consistent with Surviving Sepsis Campaign guidelines, it recommends measurement of lactate, obtaining blood cultures, administering broad spectrum antibiotics, fluid resuscitation, repeat lactate measurement for lactate clearance, and measuring central venous pressure (CVP) and central venous oxygen saturation (ScvO2). The evidence cited for all components of this measure is directly related to decreases in organ failure, overall reductions in hospital mortality, length of stay, and costs of care. For more information, please see attachment entitled NQF 0500 Tables and Forest Plots under the section "Scientific Acceptability".

1c.6 Quantity of Studies in the Body of Evidence *(Total number of studies, not articles)*: The SSC guidelines support for this measure recommendation comes from a particular emphasis on the following:
1. Rivers E, Nguyen B, Havstad S, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med 2001;345:1368-77.
2. Gao F, Melody T, Daniels DF, Giles S, Fox S. The impact of compliance with 6-hour and 24-hour sepsis bundles on hospital mortality in patients with severe sepsis: a prospective observational study. Crit Care 2005;9:R764-70.
3. Sebat F, Johnson D, Musthafa AA, et al. A multidisciplinary community hospital program for early and rapid resuscitation of shock in nontrauma patients. Chest 2005;127:1729-43.
4. Kortgen A, Niederprum P, Bauer M. Implementation of an evidence-based "standard operating procedure" and outcome in septic shock. Crit Care Med 2006;34:943-9.
5. Shapiro NI, Howell MD, Talmor D, et al. Implementation and outcomes of the Multiple Urgent Sepsis Therapies (MUST) protocol. Crit Care Med 2006;34:1025-32.
6. Trzeciak S, Dellinger RP, Abate NL, et al. Translating research to clinical practice: a 1-year experience with implementing early goal-directed therapy for septic shock in the emergency department. Chest 2006;129:225-32.
7. Micek ST, Roubinian N, Heuring T, et al. Before-after study of a standardized hospital order set for the management of septic shock. Crit Care Med 2006;34:2707-13.
8. Lin SM, Huang CD, Lin HC, Liu CY, Wang CH, Kuo HP. A modified goal-directed protocol improves clinical outcomes in intensive care unit patients with septic shock: a randomized controlled trial. Shock 2006;26:551-7.
9. Qu HP, Qin S, Min D, Tang YQ. [The effects of earlier resuscitation on following therapeutic response in sepsis with hypoperfusion]. Zhonghua Wai Ke Za Zhi 2006;44:1193-6.
10. Nguyen HB, Corbett SW, Steele R, et al. Implementation of a bundle of quality indicators for the early management of severe sepsis and septic shock is associated with decreased mortality. Crit Care Med 2007;35:1105-12.
11. Chen ZQ, Jin YH, Chen H, Fu WJ, Yang H, Wang RT. [Early goal-directed therapy lowers the incidence, severity and mortality of multiple organ dysfunction syndrome]. Nan Fang Yi Ke Da Xue Xue Bao 2007;27:1892-5.
12. Jones AE, Focht A, Horton JM, Kline JA. Prospective external validation of the clinical effectiveness of an emergency department-based early goal-directed therapy protocol for severe sepsis and septic shock. Chest 2007;132:425-32.
13. Sebat F, Musthafa AA, Johnson D, et al. Effect of a rapid response system for patients in shock on time to treatment and mortality during 5 years. Crit Care Med 2007;35:2568-75.
14. El Solh AA, Akinnusi ME, Alsawalha LN, Pineda LA. Outcome of septic shock in older adults after implementation of the sepsis "bundle". J Am Geriatr Soc 2008;56:272-8.
15. He ZY, Gao Y, Wang XR, Hang YN. [Clinical evaluation of execution of early goal directed therapy in septic shock]. Zhongguo Wei Zhong Bing Ji Jiu Yi Xue 2007;19:14-6.

16. Castro R, Regueira T, Aguirre ML, et al. An evidence-based resuscitation algorithm applied from the emergency room to the ICU improves survival of severe septic shock. Minerva Anestesiol 2008;74:223-31.
17. Zambon M, Ceola M, Almeida-de-Castro R, Gullo A, Vincent JL. Implementation of the Surviving Sepsis Campaign guidelines for severe sepsis and septic shock: we could go faster. J Crit Care 2008;23:455-60.
18. Zubrow MT, Sweeney TA, Fulda GJ, et al. Improving care of the sepsis patient. Jt Comm J Qual Patient Saf 2008;34:187-91.
19. Peel M. Care bundles: resuscitation of patients with severe sepsis. Nurs Stand 2008;23:41-6.
20. Focht A, Jones AE, Lowe TJ. Early goal-directed therapy: improving mortality and morbidity of sepsis in the emergency department. Jt Comm J Qual Patient Saf 2009;35:186-91.
21. Moore LJ, Jones SL, Kreiner LA, et al. Validation of a screening tool for the early identification of sepsis. J Trauma 2009;66:1539-46; discussion 46-7.
22. Puskarich MA, Marchick MR, Kline JA, Steuerwald MT, Jones AE. One year mortality of patients treated with an emergency department based early goal directed therapy protocol for severe sepsis and septic shock: a before and after study. Crit Care 2009;13:R167.
23. Ferrer R, Artigas A, Levy MM, et al. Improvement in process of care and outcome after a multicenter severe sepsis educational program in Spain. Jama 2008;299:2294-303.
24. Girardis M, Rinaldi L, Donno L, et al. Effects on management and outcome of severe sepsis and septic shock patients admitted to the intensive care unit after implementation of a sepsis program: a pilot study. Crit Care 2009;13:R143.
25. Wang JL, Chin CS, Chang MC, et al. Key process indicators of mortality in the implementation of protocol-driven therapy for severe sepsis. J Formos Med Assoc 2009;108:778-87.
26. Thiel SW, Asghar MF, Micek ST, Reichley RM, Doherty JA, Kollef MH. Hospital-wide impact of a standardized order set for the management of bacteremic severe sepsis. Crit Care Med 2009;37:819-24.
27. Pestana D, Espinosa E, Sanguesa-Molina JR, et al. Compliance With a Sepsis Bundle and Its Effect on Intensive Care Unit Mortality in Surgical Septic Shock Patients. J Trauma 2010.
28. Castellanos-Ortega A, Suberviola B, Garcia-Astudillo LA, et al. Impact of the Surviving Sepsis Campaign protocols on hospital length of stay and mortality in septic shock patients: results of a three-year follow-up quasi-experimental study. Crit Care Med 2010;38:1036-43.
29. Lefrant JY, Muller L, Raillard A, et al. Reduction of the severe sepsis or septic shock associated mortality by reinforcement of the recommendations bundle: A multicenter study. Ann Fr Anesth Reanim 2010.
30. Cardoso T, Carneiro AH, Ribeiro O, Teixeira-Pinto A, Costa-Pereira A. Reducing mortality in severe sepsis with the implementation of a core 6-hour bundle: results from the Portuguese community-acquired sepsis study (SACiUCI study). Crit Care 2010;14:R83.
31. [The effect of early goal-directed therapy on treatment of critical patients with severe sepsis/septic shock: a multi-center, prospective, randomized, controlled study]. Zhongguo Wei Zhong Bing Ji Jiu Yi Xue 2010;22:331-4.
32. Patel GW, Roderman N, Gehring H, Saad J, Bartek W. Assessing the Effect of the Surviving Sepsis Campaign Treatment Guidelines on Clinical Outcomes in a Community Hospital (November). Ann Pharmacother 2010.
33. Crowe CA, Mistry CD, Rzechula K, Kulstad CE. Evaluation of a modified early goal-directed therapy protocol. Am J Emerg Med 2010;28:689-93.
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35. Gerber K. Surviving sepsis: a trust-wide approach. A multi-disciplinary team approach to implementing evidence-based guidelines. Nurs Crit Care 2010;15:141-51.
36. Gurnani PK, Patel GP, Crank CW, et al. Impact of the implementation of a sepsis protocol for the management of fluid-refractory septic shock: A single-center, before-and-after study. Clin Ther 2010;32:1285-93.
37. Levy MM, Dellinger RP, Townsend SR, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Critical Care Medicine 2010;38:367-74.
38. Macredmond R, Hollohan K, Stenstrom R, Nebre R, Jaswal D, Dodek P. Introduction of a comprehensive management protocol for severe sepsis is associated with sustained improvements in timeliness of care and survival. Qual Saf Health Care 2010.
39. Mikkelsen ME, Gaieski DF, Goyal M, et al. Factors associated with nonadherence to early goal-directed therapy in the ED. Chest 2010;138:551-8.
40. Coba V, Whitmill M, Mooney R, et al. Resuscitation Bundle Compliance in Severe Sepsis and Septic Shock: Improves Survival, Is Better Late than Never. J Intensive Care Med 2011.
41. Sivayoham N, Rhodes A, Jaiganesh T, van Zyl Smit N, Elkhodhair S, Krishnanandan S. Outcomes from implementing early goal-directed therapy for severe sepsis and septic shock : a 4-year observational cohort study. Eur J Emerg Med 2011.

42. Westphal GA, Koenig A, Caldeira Filho M, et al. Reduced mortality after the implementation of a protocol for the early detection of severe sepsis. J Crit Care 2011;26:76-81.
43. Castellanos-Ortega A, Suberviola B, Garcia-Astudillo LA, Ortiz F, Llorca J, Delgado-Rodriguez M. Late compliance with the sepsis resuscitation bundle: impact on mortality. Shock 2011;36:542-7.
44. Jones AE, Troyer JL, Kline JA. Cost-effectiveness of an emergency department-based early sepsis resuscitation protocol. Crit Care Med 2011;39:1306-12.
45. O´Neill R, Morales J, Jule M. Early Goal-directed Therapy (EGDT) for Severe Sepsis/Septic Shock: Which Components of Treatment are More Difficult to Implement in a Community-based Emergency Department? J Emerg Med 2011.
46. Casserly B, Baram M, Walsh P, Sucov A, Ward NS, Levy MM. Implementing a collaborative protocol in a sepsis intervention program: lessons learned. Lung 2011;189:11-9.
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48. Suarez D, Ferrer R, Artigas A, et al. Cost-effectiveness of the Surviving Sepsis Campaign protocol for severe sepsis: a prospective nation-wide study in Spain. Intensive Care Med 2011;37:444-52.
49. Nguyen HB, Kuan WS, Batech M, et al. Outcome effectiveness of the severe sepsis resuscitation bundle with addition of lactate clearance as a bundle item: a multi-national evaluation. Crit Care 2011;15:R229.
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51. Tromp M, Tjan DH, van Zanten AR, et al. The effects of implementation of the Surviving Sepsis Campaign in the Netherlands. Neth J Med 2011;69:292-8.
52. Winterbottom F, Seoane L, Sundell E, Niazi J, Nash T. Improving Sepsis Outcomes for Acutely Ill Adults Using Interdisciplinary Order Sets. Clin Nurse Spec 2011;25:180-5.
53. Bastani A, Galens S, Rocchini A, et al. ED identification of patients with severe sepsis/septic shock decreases mortality in a community hospital. Am J Emerg Med 2011.
54. Jeon K, Shin TG, Sim MS, et al. Improvements in Compliance of Resuscitation Bundles and Achievement of End Points After an Educational Program on the Management of Severe Sepsis and Septic Shock. Shock 2012.
55. Cannon CM, for the Multicenter Severe S, Septic Shock Collaborative G. The GENESIS Project (GENeralization of Early Sepsis InterventionS): A Multicenter Quality Improvement Collaborative. Acad Emerg Med 2010;17:1258.

1c.7 Quality of Body of Evidence (*Summarize the certainty or confidence in the estimates of benefits and harms to patients across studies in the body of evidence resulting from study factors. Please address: a) study design/flaws; b) directness/indirectness of the evidence to this measure (e.g., interventions, comparisons, outcomes assessed, population included in the evidence); and c) imprecision/wide confidence intervals due to few patients or events*): DETERMINATION OF QUALITY OF EVIDENCE

UNDERLYING METHODOLOGY:
A. RCT
B. Downgraded RCT or upgraded observational studies
C. Well-done observational studies
D. Case series or expert opinion

FACTORS THAT MAY DECREASE THE STREGNTH OF EVIDENCE:
1. Poor quality of planning and implementation of available RCTs, suggesting high likelihood of bias
2. Inconsistency of results (including problems with subgroup analyses)
3. Indirectness of evidence (differing population, intervention, control, outcomes, comparison)
4. Imprecision of results
5. High likelihood of reporting bias

MAIN FACTORS THAT MAY INCREASE STRENGTH OF EVIDENCE:
1. Large magnitude of effect (direct evidence, RR 2 with no plausible confounders)
2. Very large magnitude of effect with RR 5 and no threats to validity (by two levels)
3. Dose-response gradient RCT, randomized controlled trial; RR, relative risk.

FACTORS DETERMINING STRONG VS WEAK RECOMMENDATION:

1. Quality of evidence: the lower the quality of evidence, the less likely a strong recommendation
2. Relative importance of the outcomes: if values and preferences vary widely, a strong recommendation becomes less likely
3. Baseline risks of outcomes: the higher the risk, the greater the magnitude of benefit
4. Magnitude of relative risk, including benefits, harms, and burden: larger relative risk reductions or larger increases in relative risk of harm make a strong recommendation more or less likely, respectively
5. Absolute magnitude of the effect: the larger the absolute benefits and harms, the greater or lesser likelihood, respectively, of a strong recommendation
6. Precision of the estimates of the effects: the greater the precision, the more likely a strong recommendation
7. Costs: the higher the cost of treatment, the less likely a strong recommendation

1c.8 Consistency of Results across Studies *(Summarize the consistency of the magnitude and direction of the effect):* Although there is no explicit statement in the Surviving Sepsis Campaign (SSC)2008 guidelines regarding the overall consistency of results across studies supporting the guideline recommendations, the development of the SSC 2008 guidelines was by a committee of 68 international experts using the modified Delphi process in developing recommendations for the best current care of patients with severe sepsis and septic shock. These individuals represented 29 Sponsoring organizations: American Association of Critical-Care Nurses, American College of Chest Physicians, American College of Emergency Physicians, American Thoracic Society, Asia Pacific Association of Critical Care Medicine, Australian and New Zealand Intensive Care Societies, Brazilian Society of Critical Care, Canadian Critical Care Society, Chinese Society of Critical Care Medicine, Chinese Society of Critical Care Medicine - China Medical Association, Emirates Intensive Care Society, European Respiratory Society, European Society of Clinical Microbiology and Infectious Diseases, European Society of Intensive Care Medicine, European Society of Pediatric and Neonatal Intensive Care, Infectious Diseases Society of America, Indian Society of Critical Care Medicine, International Pan Arabian Critical Care Medicine Society, Japanese Association for Acute Medicine, Japanese Society of Intensive Care Medicine, Pediatric Acute Lung Injury and Sepsis Investigators, Society for Academic Emergency Medicine, Society of Critical Care Medicine, Society of Hospital Medicine, Surgical Infection Society, World Federation of Critical Care Nurses, World Federation of Pediatric Intensive and Critical Care Societies; World Federation of Societies of Intensive and Critical Care Medicine. Participation and endorsement by the German Sepsis Society and the Latin American Sepsis Institute.

Over the last decade the external validity and generalizability of the various components of the early management bundle have been established in over 50 publications containing over 20,000 patients in community and tertiary hospitals, ED and ICU settings, and medical and surgical patients. In addition, a meta-analysis found that in eight unblinded trials, one randomized and seven with historical controls, sepsis bundles were associated with a consistent ($I^2 = 0\%$, $p = .87$) and significant increase in survival (odds ratio, 1.91; 95% confidence interval, 1.49-2.45; $p < .0001$). For all studies reporting such data, there were consistent ($I^2 = 0\%$, $p >$ or $= .64$) decreases in time to antibiotics, and increases in the appropriateness of antibiotics ($p <$ or $= .0002$ for both).(2) Similar findings were noted in a meta-analysis by Chamberlain et al.(3)

1. Dellinger RP, Levy MM, Carlet JM, Bion J, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis
and septic shock. Crit Care Med. 2008 Jan;36(1):296-327.
2. Barochia AV, Cui X, Vitberg D, et al. Bundled care for septic shock: an analysis of clinical trials. Crit Care Med. Feb 2010;38(2):668-678.
3. Chamberlain DJ, Willis EM, Bersten AB. The severe sepsis bundles as processes of care: A meta-analysis. Aust Crit Care. Feb 14 2011.

1c.9 Net Benefit *(Provide estimates of effect for benefit/outcome; identify harms addressed and estimates of effect; and net benefit - benefit over harms)*:
A meta-analysis found that in eight unblinded trials, one randomized and seven with historical controls, sepsis bundles were associated with a consistent ($I^2 = 0\%$, $p = .87$) and significant increase in survival (odds ratio, 1.91; 95% confidence interval, 1.49-2.45; $p < .0001$).(1) Similar findings were noted in a more recent and larger meta-analysis by Chamberlain.(7) In the presence of septic shock each hour delay in achieving administration of effective antibiotics is associated with a measurable 7.6% increase in mortality.(2) Although restriction of antibiotics as a strategy to reduce the development of antimicrobial resistance or to reduce cost is not an appropriate initial strategy in this patient population, once the causative pathogen has been identified, it may become apparent that none of the empirical drugs offers optimal therapy; that is, there may be another drug proven to produce superior clinical outcome that should therefore replace empirical agents. Narrowing the spectrum of antibiotic coverage and reducing the

duration of antibiotic therapy will reduce the likelihood that the patient will develop superinfection with pathogenic or resistant organisms, such as Candida species, Clostridium difficile, or vancomycin-resistant Enterococcus faecium. However, the desire to minimize superinfections and other complications should not take precedence over the need to give the patient an adequate course of therapy to cure the infection that caused the severe sepsis or septic shock.3 After adjustment for baseline characteristics, administration of broad-spectrum antibiotics (OR, 0.86; 95%, CI 0.79– 0.93; p .0001), obtaining blood cultures before their initiation (OR, 0.76; 95% CI, 0.70 – 0.83; p < .0001) were all associated with lower hospital mortality.(4) Blood pressure and lactate targets are predictors of outcome, detect early organ dysfunction and sudden hemodynamic compensation. Early aggressive fluid therapy is associated with improved outcomes over later aggressive fluid therapy.(5) ScvO2 is one of the most important bundle elements, predictive of outcome, and is superior to physical examination in detecting low cardiac index.(6)Patients attaining an ScvO2 of 70% have a two-fold improved mortality than patients treating without it.(7)

1. Barochia AV, Cui X, Vitberg D, et al. Bundled care for septic shock: an analysis of clinical trials. Crit Care Med. Feb 2010;38(2):668-678.
2. Kumar A, Roberts D, Wood KE, et al: Duration of hypotension prior to initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. Crit Care Med 2006; 34:1589–1596.
3. Dellinger RP, Levy MM, Carlet JM, Bion J, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock. Crit Care Med. 2008 Jan;36(1):296-327.
4. Levy MM, Dellinger RP, Townsend SR, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Critical Care Medicine 2010;38:367-74.
5. Murphy C, Schramm G, Doherty J, et al. The Importance of Fluid Management in Acute Lung Injury Secondary to Septic Shock. CHEST. 2009 July; vol 136, no. 1;102-109
6. Rivers EP, Katranji M, Jaehne KA, Brown S, Abou Dagher G, Cannon C, Coba V. Early interventions in severe sepsis and septic shock: a review of the evidence one decade later. Minerva Anestesiol. 2012 Jun;78(6):712-24
7. Chamberlain DJ, Willis EM, Bersten AB. The severe sepsis bundles as processes of care: A meta-analysis. Aust Crit Care. Feb 14 2011.

1c.10 Grading of Strength/Quality of the Body of Evidence. Has the body of evidence been graded? Yes

1c.11 If body of evidence graded, identify the entity that graded the evidence including balance of representation and any disclosures regarding bias: The Surviving Sepsis Campaign is comprised of a consensus committee of over 50 international experts using the modified Delphi process. These individuals represented 29 Sponsoring organizations: American Association of Critical-Care Nurses, American College of Chest Physicians, American College of Emergency Physicians, American Thoracic Society, Asia Pacific Association of Critical Care Medicine, Australian and New Zealand Intensive Care Societies, Brazilian Society of Critical Care, Canadian Critical Care Society, Chinese Society of Critical Care Medicine, Chinese Society of Critical Care Medicine - China Medical Association, Emirates Intensive Care Society, European Respiratory Society, European Society of Clinical Microbiology and Infectious Diseases, European Society of Intensive Care Medicine, European Society of Pediatric and Neonatal Intensive Care, Infectious Diseases Society of America, Indian Society of Critical Care Medicine, International Pan Arabian Critical Care Medicine Society, Japanese Association for Acute Medicine, Japanese Society of Intensive Care Medicine, Pediatric Acute Lung Injury and Sepsis Investigators, Society for Academic Emergency Medicine, Society of Critical Care Medicine, Society of Hospital Medicine, Surgical Infection Society, World Federation of Critical Care Nurses, World Federation of Pediatric Intensive and Critical Care Societies; World Federation of Societies of Intensive and Critical Care Medicine. Participation and endorsement by the German Sepsis Society and the Latin American Sepsis Institute.

The 2008 guidelines process was funded fully by the Society of Critical Care Medicine. No industry funding was accepted or utilized. Nominal groups were assembled at key international meetings (for those committee members attending the conference). A stand-alone meeting was held for all sub-group heads, co- and vice chairs, and selected key individuals. Teleconferences and electronic-based discussion among subgroups and among the entire committee served as an integral part of the development. Methods: The Grading of Recommendations Assessment, Development and Evaluation. (GRADE) system to guide assessment of quality of evidence from high (A) to very low (D) and to determine the strength of recommendations was used. A strong recommendation (1) indicates that an intervention's desirable effects clearly outweigh its undesirable effects (risk, burden, cost) or clearly do not. Weak recommendations (2) indicate that the tradeoff between desirable and undesirable effects is less clear. Some recommendations are ungraded (UG). The grade of strong or weak is considered of greater clinical importance than a difference in letter level of quality of evidence. In areas without complete agreement, a formal process of resolution was developed and applied.

Recommendations are in 3 groups: 1) those directly targeting severe sepsis; 2) recommendations targeting general care of the critically ill patient that are considered high priority in severe sepsis; and 3) pediatric considerations. A formal conflict of interest policy (COI) was developed at the onset of the process and enforced throughout. The entire guidelines process was conducted independent of any industry funding.

1c.12 System Used for Grading the Body of Evidence: GRADE

1c.13 If other, identify and describe the grading scale with definitions:

1c.14 Grade Assigned to the Body of Evidence: EARLY MANAGEMENT WITHIN 6 HOURS=1C, MEASURE LACTATE=1C, BLOOD CULTURES=1C, ANTIBIOTICS=1B, FLUIDS=1B, VASOPRESSORS=1D, MEASURE CVP & ScVO2=1C

1c.15 Summary of Controversy/Contradictory Evidence:

1c.16 Citations for Evidence other than Guidelines*(Guidelines addressed below)*:

1. Rivers E, Nguyen B, Havstad S, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med 2001;345:1368-77.
2. Gao F, Melody T, Daniels DF, Giles S, Fox S. The impact of compliance with 6-hour and 24-hour sepsis bundles on hospital mortality in patients with severe sepsis: a prospective observational study. Crit Care 2005;9:R764-70.
3. Sebat F, Johnson D, Musthafa AA, et al. A multidisciplinary community hospital program for early and rapid resuscitation of shock in nontrauma patients. Chest 2005;127:1729-43.
4. Kortgen A, Niederprum P, Bauer M. Implementation of an evidence-based "standard operating procedure" and outcome in septic shock. Crit Care Med 2006;34:943-9.
5. Shapiro NI, Howell MD, Talmor D, et al. Implementation and outcomes of the Multiple Urgent Sepsis Therapies (MUST) protocol. Crit Care Med 2006;34:1025-32.
6. Trzeciak S, Dellinger RP, Abate NL, et al. Translating research to clinical practice: a 1-year experience with implementing early goal-directed therapy for septic shock in the emergency department. Chest 2006;129:225-32.
7. Micek ST, Roubinian N, Heuring T, et al. Before-after study of a standardized hospital order set for the management of septic shock. Crit Care Med 2006;34:2707-13.
8. Lin SM, Huang CD, Lin HC, Liu CY, Wang CH, Kuo HP. A modified goal-directed protocol improves clinical outcomes in intensive care unit patients with septic shock: a randomized controlled trial. Shock 2006;26:551-7.
9. Qu HP, Qin S, Min D, Tang YQ. [The effects of earlier resuscitation on following therapeutic response in sepsis with hypoperfusion]. Zhonghua Wai Ke Za Zhi 2006;44:1193-6.
10. Nguyen HB, Corbett SW, Steele R, et al. Implementation of a bundle of quality indicators for the early management of severe sepsis and septic shock is associated with decreased mortality. Crit Care Med 2007;35:1105-12.
11. Chen ZQ, Jin YH, Chen H, Fu WJ, Yang H, Wang RT. [Early goal-directed therapy lowers the incidence, severity and mortality of multiple organ dysfunction syndrome]. Nan Fang Yi Ke Da Xue Xue Bao 2007;27:1892-5.
12. Jones AE, Focht A, Horton JM, Kline JA. Prospective external validation of the clinical effectiveness of an emergency department-based early goal-directed therapy protocol for severe sepsis and septic shock. Chest 2007;132:425-32.
13. Sebat F, Musthafa AA, Johnson D, et al. Effect of a rapid response system for patients in shock on time to treatment and mortality during 5 years. Crit Care Med 2007;35:2568-75.
14. El Solh AA, Akinnusi ME, Alsawalha LN, Pineda LA. Outcome of septic shock in older adults after implementation of the sepsis "bundle". J Am Geriatr Soc 2008;56:272-8.
15. He ZY, Gao Y, Wang XR, Hang YN. [Clinical evaluation of execution of early goal directed therapy in septic shock]. Zhongguo Wei Zhong Bing Ji Jiu Yi Xue 2007;19:14-6.
16. Castro R, Regueira T, Aguirre ML, et al. An evidence-based resuscitation algorithm applied from the emergency room to the ICU improves survival of severe septic shock. Minerva Anestesiol 2008;74:223-31.
17. Zambon M, Ceola M, Almeida-de-Castro R, Gullo A, Vincent JL. Implementation of the Surviving Sepsis Campaign guidelines for severe sepsis and septic shock: we could go faster. J Crit Care 2008;23:455-60.
18. Zubrow MT, Sweeney TA, Fulda GJ, et al. Improving care of the sepsis patient. Jt Comm J Qual Patient Saf 2008;34:187-91.
19. Peel M. Care bundles: resuscitation of patients with severe sepsis. Nurs Stand 2008;23:41-6.
20. Focht A, Jones AE, Lowe TJ. Early goal-directed therapy: improving mortality and morbidity of sepsis in the emergency

department. Jt Comm J Qual Patient Saf 2009;35:186-91.
21. Moore LJ, Jones SL, Kreiner LA, et al. Validation of a screening tool for the early identification of sepsis. J Trauma 2009;66:1539-46; discussion 46-7.
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23. Ferrer R, Artigas A, Levy MM, et al. Improvement in process of care and outcome after a multicenter severe sepsis educational program in Spain. Jama 2008;299:2294-303.
24. Girardis M, Rinaldi L, Donno L, et al. Effects on management and outcome of severe sepsis and septic shock patients admitted to the intensive care unit after implementation of a sepsis program: a pilot study. Crit Care 2009;13:R143.
25. Wang JL, Chin CS, Chang MC, et al. Key process indicators of mortality in the implementation of protocol-driven therapy for severe sepsis. J Formos Med Assoc 2009;108:778-87.
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Treatment are More Difficult to Implement in a Community-based Emergency Department? J Emerg Med 2011.
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1c.17 Quote verbatim, the specific guideline recommendation *(Including guideline # and/or page #)*:

GOALS OF INITIAL RESUSCITATION (Strong Recommendation):
This protocol should be initiated as soon as hypoperfusion is recognized and should not be delayed pending ICU admission. During the first 6 hrs of resuscitation, the goals of initial resuscitation of sepsis-induced hypoperfusion should include all of the following as one part of a treatment protocol: central venous pressure 8–12 mm Hg, mean arterial pressure (MAP) >=65 mm Hg, urine output >=0.5 mL·kg-1·hr-1, central venous (superior vena cava) or mixed venous oxygen saturation >=70% or >=65%, respectively (grade 1C).

MEASURE LACTATE (Strong Recommendation):
We recommend the protocolized resuscitation of a patient with sepsis induced shock, defined as tissue hypoperfusion (hypotension persisting after initial fluid challenge or blood lactate concentration > or =4 mmol/L). (grade 1C).

APPROPRIATE BLOOD CULTURES (Strong Recommendation):
We recommend obtaining appropriate cultures before antimicrobial therapy is initiated if such cultures do not cause significant delay in antibiotic administration. To optimize identification of causative organisms, we recommend at least two blood cultures be obtained before antibiotics with at least one drawn percutaneously and one drawn through each vascular access device, unless the device was recently (<48 hrs) inserted. Cultures of other sites (preferably quantitative where appropriate), such as urine, cerebrospinal fluid, wounds, respiratory secretions, or other body fluids that may be the source of infection should also be obtained before antibiotic therapy if not associated with significant delay in antibiotic administration (grade 1C).

ANTIBIOTIC THERAPY (Strong Recommendations):
1. We recommend that intravenous antibiotic therapy be started as early as possible and within the first hour of recognition of septic shock (1B) and severe sepsis without septic shock (1D). Appropriate cultures should be obtained before initiating antibiotic therapy but should not prevent prompt administration of antimicrobial therapy (grade 1D).
2a. We recommend that initial empirical anti-infective therapy include one or more drugs that have activity against all likely pathogens (bacterial and/or fungal) and that penetrate in adequate concentrations into the presumed source of sepsis (grade 1B).

FLUID THERAPY (Strong Recommendation):
1. We recommend fluid resuscitation with either natural/artificial colloids or crystalloids. There is no evidence-based support for one type of fluid over another (grade 1B).
2. We recommend that fluid resuscitation initially target a central venous pressure of >=8 mm Hg (12 mm Hg in mechanically ventilated patients). Further fluid therapy is often required (grade 1C).

3a. We recommend that a fluid challenge technique be applied wherein fluid administration is continued as long as the hemodynamic improvement (e.g., arterial pressure, heart rate, urine output) continues (grade 1D).
3b. We recommend that fluid challenge in patients with suspected hypovolemia be started with >=1000 mL of crystalloids or 300–500 mL of colloids over 30 mins. More rapid administration and greater amounts of fluid may be needed in patients with sepsis-induced tissue hypoperfusion (see Initial Resuscitation recommendations)(grade 1D).
3c. We recommend that the rate of fluid administration be reduced substantially when cardiac filling pressures (central venous pressure or pulmonary artery balloon-occluded pressure) increase without concurrent hemodynamic improvement (grade 1D).

VASOPRESSORS (Strong Recommendations):
1. We recommend that mean arterial pressure (MAP) be maintained >65 mm Hg(grade 1C).
2. We recommend either norepinephrine or dopamine as the first choice vasopressor agent to correct hypotension in septic shock (administered through a central catheter as soon as one is available) (grade 1C).
5. We recommend that low-dose dopamine not be used for renal protection(grade 1A).
6. We recommend that all patients requiring vasopressors have an arterial catheter placed as soon as practical if resources are available (grade 1D).

MEASURE CVP & MEASURE ScvO2: (Strong Recommendation)
1.We suggest that during the first 6 hrs of resuscitation of severe sepsis or septic shock, if ScvO2 or SCvO2 of 70% or 65%, respectively, is not achieved with fluid resuscitation to the central venous pressure target (1C)
2.If the ScvO2 is <70%, CVP and MAP goals are met; then transfusion of packed red blood cells to achieve a hematocrit of >=30% and/or administration of a dobutamine infusion (up to a maximum of 20 micrograms·kg-1·min-1) be used to achieve this goal (2C).

1c.18 Clinical Practice Guideline Citation: Dellinger RP, Levy MM, Carlet JM, Bion J, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock. Crit Care Med. 2008 Jan;36(1):296-327.

1c.19 National Guideline Clearinghouse or other URL:
http://www.guideline.gov/content.aspx?id=12231&search=surviving+sepsis

1c.20 Grading of Strength of Guideline Recommendation. Has the recommendation been graded? Yes

1c.21 If guideline recommendation graded, identify the entity that graded the evidence including balance of representation and any disclosures regarding bias: APPENDIX I: 2008 Surviving Ssepsis Campaign (SSC) Guidelines Committee:
R. Phillip Dellinger (Chair), Tom Ahrens(a), Naoki Aikawa(b), Derek Angus, Djillali Annane, Richard Beale, Gordon R. Bernard, Julian Bion(c), Christian Brun-Buisson, Thierry Calandra, Joseph Carcillo, Jean Carlet, Terry Clemmer, Jonathan Cohen, Edwin A. Deitch(d),Jean-Francois Dhainaut, Mitchell Fink, Satoshi Gando (b), Herwig Gerlach, Gordon Guyatt (e), Maurene Harvey, Jan Hazelzet, Hiroyuki Hirasawa,f Steven M. Hollenberg, Michael Howell, Roman Jaeschke (e), Robert Kacmarek, Didier Keh, Mitchell M. Levy (g), Jeffrey Lipman, John J. Marini, John Marshall, Claude Martin, Henry Masur, Steven Opal, Tiffany M. Osborn (h), Giuseppe Pagliarello (i), Margaret Parker, Joseph Parrillo, Graham Ramsay, Adrienne Randolph, Marco Ranieri, Robert C. Read (j), Konrad Reinhart (k), Andrew Rhodes, Emanuel Rivers (h), Gordon Rubenfeld, Jonathan Sevransky, Eliezer Silva,l Charles L. Sprung, B. Taylor Thompson, Sean R. Townsend, Jeffery Vender (m), Jean-Louis Vincent (n), Tobias Welte (o), Janice Zimmerman.

a American Association of Critical-Care Nurses;
b Japanese Association for Acute Medicine;
c European Society of Intensive Care Medicine;
d Surgical Infection Society;
e Grades of Recommendation, Assessment, Development and Evaluation (GRADE)
f Japanese Society of Intensive Care Medicine;
g Society of Critical Care Medicine;
h American College of Emergency Physicians;
i Canadian Critical Care Society;
j European Society of Clinical Microbiology and Infectious Diseases;
k German Sepsis Society;

l Latin American Sepsis Institute;
m American College of Chest Physicians;
n International Sepsis Forum;
o European Respiratory Society.

APPENDIX J: Author Disclosure Information 2006–2007
Dr. Dellinger has consulted for Astra-Zeneca, Talecris, and B Braun. He has received honoraria from Eli Lilly (2),Brahms (2), INO Therapeutics (1), Pulsion (1), and bioMerieux (1). He has also received grant support from AstraZeneca and Artisan. Dr. Levy has received honoraria from Eli Lilly and Edwards Lifesciences. He has also received grant support from Philips Medical Systems, Edwards Lifesciences, Philips Medical Systems, Novartis, Biosite, and Eisai.
Dr. Carlet has consulted for Forrest, Wyeth, Chiron, bioMerieux, and Glaxo-
SmithKline. He has also received honoraria from Eli Lilly, Becton Dickinson,
Jansen, Cook, AstraZeneca, Hutchinson, Bayer, Gilead, MSD, and Targanta. Dr. Bion has not disclosed any potential conflicts of interest. Dr. Parker has consulted for Johnson & Johnson. Dr. Jaeschke has received honoraria from AstraZeneca, Boehringer, Eli Lilly, GlaxoSmithKline, and MSD. Dr. Reinhart has consulted for Eli Lilly and Edwards Lifesciences. He has also received honoraria from B Braun and royalties from Edwards Lifesciences. Dr. Angus has consulted for or received speaking fees from AstraZeneca, BrahmsDiagnostica, Eisai, Eli Lilly, Glaxo-SmithKline, OrthoBiotech, Takeda, and Wyeth-Ayerst. He has also received grant support from GlaxoSmithKline, Ortho-Biotech, and Amgen.
Dr. Brun-Buisson has not disclosed any potential conflicts of interest. Dr. Beale has received honoraria from Eisai and speaking fees (paid to university)
from Lilly UK, Philips, Lidco, and Chiron. Dr. Calandra has consulted for Baxter, received honoraria from Roche Diagnostics, and received grant support from Baxter and Roche Diagnostics. He also served on the advisory board for Biosite. Dr. Dhainaut has consulted for Eli Lilly and Novartis. He has also received honoraria from Eli Lilly. Dr. Gerlach has not disclosed any potential conflicts of interest. Ms. Harvey has not disclosed any potential conflicts of interest. Dr. Marini has consulted for KCl and received honoraria from Maquet.
Dr. Marshall has consulted for Becton Dickinson, Takeda, Pfizer, Spectral Diagnostics, Eisai, and Leo-Pharma. He has also received honoraria from Spectral Diagnostics. Dr. Ranieri has served on the advisor board for Maquet and received support for a sponsored trial from Eli Lilly. He has also received grant support from Tyco, Draeger, and Hamilton. Dr. Ramsay has consulted for Edwards Lifesciences and Respironics. Dr. Sevransky has not disclosed any
potential conflicts of interest. Dr. Thompson has consulted for Eli Lilly, Abbott, and AstraZeneca. He has also received grant support from the NIH
for a study on computerized glucose control. Dr. Townsend has not disclosed any
potential conflicts of interest. Dr. Vender has consulted and received
honoraria from Eli Lilly. Dr. Zimmerman has not disclosed any potential conflicts of interest. Dr. Vincent has consulted for Astra-Zeneca, Biosite, bioMerieux, Edwards Lifesciences, Eli Lilly, Eisai, Ferring, Glaxo-SmithKline, Intercell, Merck, Novartis, NovoNordisk, Organon, Pfizer, Philips Medical Systems, Roche Diagnostics, Spectral Diagnostics, Takeda, and Wyeth-Lederle. He has also received honoraria from Eli Lilly, Edwards Lifesciences, Eisai, GlaxoSmithKline, Novartis, NovoNordisk, and Pfizer.

1c.22 System Used for Grading the Strength of Guideline Recommendation: GRADE

1c.23 If other, identify and describe the grading scale with definitions:

1c.24 Grade Assigned to the Recommendation: EARLY MANAGEMENT WITHIN 6 HOURS=1C, MEASURE LACTATE=1C, BLOOD CULTURES=1C, ANTIBIOTICS=1B, FLUIDS=1B, VASOPRESSORS=1D, MEASURE CVP & ScVO2=1C

1c.25 Rationale for Using this Guideline Over Others: It is the Henry Ford Hospital policy to use guidelines, which are evidence-based, actionable by facilities and health-care providers, and developed by a national specialty organization or government agency. In addition, the HFH also accepts as the evidence base for measures to include documented quality improvement (QI) initiatives or implementation projects that have demonstrated improvement in quality of care. There was strong agreement among a large cohort of 55 international experts regarding many recommendations for the best current care of patients with severe sepsis and septic shock. Evidence-based recommendations are the first step toward improved outcomes for this important group of critically ill patients.

Based on the NQF descriptions for rating the evidence, what was the <u>developer's assessment</u> of the quantity, quality, and

consistency of the body of evidence?
1c.26 Quantity: High 1c.27 Quality: High 1c.28 Consistency: High
1c.29 Attach evidence submission form:
1c.30 Attach appendix for supplemental materials:

Was the threshold criterion, *Importance to Measure and Report*, met?
(*1a & 1b must be rated moderate or high and 1c yes*) Yes☐ No☐
Provide rationale based on specific subcriteria:

For a new measure if the Committee votes NO, then STOP.
For a measure undergoing endorsement maintenance, if the Committee votes NO because of 1b. (no opportunity for improvement), it may be considered for continued endorsement and all criteria need to be evaluated.

2. RELIABILITY & VALIDITY - SCIENTIFIC ACCEPTABILITY OF MEASURE PROPERTIES

In the future, NQF will require measure stewards to provide a URL link to a web page where current detailed specifications can be obtained?
S.1 Do you have a web page where current detailed specifications for this measure can be obtained? No
S.2 If yes, provide web page URL:

2a. Precisely Specified

2a.0.1 Components of the Composite. (List the components, i.e., domains/sub-composites, individual measures. If component measures are NQF-endorsed, include NQF measure number; if not NQF-endorsed, provide date of submission to NQF)

If the composite measure cannot be specified with a numerator and denominator, please consult with NQF staff.
If the component measures are combined at the aggregate level, do not include the individual measure specifications below.

2a1.1 Composite Numerator Statement *(Brief, narrative description of the measure focus or what is being measured about the target population, e.g., cases from the target population with the target process, condition, event, or outcome)*:
If:

A. measure lactate level
B. obtain blood cultures prior to antibiotics
C. administer broad spectrum antibiotics
D. administer 30 ml/kg crystalloid for hypotension or lactate >=4 mmol/L
E. apply vasopressors (for hypotension that does not respond to initial fluid resuscitation to maintain a mean areterial pressure >= 65)
F. In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate >=4 mmol/L (36 mg/dl) measure central venous pressure and central venous oxygen saturation
G. remeasure lactate if initial lactate is elevated

represent processes of care:

Numerator statement: Patients from the denominator who received all the following: A, B, and C within 3 hours of time of presentation† AND IF septic shock is present (as either defined as hypotension* or lactate >=4 mmol/L) who also received D and E and F and G within 6 hours of time of presentation.

† "time of presentation" is defined as the time of triage in the Emergency Department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements severe sepsis or septic shock ascertained through chart review.

* "hypotension" is defined as systolic blood pressure (SBP) <90 mm Hg or mean arterial pressure (MAP) <70 mm Hg or a SBP decrease >40 mm Hg or <2 SD below normal for age or known baseline.

2a1.2 Numerator Time Window *(The time period in which the target process, condition, event, or outcome is eligible for inclusion)*:

Bundle elements should be *completed* in the times outlined in the numerator statement, however patients are *eligible* for inclusion in the numerator if diagnosed with severe sepsis or septic shock at anytime during their hospitalization.

2a1.3 Numerator Details *(All information required to identify and calculate the cases from the target population with the target process, condition, event, or outcome such as definitions, codes with descriptors, and/or specific data collection items/responses*: Following the scheme outlined in 2a1.1

"A" requires a response of "yes" to the question: "Was a lactate level obtained within 3 hours of time of presentation?"

"B" requires a response of "yes" to the question: "Were blood cultures obtained prior to antibiotic administration and within 3 hours of time of presentation?"

"C" requires a response of "yes" to the question: "Were broad spectrum antibiotics administered within 3 hours of the time of presentation?"

"Septic Shock" requires a response of "yes" to the question: "Was either hypotension (defined as SBP < 90 or MAP < 65 or decrease in SBP 30 mmHg from baseline) OR lactate >=4 mmol/L present in the first 6 hour of the time of presentation?"

"D" requires a response of "yes" or "not applicable" to the question: "Were 30ml/kg of crystalloid administered for hypotension or lactate >= 4 mmol/L within 6 hours of the time of presentation?"

"E" requires a response of "yes" or "not applicable" to the question: "Were vasopressors applied within 6 hours of the time of presentation for hypotension that did not respond to initial fluid resuscitation to maintain a mean arterial pressure >= 65 mmHg?"

"F" requires a response of "yes" or "not applicable" to the question: "Were central venous pressure (CVP) and central venous oxygen saturation (ScVO2) measured within 6 hours of presentation in the event of hypotension despite volume resuscitation or initial lactate >= 4 mmol/L (36 mg/dl)?"

"G" requires a response of "yes" or "not applicable" to the question: "Was serum lactate re-measured if initially elevated within 6 hours of presentation."

2a1.4 Composite Denominator Statement *(Brief, narrative description of the target population being measured)*:
Number of patients presenting with severe sepsis or septic shock.

2a1.5 Target Population Category *(Check all the populations for which the measure is specified and tested if any)*: Adult/Elderly Care, Populations at Risk, Populations at Risk : Dual eligible beneficiaries, Populations at Risk : Individuals with multiple chronic conditions, Populations at Risk : Veterans, Senior Care

2a1.6 Denominator Time Window *(The time period in which cases are eligible for inclusion)*:
Patients are eligible for inclusion in the denominator for each episode of severe sepsis or septic shock during a hospitalization from emergency room presentation though discharge. The collection period for each increment of data reporting is monthly.

2a1.7 Denominator Details (*All information required to identify and calculate the target population/denominator such as definitions, codes with descriptors, and/or specific data collection items/responses)*:
The denominator may be derived by a) prospective real-time screening of all patients presenting for care to the facility, or b) retrospective screening through chart review of all patients presenting to the medical facility, or c) both methods. In each case the clinical diagnostic criteria for severe sepsis or septic shock as outlined below are applied to the population initially identified. The clinical criteria that must be applied in either instance do not vary whether prospective or retrospective data collection is employed.

SEVERE SEPSIS:

Severe sepsis is defined as a suspected source of clinical infection, 2 or more manifestations of systemic infection (SIRS criteria) and the presence of sepsis-induced organ dysfunction.

SIRS criteria include: Temperature >38.3 C or <36.0 C, Heart rate >90 beats per minute, Respiration > 20 breaths/min, White blood cell count >12,000 or <4000/mm3, or >10% bandemia.

Organ dysfunction variables include: (SBP)<90 mm Hg or mean arterial pressure <70 mm Hg or a SBP decrease >40 mm Hg or <2 SD below normal for age or known baseline, Creatinine > 2.0 mg/dl (176.8 mmol/L) or Urine Output < 0.5 ml/kg/hour for > 2 hours, Bilirubin > 2 mg/dl (34.2 mmol/L), Platelet count < 100,000, Coagulopathy (INR >1.5 or aPTT >60 secs), Lactate > 2 mmol/L (18.0 mg/dl).

SEPTIC SHOCK:

Septic shock requires the presence of severe sepsis as above AND as sepsis-induced hypoperfusion persisting despite adequate fluid resuscitation OR lactate > 4 mmol/L.

Sepsis induced tissue hypoperfusion is present with (SBP)<90 mm Hg or mean arterial pressure <70 mm Hg or a SBP decrease >40 mm Hg or <2 SD below normal for age or known baseline.

If clinical coding documentation is used to derive the denominator in a retrospective collection effort, the codes that should be applied include:

ICD9 DX:

a) 0031: SALMONELLA SEPTICEMIA
b) 0362: MENINGOCOCCEMIA
c) 0380: STREPTOCOCCAL SEPTICEMIA
d) 03810: STAPH SEPTICEMIA NOS
e) 03811: MSSA SEPTICEMIA
f) 03812: MRSA SEPTICEMIA
g) 03819: STAPH SEPTICEMIA NEC
h) 0382: PNEUMOCOCCAL SEPTICEMIA
i) 0383: ANAEROBIC SEPTICEMIA
j) 03840: GRAM-NEG SEPTICEMIA NOS
k) 03841: H. INFLUENZAE SEPTICEMIA
l) 03842: E. COLI SEPTICEMIA
m) 03843: PSEUDOMONAS SEPTICEMIA
n) 03844: SERRATIA SEPTICEMIA
o) 03849: GRAM-NEG SEPTICEMIA NEC
p) 0388: SEPTICEMIA NEC
q) 0389: SEPTICEMIA NOS
r) 78552: SEPTIC SHOCK
s) 99591: SEPSIS
t) 99592: SEVERE SEPSIS

2a1.8 Denominator Exclusions *(Brief narrative description of exclusions from the target population)*:

A) Patients with advanced directives for comfort care are excluded.

B) Clinical conditions that preclude total measure completion should be excluded (e.g. mortality within the first 6 hours of presentation as defined above in 2a1.1).

C) Patients for whom a central line is clinically contraindicated (e.g. coagulopathy that cannot be corrected, inadequate internal jugular or subclavian central venous access due to repeated cannulations).

D) Patients for whom a central line was attempted but could not be successfully inserted.

E) Patient or surrogate decision maker declined or is unwilling to consent to such therapies or central line placement.

2a1.9 Denominator Exclusion Details *(All information required to identify and calculate exclusions from the denominator such as definitions, codes with descriptors, and/or specific data collection items/responses)*:
The exclusion details described in 2a1.8 must be ascertained by chart review.

No specific definitions are required to discover this information from standard chart annotation.

2a1.10 Stratification Details/Variables *(All information required to stratify the measure results including the stratification variables, codes with descriptors, definitions, and/or specific data collection items/responses)*:
Henry Ford Hospital (HFH) encourages the results of this measure to be stratified by race, ethnicity, gender, and primary language, illness severity and have included these variables as recommended data elements to be collected.

If the component measures are combined at the patient level and include outcomes, complete the following

2a1.11 Risk Adjustment Type *(Select type. Provide specifications for risk stratification in 2a1.10 and for statistical model in 2a1.13)*: No risk adjustment or risk stratification 2a1.12 If "Other," please describe:

2a1.13 Statistical Risk Model and Variables *(Name the statistical method - e.g., logistic regression and list all the risk factor variables. Note - risk model development should be addressed in 2b4.)*:
None

2a1.14-16 Detailed Risk Model Available at Web page URL (or attachment). Include coefficients, equations, codes with descriptors, definitions, and/or specific data collection items/responses. Attach documents only if they are not available on a webpage and keep attached file to 5 MB or less. NQF strongly prefers you make documents available at a Web page URL. Please supply login/password if needed:

2a1.17 Type of Score: Non-weighted score/composite/scale

2a1.19 Interpretation of Score *(Classifies interpretation of score according to whether better quality is associated with a higher score, a lower score, a score falling within a defined interval, or a passing score)*: Better quality = Higher score

2a1.20 Method of Scoring Opportunity scoring (overall percentage)

2a1.21 If "other" scoring method, describe

2a1.22 Missing Component Score *(Indicate how missing component scores are handled)*: At Henry Ford Hospital, missing components of the measure are considered not performed.

2a1.23 Weighting: Equal

2a1.24 If differential weighting, describe:

2a1.25 Calculation Algorithm/Measure Logic*(Describe the calculation of the measure score as an ordered sequence of steps including identifying the target population; exclusions; cases meeting the target process, condition, event, or outcome; aggregating data; risk adjustment; etc.)*:
The data calculations may be performed in one of two ways.

The Surviving Sepsis Campaign Database available at SurvivingSepsis.org automatically performs all calculations if data is entered into the required fields. However, hospitals are not restricted to use of the database to perform the required calculations. Two

paper tools described below capture the logic.

The two tools, URLs provided in 2a1.26.1, ("Individual Chart Measurement Tool" [ICMT], and "Monthly Measurement Worksheet" [MMW]) govern the calculation of the elements of the "all or nothing" composite measure.

The tools, in fact, exceed the information required for calculation of the composite measure extending care to variables beyond the scope of this submission (e.g. care patterns for the first 24 hours of care such as the application of steroids or glucose control; calculation of individual component measures not requested for endorsement at this time). They are provided as a clear, yet highly detailed, statement of the logic.

To simplify matters, the algorithm will be described in plain language here:

1. Find the patients who meet the initial patient population (ie, the general group of patients that the performance measure is designed to address). This is accomplished as described in 2a1.7 either through prospective, retrospective or both forms of data screening. Codes and criteria are specified in 2a1.7.

2. From the patients within the initial patient population criteria, find the patients who qualify for the denominator (ie, the specific group of patients for inclusion in a specific performance measure based on defined criteria). All exclusions identified by chart review in 2a1.8 will not, by definition, qualify for the denominator. Note: in some cases the initial patient population and denominator are identical.

3. From the patients within the denominator less those excluded, find the patients who qualify for the Numerator (ie, the group of patients in the denominator for whom a process or outcome of care occurs). The individual component elements of the composite indicator (eg, lactate collected, blood cultures obtained, etc.) will be found on each instance of the ICMT (one per patient chart reviewed). Each month, all ICMT's will be gathered and tabulated to generate the composite numerator using the MMW. In this way the MMW consolidates all information gathered in each ICMT to create the composite numerator. For more detail, the steps are identified below:

a. The logic on the ICMT captures all necessary data to be abstracted from a single chart to inform the numerator.

b. The "time of presentation" is captured as defined in 2a1.1 in question 3 of the ICMT.

c. Collection of lactate is determined and timed in question 4 of the ICMT.

d. Administration of broad spectrum antibiotics and timing are captured in question 5 of the ICMT.

e. Collection of blood cultures and timing is captured in question 6 of the ICMT.

f. Next, required determinations to inform the conditional elements in the composite measure are made. Specifically, since component elements "D, E, F, G" defined in 2a1.1 above are dependent on the presence of septic shock, the shock state is documented in question 7 of the ICMT.

i. If the patient has shock documentation of the administration of fluids is captured in question 7c of the ICMT.
ii. If the patient has shock documentation of the application of vasopressors is captured in question 7e of the ICMT.
iii. If the patient has shock documentation of the assessment of CVP and timing is captured in question 8 of the ICMT.
iv. If the patient has shock documention of the assessment of ScVO2 and timing is captured in question 9 of the ICMT.

g. If shock is not present, credit is assigned for the dependent elements "D, E, F, G" and documented on line 16 of the ICMT.

h. The tally of affirmative responses (or where credit has been assigned) to the individual component measures on a per chart basis is recorded by placing a mark in the designated boxes in line 16 of the ICMT.

i. Note: questions 10-15 on the ICMT do not apply to the composite measure under submission here.

j. Once monthly the MMW will be employed to tabulate all of the line 16 scores on the ICMT to generate the composite numerator for the month.

i. While the MMW is designed to report out the component measures as individual quality indicators, this is not required for the composite measure under consideration. Thus, questions 1 to 12 on the MMW are not necessary in this instance.
ii. Question 13 on the MMW generates the monthly "all or nothing" numerator by requiring that ALL boxes on line 16 of each ICMT be marked complete.
iii. If a single box on line 16 of the ICMT is not completed, then the "all or nothing" criterion is not met and the individual chart is not included in the numerator. This represents a quality failure.
iv. Questions 14 and 15 also do not apply to the composite measure under consideration here.

4. Although the exclusion cases are removed from the denominator population for the performance calculation, the number of patients with valid exclusions should be calculated and reported along with performance rates to track variations in care and highlight possible areas of focus for QI.

2a1.26 Calculation Algorithm/Measure Logic Diagram URL or attachment:
URL
http://www.survivingsepsis.org/About_the_Campaign/Documents/individualchartmeasurementtool.pdf AND
http://www.survivingsepsis.org/About_the_Campaign/Documents/monthlymeasurementworksheet.pdf

2a1.27 Sampling (Survey) Methodology. If measure is based on a sample (or survey), provide instructions for obtaining the sample, conducting the survey and guidance on minimum sample size (response rate):
Not applicable. The measure does not require sampling or a survey. However, the minimum sample size recommended should be no less than 50 patients per facility.

2a1.28 Data Source *(Check all the sources for which the measure is specified and tested*). If other, please describe:
Electronic Clinical Data, Electronic Clinical Data : Electronic Health Record, Electronic Clinical Data : Registry, Paper Medical Records

2a1.29 Data Source/Data Collection Instrument (*Identify the specific data source/data collection instrument, e.g. name of database, clinical registry, collection instrument, etc.*): Surviving Sepsis Campaign Electronic Database:

http://www.survivingsepsis.org/manual_database/Pages/default.aspx

Paper Tools:

http://www.survivingsepsis.org/About_the_Campaign/Documents/monthlymeasurementworksheet.pdf

http://www.survivingsepsis.org/About_the_Campaign/Documents/individualchartmeasurementtool.pdf

2a1.30-32 Data Source/data Collection Instrument Reference Web Page URL or Attachment:
URL
http://www.survivingsepsis.org/manual_database/Pages/default.aspx

2a1.33-35 Data Dictionary/Code Table Web Page URL or Attachment:
URL
http://www.survivingsepsis.org/About_the_Campaign/Documents/le_field_descriptions_and_coding_information.pdf

2a1.36 Level of Analysis (*Check the levels of analysis for which the measure is specified and tested)*: Facility, Integrated

Delivery System

2a1.37 Care Setting *(Check all the settings for which the measure is specified and tested)*: Hospital/Acute Care Facility

2a2. Reliability Testing. (*Reliability testing was conducted with appropriate method, scope, and adequate demonstration of reliability*.)

2a2.1 Data/Sample *(Description of the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)*:
The Surviving Sepsis Campaign database provides unequivocal results that compare reliability across 200 organizations using the "all or nothing" composite measure specified in 2a1.

- Surviving Sepsis Campaign Database

Between January 2005 and March 2008, 15,775 subjects at 252 qualifying sites (individual hospitals) were entered into the Surviving Sepsis Campaign (SSC) database. Excluding hospitals that contributed fewer than 20 subjects, the final sample consisted of 15,022 patients at 165 hospitals (median, 57; range, 20–471 subjects per hospital). Data from up to eight quarters were analyzed from each site. Hospitals contributed data for a mean duration of 15.6 months (median, 14 months). Data from 15,022 subjects at 165 sites were analyzed to determine the compliance with bundle targets and association with hospital mortality.

Sites were instructed to set up screening procedures to identify patients with severe sepsis and septic shock based on previously established criteria as provided in a manual that included specific specifications consistent with those in section 2a1 of this submission.

Sites were provided a sample screening tool in the Campaign manual and on the Web site. Participating sites were asked to screen for patients in the emergency department, the clinical wards, and the ICU. To be enrolled, a subject had to have a suspected site of infection, 2 systemic inflammatory response syndrome criteria, and 1 organ dysfunction criterion. Clinical and demographic characteristics and time of presentation with severe sepsis criteria were collected for analysis of time-based measures.

Data were entered into the SSC database locally at individual hospitals into pre-established, structured data fields documenting performance and the time of specific actions and findings. Hospitals could not modify these fields. Hospitals were instructed to exclude only those patients with comfort measures status. These instructions were consistent with the exclusions identified in 2a1.8 of this submission and conveyed to sites in the manual that accompanied download of the database. Variation in structured data fields was not possible with the database and full completion was required to submit any data to the master database.

Data stripped of private health information were submitted every 30 days to the secure master SSC server at the Society of Critical Care Medicine via file transfer protocol or as comma delimited text files attached to e-mail submitted to the Campaign's server.

Additional data was obtained after the initial data collection period described above. The Surviving Sepsis Campaign database now contains data submitted from January 2005 through July 2012. Analyses constrained by the same criteria as above now are possible with a total of 28,150 patients with severe sepsis and septic shock at 218 international sites.

2a2.2 Analytic Method *(Describe method of reliability testing & rationale)*:
The analytic methods for reliability testing of the data is described below:

- Surviving Sepsis Campaign Database

For purposes of reliability testing, the SSC data was analyzed as described in the RAND Corporations "The Reliability of Provider Profiling: A Tutorial" by John L. Adams (see appendix). This methodology is specifically endorsed by the NQF to analyze the reliability of performance for proposed metrics.

The analysis is sometimes referred to as a signal-to-noise analysis. As a measure of reliability, the analysis is a key determinant of suitability because it permits an assessment of how well one can confidently distinguish the performance of one entity from another. The signal in this case is the proportion of the variability in measured performance that can be explained by real differences in

performance.

The SSC biostatician, Gary Phillips, MAS (Ohio State University Center for Biostatistics), used the Rand model to generate the reliability of the "all or nothing" composite metric specified in section 2a1 above by hospital site. The strategy involves fitting a beta-binomial model for each indicator. From each model two parameters are generated (alpha and beta) that define the beta-binomial distribution. From these parameters Mr. Philips then produced the between hospital variance. Next the within hospital variance is generated based on a proportion affirmative answers for each quality indicator (the binomial distribution). Analyzing the between hospital variance and the within hospital variance generates the reliability for each hospital site.

2a2.3 Testing Results *(Reliability statistics, assessment of adequacy in the context of norms for the test conducted)*:
The testing results for the reliability of the indicator are described below:

- Surviving Sepsis Campaign Database

The reliability of the measure using the SSC database (on a scale of 0 to 1) was examined by each site for the resuscitation bundle as described in 2a2.2 above. The mean reliability (and its associated standard deviation) for each of the deciles of reliability for the composite measure is as written in text format below.

A limitation of this online submission form is that tables cannot be easily inserted, therefore please see the text Table 1 "Reliability deciles with SD from beta-binomial model by site" just below. For specific reliabilities for each of 210 hospitals/sites with the associated number of contributed charts per hospital see Table 2 "Reliability estimated from beta-binomial model by site ID" included at the bottom of this field.

Table 1 "Reliability deciles with SD from beta-binomial model by site":

1st Decile: N = 22, Mean reliability = 0.751, SD of reliability = 0.0539.
2nd Decile: N = 22, Mean reliability = 0.850, SD of reliability = 0.0182.
3rd Decile: N = 22, Mean reliability = 0.889, SD of reliability = 0.0075.
4th Decile: N = 22, Mean reliability = 0.915, SD of reliability = 0.0077.
5th Decile: N = 21, Mean reliability = 0.929, SD of reliability = 0.0025.
6th Decile: N = 22, Mean reliability = 0.939, SD of reliability = 0.0049.
7th Decile: N = 22, Mean reliability = 0.956, SD of reliability = 0.0052.
8th Decile: N = 22, Mean reliability = 0.973, SD of reliability = 0.0041.
9th Decile: N = 22, Mean reliability = 0.988, SD of reliability = 0.0040.
10th Decile: N = 21, Mean reliability = 0.999, SD of reliability = 0.0013.

Total: N = 218, Mean reliability = 0.919, SD of reliability 0.0732.

Note also that although for purposes of this submission only the composite measure is being considered for endorsement, the specific reliabilities of the underlying components is known and were calculated using the same methodology.

Results are summarized below as percentages:

N = 28150

Serum lactate.....Mean reliability = 94.96.....SD = 4.57
Culture before antibiotics.....Mean reliability = 90.19.....SD = 8.03
Timely antibiotics.....Mean reliability = 87.66.....SD = 8.82
Fluids & Vasopressors.....Mean reliability = 94.12.....SD = 5.32
CVP Assessment.....Mean reliability = 90.81.....SD = 8.15
ScVO2 Assessment.....Mean reliability = 89.84.....SD = 89.84

Overall Bundle.....Mean reliability = 91.86.....SD = 7.30

Table 2 “Reliability estimated from beta-binomial model by site ID":

ID	N	Composite measure reliability
1	63	0.937
2	38	0.930
3	36	0.864
4	34	0.954
5	34	0.880
6	73	0.881
7	35	1.000
8	50	0.922
9	21	1.000
10	49	0.919
11	62	0.985
12	66	0.899
13	97	0.924
14	67	0.976
15	46	0.974
16	22	1.000
17	43	0.879
18	40	0.885
19	29	0.887
20	63	0.960
21	37	0.926
22	47	0.880
23	52	0.961
24	37	0.777
25	27	0.924
26	22	0.898
27	29	0.887
28	27	1.000
29	82	0.961
30	35	0.832
31	28	0.934
32	50	0.922
33	29	1.000
34	92	0.938
35	31	1.000
36	34	0.880
37	94	1.000
38	217	0.991
39	96	0.947
40	80	0.916
41	20	1.000
42	28	0.880
43	20	1.000
44	40	0.845
45	25	0.855
46	73	1.000

47.....44.....0.923
48.....38.....0.901
49.....306.....0.969
50.....28.....0.691
51.....62.....0.897
52.....230.....0.968
53.....285.....0.953
54.....214.....0.937
55.....20.....0.732
56.....58.....0.916
57.....183.....0.932
58.....126.....0.911
59.....30.....0.701
60.....62.....0.888
61.....684.....0.983
62.....40.....0.813
63.....70.....0.830
64.....52.....0.809
65.....310.....0.973
66.....20.....0.604
67.....59.....0.808
68.....39.....0.880
69.....75.....1.000
70.....27.....0.731
71.....169.....0.938
72.....304.....0.974
73.....100.....0.928
74.....204.....0.938
75.....159.....0.932
76.....101.....0.948
77.....97.....0.924
78.....60.....0.891
79.....50.....0.939
80.....85.....0.855
81.....117.....0.928
82.....110.....0.939
83.....87.....0.932
84.....167.....0.959
85.....36.....0.769
86.....22.....0.822
87.....57.....0.882
88.....110.....0.895
89.....44.....1.000
90.....34.....0.954
91.....236.....0.978
92.....108.....0.961
93.....47.....0.932
94.....93.....0.981
95.....165.....0.960
96.....27.....0.929
97.....27.....0.872
98.....39.....1.000
99.....23.....0.906

100.....33.....1.000
101.....140.....0.956
102.....264.....0.992
103.....114.....0.979
104.....136.....0.980
105.....312.....0.994
106.....20.....0.794
107.....203.....0.968
108.....27.....0.757
109.....62.....0.947
110.....40.....1.000
111.....67.....0.826
112.....351.....0.966
113.....37.....0.846
114.....162.....0.919
115.....155.....0.955
116.....148.....0.990
117.....58.....1.000
118.....528.....0.974
119.....105.....0.928
120.....20.....0.794
121.....58.....0.916
122.....240.....0.957
123.....87.....0.947
124.....177.....0.988
125.....414.....0.997
126.....159.....0.989
127.....51.....0.979
128.....621.....0.987
129.....264.....0.980
130.....35.....1.000
131.....207.....0.972
132.....80.....0.932
133.....200.....0.992
134.....126.....0.929
135.....148.....0.933
136.....187.....0.930
137.....104.....0.898
138.....26.....0.816
139.....35.....0.956
140.....36.....0.864
141.....87.....0.932
142.....68.....0.878
143.....31.....0.899
144.....168.....0.933
145.....22.....0.822
146.....101.....0.944
147.....52.....0.863
148.....166.....0.928
149.....107.....0.932
150.....74.....0.945
151.....551.....0.982
152.....80.....0.916

153.....75.....0.901
154.....89.....0.986
155.....23.....0.779
156.....153.....0.928
157.....21.....0.749
158.....23.....0.701
159.....25.....0.919
160.....421.....0.981
161.....454.....0.970
162.....167.....0.994
163.....1131.....0.998
164.....106.....0.884
165.....142.....0.911
166.....251.....0.948
167.....222.....0.942
168.....70.....0.853
169.....291.....0.953
170.....152.....0.934
171.....66.....0.892
172.....61.....0.841
173.....312.....0.997
174.....119.....0.988
175.....151.....0.969
176.....124.....0.946
177.....127.....0.918
178.....112.....0.925
179.....313.....0.992
180.....321.....0.986
181.....23.....0.834
182.....142.....0.934
183.....204.....0.961
184.....75.....0.857
185.....40.....0.748
186.....157.....0.933
187.....243.....0.948
188.....383.....0.968
189.....394.....0.985
190.....506.....0.985
191.....1023.....0.991
192.....100.....0.876
193.....34.....0.914
194.....70.....0.989
195.....473.....0.972
196.....37.....0.896
197.....28.....0.662
198.....41.....0.794
199.....290.....0.973
200.....227.....0.945
201.....93.....0.900
202.....28.....0.929
203.....26.....0.924
204.....231.....0.996
205.....150.....0.954

206.....93.....0.959
207.....150.....0.913
208.....44.....0.851
209.....251.....0.973
210.....31.....0.755

2b. VALIDITY. Validity, Testing, including all Threats to Validity: H☐ M☐ L☐ I ☐

2b1.1 Describe how the measure specifications *(measure focus, target population, and exclusions)* are consistent with the evidence cited in support of the measure focus (*criterion 1c)* and identify any differences from the evidence:
The measure is consistent with regard to the evidence cited in criterion 1c with respect to the measure focus, the target population and the exclusions.

Each will be detailed below:

- Measure Focus:

The "all or nothing" composite measure specifications directly pertain to the measure focus (the early management of patients with severe sepsis and septic shock) inasmuch as the measure is constrained to observations in first 6 hours of care.

The specifications are identical to the evidence cited in 1c. Each cited piece of literature was evaluated using a binary (affirmative or negative) response as regards the provision of specific components of care delivery in determining the composite "all or nothing" calculation. The health outcomes assessed in each study involved no intermediate clinical outcomes, but rather focused on mortality in each instance. The reliability data provided from the SSC was derived under these conditions and, in fact, makes up the largest body of the clinical evidence for the measure focus.

- Target Population:

The specified target population of the measure is entirely consistent across the evidence. All studies have looked at patients with severe sepsis and septic shock as defined by the the 2001 Society of Critical Care Medicine/European Society of Intensive Care Medicine/American College of Chest Physicians/American Thoracic Society/Surgical Infection Society consensus sepsis definition. The data provided as regards reliability here is not to the contrary in any material form.

- Exclusions:

Exclusions were uniform from the specifications cited in 2a1 and the evidence cited here as regards reliability. In particular, patients were excluded in the SSC analysis with advanced directives for comfort care and/or clinical conditions that precluded total measure completion. These exclusions were conveyed to hospitals in the manual that accompanied the SSC database.

2b2. Validity Testing. (*Validity testing was conducted with appropriate method, scope, and adequate demonstration of validity.)*

2b2.1 Data/Sample *(Description of the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)*:
Although there may often be a distinction between the data used to inform the evidence for the importance of the measure focus and the data that informs reliability and validity testing, the authors of this submission have access to the database that produced the foundational evidence for the importance of the measure and have used the same data to produce calculations related to the reliability and validity of the data. Therefore, the distinction is not applicable in this case.

The data sample then is identical to the data identified in 2a2.1 and repeated here:

- Surviving Sepsis Campaign Database

Between January 2005 and March 2008, 15,775 subjects at 252 qualifying sites (individual hospitals) were entered into the Surviving Sepsis Campaign (SSC) database. Excluding hospitals that contributed fewer than 20 subjects, the final sample consisted

of 15,022 patients at 165 hospitals (median, 57; range, 20–471 subjects per hospital). Data from up to eight quarters were analyzed from each site. Hospitals contributed data for a mean duration of 15.6 months (median, 14 months). Data from 15,022 subjects at 165 sites were analyzed to determine the compliance with bundle targets and association with hospital mortality.

Sites were instructed to set up screening procedures to identify patients with severe sepsis and septic shock based on previously established criteria as provided in a manual that included specific specifications consistent with those in section 2a1 of this submission.

Sites were provided a sample screening tool in the Campaign manual and on the Web site. Participating sites were asked to screen for patients in the emergency department, the clinical wards, and the ICU. To be enrolled, a subject had to have a suspected site of infection, 2 systemic inflammatory response syndrome criteria, and 1 organ dysfunction criterion. Clinical and demographic characteristics and time of presentation with severe sepsis criteria were collected for analysis of time-based measures.

Data were entered into the SSC database locally at individual hospitals into pre-established, structured data fields documenting performance and the time of specific actions and findings. Hospitals could not modify these fields. Hospitals were instructed to exclude only those patients with comfort measures status. These instructions were consistent with the exclusions identified in 2a1.8 of this submission and conveyed to sites in the manual that accompanied download of the database. Variation in structured data fields was not possible with the database and full completion was required to submit any data to the master database.

Data stripped of private health information were submitted every 30 days to the secure master SSC server at the Society of Critical Care Medicine via file transfer protocol or as comma delimited text files attached to e-mail submitted to the Campaign's server.

Additional data was obtained after the initial data collection period described above. The Surviving Sepsis Campaign database now contains data submitted from January 2005 through July 2012. Analyses constrained by the same criteria as above now are possible with a total of 28,150 patients with severe sepsis and septic shock at 218 international sites.

2b2.2 Analytic Method *(Describe method of validity testing and rationale; if face validity, describe systematic assessment)*:
Validity testing of the performance measure presented here is based on the measure as specified and submitted for endorsement. The SSC database was used to generate this analysis. The performance scores reported were generated for the hospitals using the specifications submitted for endorsement.

As noted in the Measure Testing Task Force report, validity testing (as with reliability testing) can be conducted at the level of the critical data elements or the performance measure score. The testing presented here is testing at the level of the performance measure score based on conceptual understanding of the measure and also the data that are available.

• As such, a reasonable hypothesis for validity testing of the performance measure score would be that those with higher scores on the composite performance measure should have a lower score on a risk-adjusted mortality measure.

To test this hypothesis, the SSC biostatician, Gary Phillips, MAS (Ohio State University Center for Biostatistics) built a random effects logistic regression where patient level observations were nested within a particular site (hospital). The regression model is adjusted for the variables shown below.

The model included the following variables (Organ Failure abbreviated OF):

Sepsis origin
.....ED (referent)
.....Ward
.....ICU
Geographic region
.....Europe
.....North America (referent)
.....South America
Cardiovascular OF

.....Lactate > 4 mmol/L
.....Cardiovascular OF with Lactate > 4 mmol/L
.....No hypotension (referent)
.....Hypotension with MAP < 65 mm Hg
.....Hypotension with MAP = 65 mm Hg
Received =20 ml/kg of crystalloid or equivalent
Received vasopressors
Pneumonia
UTI
Abdominal
Meningitis
Catheter
Device
Other infection
Renal organ failure
Hepatic organ failure
Hematologic organ failure
No mechanical ventilation and no pulmonary OF (referent)
No mechanical ventilation and pulmonary OF
Mechanical ventilation with plateau pressure < 30 cm H2O and no pulmonary OF
Mechanical ventilation with plateau pressure < 30 cm H2O and pulmonary OF
Mechanical ventilation with plateau pressure = 30 cm H2O independent of pulmonary OF
Hyperthermia (> 38.3° C) or (101.0° F)
Hypothermia (< 36° C) or (96.8° F)
Chills with rigor
Tachypnea (BPM > 20)
Leukopenia (WBC count < 4,000/µL)
Hyperglycemia (plasma glucose > 120 mg/dL)
Acutely alter mental status

• Separately, there is substantial face validity of the measure. The Measure Testing TF report indicates that NQF does allow for face validity of the performance measure score if it is systematically assessed. Here, the measure submitted for evaluation does not substantially differ from the components of the composite measure systematically assessed in the SSC peer reviewed publication "Levy MM, Dellinger RP, Townsend SR, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Critical Care Medicine 201 0; 38:367-74." In fact, the analysis performed for this submission is the identical data set to the SSC data set. This publication demonstrated declining mortality associated with increased compliance. The specific results are provided in 2b2.3 for review.

2b2.3 Testing Results *(Statistical results, assessment of adequacy in the context of norms for the test conducted; if face validity, describe results of systematic assessment)*:
• In the random effects logistic regression model created specific for this submission by Mr. Phillips described in 2b2.2, the odds of hospital mortality are reduced 10% (odds ratio = 0.90, 95% CI: 0.83 to 0.97, p-value = 0.008) for patients that are compliant with the measure as described in sections 2a1.1 and 2a1.4 of this submission.

• The face validity of the measure specifications is bolstered by the publication "Levy MM, Dellinger RP, Townsend SR, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Critical Care Medicine 201 0; 38:367-74," which systematically assessed a composite measure not materially different from the performance measure here. This publication demonstrated declining mortality associated with increased compliance. The specific results are recited here:

"Outcome measures included hospital mortality, hospital length of stay, and ICU length of stay. Ten performance measures were

established, based on the individual elements of the resuscitation bundle and the management bundle. The analysis set was constructed from the subjects entered into the SSC database from its launch in January 2005 through March 2008. The a priori data analysis plan limited inclusion to sites with at least 20 subjects and at least 3 months of subject enrollment. Analysis presented here was limited to the first 2 yrs of subjects at each site. Sites were characterized by: hospital size (250, 250–500, >500 beds); teaching status; ICU type (medical, medical/surgical, other); and geographic region (Europe, North America, South America). Subjects were characterized by baseline severe sepsis information: location of enrollment (emergency department, ICU, ward); site of infection (pulmonary, urinary tract, abdominal, central nervous system, skin, bone, wound, catheter, cardiac, device, other); acute organ dysfunction (cardiovascular, pulmonary, renal, hepatic, hematologic). Data were organized by quarter through 2 yrs, with the first 3 months that a site entered subjects into the database defined as the first quarter, regardless of when those months occurred from January 2005 through March 2008. The effects of predictor variables on hospital mortality we expressed using odds ratios (ORs), including 95% confidence intervals (CIs) for risk-adjusted results. Logistic regression model fit was assessed using the Hosmer Lemeshow C statistic, the chi-square dispersion, the proportion of log-likelihood accounted for by the model, and an examination of model residuals. We constructed the databases in Access and Fox-Pro (Microsoft Corp, Redmond, WA) and conducted analyses in DataDesk (Data Description, Ithaca, NY) and SAS (SAS Institute, Cary, NC).

SURVIVING SEPSIS CAMPAIGN - CHANGES IN ACHIEVEMENTS OF BUNDLE TARGETS OVER TIME:

Compliance rates for achieving all bundle targets over time—both the overall bundles and the individual elements within both bundles—increased over time, although both basal achievement rates and the magnitude of improvement varied considerably across targets. Compliance with the initial bundle targets increased linearly from 10.9% of subjects in the first site quarter to 31.3% by the end of 2 yrs in the campaign, achieving statistical significance by the second quarter (10.9% vs. 14.9%, p .0001). The ability to achieve the entire bundle targets started higher, at 18.4% in the first quarter, and increased to 25.5% by the end of 2 yrs, but did not achieve statistical significance until the fourth quarter (18.4% vs. 21.5%, p < .008).

SURVIVING SEPSIS CAMPAIGN - CHANGES IN HOSPITAL MORTALITY:

Unadjusted hospital mortality decreased from 37.0% in the first quarter in the Campaign to 30.8% by 2 yrs (p < .001). On average, unadjusted mortality decreased by 0.91% (95% CI, 0.42–1.40) for each quarter in the Campaign. The results of the multivariable model examining the effect of time in the Campaign on hospital mortality, fit well (Hosmer and Lemeshow C statistic of 18.1 with 18 df, p <.34, accounted for 36.6% of variation in the data, with a chi-square dispersion of 1.04). In both the unadjusted and adjusted models, the chance of death decreased the longer a site was in the Campaign, resulting in an adjusted absolute drop of 0.8% per quarter and 5.4% over the first 2 yrs (95% CI, 2.5–8.4).

SURVIVING SEPSIS CAMPAIGN - RELATIONSHIP BETWEEN BUNDLE ELEMENTS AND IN HOSPITAL MORTALITY:

After adjustment for baseline characteristics, administration of broad-spectrum antibiotics (OR, 0.86; 95%, CI 0.79– 0.93; p .0001), obtaining blood cultures before their initiation (OR, 0.76; 95% CI, 0.70– 0.83; p < .0001) were all associated with lower hospital mortality. To control for entry of less severely ill patients in the database over time as the reason for decreasing mortality, severity was assessed based on variables linked to patient mortality that were available in the database. When mortality was adjusted accordingly, while the magnitude of the effect was slightly reduced, it remained statistically significant. The results of this study demonstrate that the use of a multifaceted performance improvement initiative was successful in changing sepsis treatment behavior as demonstrated by a significant increase in compliance with sepsis performance measures. This compliance was associated with a significant reduction in hospital mortality in patients with severe sepsis and septic shock. These results are consistent with an earlier report from Ferrer et al in Spain. The findings of this study show that the improvement in achievement of bundle targets and association with improved outcome is sustained over time and is demonstrated across a wide number of countries and settings."

POTENTIAL THREATS TO VALIDITY. (*All potential threats to validity were appropriately tested with adequate results.*)

If the component measures are combined at the patient level, complete 2b

2b3. Measure Exclusions. (*Exclusions were supported by the clinical evidence in 1c or appropriately tested with results demonstrating the need to specify them.*)

2b3.1 Data/Sample for analysis of exclusions *(Description of the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)*:

The validity analysis provided above provides discriminatory power at the level of the performance measure. Please note that the exclusions are highly intuitive and reasonable. Thus, imagining a world for testing purposes, where patients who did not consent for lines received them or who wished to be made comfort measures were treated aggressively is wholly unlikely. Exclusions referenced in section 2a1.8 therefore were not independently analyzed for their effect on the performance measure score given the impropriety of such testing. Such a study most likely could not be conducted due to appropriate IRB constraints.

Excluded patients are not included in data collection at the level of the data collection tool during the time of chart review (either in the sepsis campaign database or the paper equivalent tools, the "ICMT"). See 2a1.25 for specific algorithm and logic.

2b3.2 Analytic Method (*Describe type of analysis and rationale for examining exclusions, including exclusion related to patient preference)*:
Not applicable, see 2b3.1.

2b3.3 Results *(Provide statistical results for analysis of exclusions, e.g., frequency, variability, sensitivity analyses):*
Not applicable, see 2b3.1.

If the component measures are combined at the patient level and include outcomes, complete 2e
2b4. Risk Adjustment Strategy. (*For outcome measures, adjustment for differences in case mix (severity) across measured entities was appropriately tested with adequate results.*)

2b4.1 Data/Sample *(Description of the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)*:
This process measure composite is not risk adjusted.

2b4.2 Analytic Method (*Describe methods and rationale for development and testing of risk model or risk stratification including selection of factors/variables)*:
This process measure composite is not risk adjusted.

2b4.3 Testing Results *(Statistical risk model: Provide quantitative assessment of relative contribution of model risk factors; risk model performance metrics including cross-validation discrimination and calibration statistics, calibration curve and risk decile plot, and assessment of adequacy in the context of norms for risk models. Risk stratification: Provide quantitative assessment of relationship of risk factors to the outcome and differences in outcomes among the strata)*:
Not applicable.

2b4.4 If outcome or resource use measure is not risk adjusted, provide rationale and analyses to justify lack of adjustment: As a process measure, no risk adjustment is neccessary.

2b5. Identification of Meaningful Differences in Performance. (*The performance measure scores were appropriately analyzed and discriminated meaningful differences in quality.*)

2b5.1 Data/Sample *(Describe the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)*:
The data sample used in this calculation of meaningful differences in performance (performed specifcially for this submission)was the enlarged SSC database (28,150 patients) identified in 2a2.1 and repeated here:

- Surviving Sepsis Campaign Database

Between January 2005 and March 2008, 15,775 subjects at 252 qualifying sites (individual hospitals) were entered into the Surviving Sepsis Campaign (SSC) database. Excluding hospitals that contributed fewer than 20 subjects, the final sample consisted of 15,022 patients at 165 hospitals (median, 57; range, 20–471 subjects per hospital). Data from up to eight quarters were analyzed from each site. Hospitals contributed data for a mean duration of 15.6 months (median, 14 months). Data from 15,022 subjects at 165 sites were analyzed to determine the compliance with bundle targets and association with hospital mortality.

Sites were instructed to set up screening procedures to identify patients with severe sepsis and septic shock based on previously established criteria as provided in a manual that included specific specifications consistent with those in section 2a1 of this

submission.

Sites were provided a sample screening tool in the Campaign manual and on the Web site. Participating sites were asked to screen for patients in the emergency department, the clinical wards, and the ICU. To be enrolled, a subject had to have a suspected site of infection, 2 systemic inflammatory response syndrome criteria, and 1 organ dysfunction criterion. Clinical and demographic characteristics and time of presentation with severe sepsis criteria were collected for analysis of time-based measures.

Data were entered into the SSC database locally at individual hospitals into pre-established, structured data fields documenting performance and the time of specific actions and findings. Hospitals could not modify these fields. Hospitals were instructed to exclude only those patients with comfort measures status. These instructions were consistent with the exclusions identified in 2a1.8 of this submission and conveyed to sites in the manual that accompanied download of the database. Variation in structured data fields was not possible with the database and full completion was required to submit any data to the master database.

Data stripped of private health information were submitted every 30 days to the secure master SSC server at the Society of Critical Care Medicine via file transfer protocol or as comma delimited text files attached to e-mail submitted to the Campaign's server.

Additional data was obtained after the initial data collection period described above. The Surviving Sepsis Campaign database now contains data submitted from January 2005 through July 2012. Analyses constrained by the same criteria as above now are possible with a total of 28,150 patients with severe sepsis and septic shock at 218 international sites.

2b5.2 Analytic Method *(Describe methods and rationale to identify statistically significant and practically/meaningfully differences in performance)*:
For purposes of this analysis, the enlarged SSC database was used with 218 sites and 28,150 patients. The data set therefore covers 16 quarters of participation in the campaign, or 4 years worth of data total. Sites were permitted to join the campaign during the duration of the 4 years.

[NB, although the large majority of hospital sites joined early and some dropped out over time, few sites joined late. Given the discrepancy therefore between calendar time and time of participation in the campaign, sites were aligned by "site quarter" meaning that the first quarter of participation was the same for all sites regardless of the calendar month they joined the campaign. This pattern was maintained for all sites through 16 quarters. Of critical note, in the campaign to adjust for the confounding variable that mortality may be decreasing over time the mortality rate was determined at site quarter 1 of all participants and there was no statistical correlation with a decrease in mortality over time at the outset of participation. Thus, an underlying secular trend to lower mortality did not confound the data regardless of the variability in time when joining the campaign. The adjustment method and results of this important analysis are available in "Levy MM, Dellinger RP, Townsend SR, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Critical Care Medicine 201 0; 38:367-74."]

Using the above data set, for this analysis, sites were aligned by number of site quarters of participation 1st quarter, 8th quarter (midpoint) and 16th quarter (endpoint). The total number of sites in the campaign at each time point was determined. The mean, SD, minimum, maximum, p25, p50, p75 of sites with a "yes" value for the composite indicator (i.e., a value counted in the numerator) is reported for each time referent in Table 1 below. Table 2 below reports the number of sites with decreasing performance over time compared with the number of sites with increasing performance over time. Please note the sharp attrition in sites reporting by site quarter 18, accounting for some of the declining performance detected. Efforts to promote participation in data collection had substantially fallen off by this time.

2b5.3 Results *(Provide measure performance results/scores, e.g., distribution by quartile, mean, median, SD, etc.; identification of statistically significant and meaningfully differences in performance)*:
Table 1. Descriptive summary of proportion where the composite is ´yes´ by site quarters of participation:

Quarters.of....Number....Mean....SD.....Min.....P25.....P50.....P75.....Max..
participation..of sites

1.....218.....0.101...0.180.....0.000...0.000...0.000...0.125...1.000

8.....88.....0.205...0.197.....0.000...0.000...0.183...0.354...0.667
16.....8.....0.158...0.102.....0.000...0.096...0.136...0.255...0.295

Please note as regards Table 1:

- Site quarters are based on a quarter of participation based on when a site entered the SSC program
- Site quarters do not align with calendar quarters (sites may enter variably)
- There were 218 sites that started the program
- After 2 years (8 quarters) there were 88 sites still participating
- After 4 years (16 quarters) there were 8 sites still participating

Table 2. Descriptive summary of proportion where the composite is ´yes´ by site quarters of participation:

Delta.....No.....Description..Mean...SD.....Min...P25....P50....P75....Max..
.....sites.....
.....
Decreased.....21.....Proportion...0.108..0.176..0.000..0.000..0.000..0.118..0.595
.....Delta.....0.247..0.246..0.021..0.059..0.200..0.334..1.000
.....
Increased.....67.....Proportion...0.235..0.196..0.000..0.000..0.213..0.385..0.667
.....Delta.....0.175..0.164..0.000..0.000..0.158..0.326..0.600

Please note as regards Table 2:
- Delta is whether or not a site decreased or increased
- 21 sites (24%) decreased from the 1st quarter while 67 sites (76%) increased
- Description: Proportion is those that met the resuscitation bundle and delta is the size of either the increase or decrease.

Finally, a description of the 8 sites with observations during site quarter 16:

- All 8 improved from the 1st quarter to the 8th quarter the mean proportion was 0.153 and the mean change from 1st to 8th quarter was 0.136
- Then from the 8th to the 16th quarter 3 sites decreased a mean proportion of 0.131 and 5 sites increased with a mean proportion of 0.087

2b6. Comparability of Multiple Data Sources/Methods. (*If specified for more than one data source, the various approaches result in comparable scores.*)

2b6.1 Data/Sample *(Describe the data or sample including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included)*:
Please see attachment under "Supplemental Information" below.

2b6.2 Analytic Method *(Describe methods and rationale for testing comparability of scores produced by the different data sources specified in the measure)*:
Please see attachment under "Supplemental Information" below.

2b6.3 Testing Results *(Provide statistical results, e.g., correlation statistics, comparison of rankings; assessment of adequacy in the context of norms for the test conducted)*:
Please see attachment under "Supplemental Information" below.

2c. Disparities in Care: H☐ M☐ L☐ I ☐ NA☐ (*If applicable, the measure specifications allow identification of disparities.*)

2c.1 If measure is stratified for disparities, provide stratified results *(Scores by stratified categories/cohorts)*: The Henry Ford Hospital, SCCM, IDSA, an emergency physician, and quality improvement organizations encourage the results of this measure to

be stratified by race, ethnicity, gender, and primary language, and have included these variables as recommended data elements to be collected.

2c.2 If disparities have been reported/identified (e.g., in 1b), but measure is not specified to detect disparities, please explain:
The Henry Ford Hospital, SCCM, IDSA, an emergency physician, and quality improvement organizations advocate that performance measure data should, where possible, be stratified by race, ethnicity, and primary language to assess disparities and initiate subsequent quality improvement activities addressing identified disparities, consistent with recent national efforts to standardize the collection of race and ethnicity data. A 2008 NQF report endorsed 45 practices including stratification by the aforementioned variables.(1) A 2009 IOM report "recommends collection of the existing Office of Management and Budget (OMB) race and Hispanic ethnicity categories as well as more finegrained categories of ethnicity(referred to as granular ethnicity and based on one's ancestry) and language need (a rating of spoken English language proficiency of less than very well and one's preferred language for health-related encounters)."(2)

References:
(1)National Quality Forum Issue Brief (No.10). Closing the Disparities Gap in Healthcare Quality with Performance Measurement and Public Reporting. Washington, DC: NQF, August 2008.
(2)Race, Ethnicity, and Language Data: Standardization for Health Care Quality Improvement. March 2010. AHRQ Publication No. 10-0058-EF. Agency for Healthcare Research and Quality, Rockville, MD. Available at: http://www.ahrq.gov/research/iomracereport. Accessed May 25, 2010.

2i. Component Item/Measure Analysis to Justify Inclusion in Composite

2i.1. Data/Sample
Please see attachment under "Supplemental Information" below.

2i.2. Analytic Method
Please see attachment under "Supplemental Information" below.

2i.3. Result
Please see attachment under "Supplemental Information" below.

2j. Component Item/Measure Analysis of Contribution to Variability in Composite Score

2j.1. Data/Sample
Please see attachment under "Supplemental Information" below.

2j.2. Analytic Method
Please see attachment under "Supplemental Information" below.

2j.3. Result
Please see attachment under "Supplemental Information" below.

2k. Analysis to Support Differential Weighting of Component Score

2k.1. Data/Sample
Composite score is not weighted.

2k.2. Analytic Method
Composite score is not weighted.

2k.3. Result

Composite score is not weighted.

2k.4. Describe how the method scoring/aggregation achieves the stated purpose and represent the quality construct
Composite score is not weighted.

2k.5. Indicate if any alternative scoring/aggregation methods were tested and why not chosen
Composite score is not weighted.

2l. Analysis of Missing Component Scores

2l.1. Data/Sample
For missing component scores fail opportunity score.

2l.2. Analytic Method
For missing component scores fail opportunity score.

2l.3. Result
For missing component scores fail opportunity score.

2.1-2.3 Supplemental Testing Methodology Information:
Attachment
NQF_0500_Tables_and_Forest_Plots.pdf

Steering Committee: Overall, was the criterion, *Scientific Acceptability of Measure Properties*, met?
(*Reliability and Validity must be rated moderate or high*) Yes☐ No☐
Provide rationale based on specific subcriteria:

If the Committee votes No, STOP

3. USABILITY

Extent to which intended audiences (e.g., consumers, purchasers, providers, policy makers) can understand the results of the measure and are likely to find them useful for decision making. (evaluation criteria)

C.1 Intended Actual/Planned Use *(Check all the planned uses for which the measure is intended)*: Professional Certification or Recognition Program, Public Reporting, Quality Improvement (Internal to the specific organization), Quality Improvement with Benchmarking (external benchmarking to multiple organizations), Regulatory and Accreditation Programs

3.1 Current Use *(Check all that apply; for any that are checked, provide the specific program information in the following questions)*: Regulatory and Accreditation Programs, Quality Improvement with Benchmarking (external benchmarking to multiple organizations), Quality Improvement (Internal to the specific organization)

3a. Usefulness for Public Reporting: H☐ M☐ L☐ I ☐
(*The measure is meaningful, understandable and useful for public reporting.*)

3a.1. Use in Public Reporting - disclosure of performance results to the public at large *(If used in a public reporting program, provide name of program(s), locations, Web page URL(s)).* If not publicly reported in a national or community program, state the reason AND plans to achieve public reporting, potential reporting programs or commitments, and timeline, e.g., within 3 years of endorsement: [*For Maintenance – If not publicly reported, describe progress made toward achieving disclosure of performance results to the public at large and expected date for public reporting; provide rationale why continued endorsement should be considered.*]
For examples please see:
Kaiser:

http://www.fiercehealthfinance.com/story/kaiser-sepsis-program-saves-36-million/2010-09-01

San Francisco Coalition:
http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2011/04/21/MNEM1J3QM1.DTL

Catholic Healthcare West:
http://www.caringisourcalling.org/case-study/catholic-healthcare-west-chw

Sutter Healthcare:
http://www.sutterhealth.org/quality/focus/quality_sepsis.html

Kaiser sepsis program saves $36 million
By Ron Shinkman
Created Sep 1 2010 - 8:54am
Introduced in late 2008 at 17 hospitals in Northern California, Kaiser´s sepsis prevention program is based on a six-step "bundle" of diagnostic and treatment tools. They include screening all emergency room patients who undergo blood testing for levels of lactate, which can be a sepsis indicator; providing a regimen of antibiotics through a central line catheter inserted through the patient´s clavicle; rigorous testing of a patient´s blood volume and arterial pressure; and performing a second lactate test within 12 hours of the first test.

Sepsis: Bay Area hospitals sharply cut death rates
Victoria Colliver, Chronicle Staff Writer
Thursday, April 21, 2011
The nine Bay Area hospitals started with an average sepsis mortality rate of 27.7 percent of cases in the six months leading up to the start of the study in December 2008. By December 2010, the average across the hospitals had dropped to 16.6 percent, for a 40 percent difference in mortality.

3a.2.Provide a rationale for why the measure performance results are meaningful, understandable, and useful for public reporting. If usefulness was demonstrated (e.g., focus group, cognitive testing), describe the data, method, and results: Henry Ford Hospital, Society for Critical Care Medicine, Infectious Diseases Society of America, and the Institute for Healthcare Improvement believe that the use of the severe sepsis and septic shock early management bundle in continuous quality improvement initiatives is a beneficial way to gather scientific data with which to improve facility performance. This is appropriate since the measure has been tested and found to be reliable and valid. NQF endorsement will facilitate our ongoing progress toward this quality improvement objective.

3.2 Use for other Accountability Functions (payment, certification, accreditation). If used in a public accountability program, provide name of program(s), locations, Web page URL(s): Memorial Hospital in Jacksonville and other hospitals also receive a certification decision regarding a Sepsis Certified Program from The Joint Commission in their Certification of Quality Report.

3b. Usefulness for Quality Improvement: H☐ M☐ L☐ I ☐
(*The measure is meaningful, understandable and useful for quality improvement.*)

3b.1. Use in QI. If used in quality improvement program, provide name of program(s), locations, Web page URL(s):
[*For Maintenance – If not used for QI, indicate the reasons and describe progress toward using performance results for improvement*].
All Henry Ford Hospital (HFH) measures are suitable for use in quality improvment initiatives and this bundle is made freely available to the public. HFH, SCCM, IDSA, IHI and others strongly encourage the use of the early management bundle in CQI intiativies and seeks to provide information on such initiative to all hospitals. As endorsed by the Instititute for Healthcare Improvement, these bundles provide an evidence-based method for improvement in care, reduction in cost and reduction in mortality.

Surviving Sepsis Campaign:
http://www.survivingsepsis.org/Pages/default.aspx

Intermountain Healthcare:
http://www.ksl.com/?nid=148&sid=11060074

Rhode Island Critical Care Collaborative:
http://www.pbn.com/Project-reduces-sepsis-deaths,46445?print=1

Catholic Health West:
http://www.idse.net/ViewArticle.aspx?d=News&d_id=217&i=January+2011&i_id=692&a_id=16436

Kaiser Permanente:
http://www.idse.net/ViewArticle.aspx?d=News&d_id=217&i=January+2011&i_id=692&a_id=16436

Institute for Healthcare Improvement:
http://www.ihi.org/knowledge/Pages/ImprovementStories/SepsisCareEntersNewEra.aspx

Greater New York Hospital Association STOP sepsis initiative:
http://www.uhfnyc.org/assets/886

Ohio Patient Safety Institute/Mount Carmel Health System:
http://www.ohiopatientsafety.org/library/Success%20Story%20PDFs/Sepsis%20Collaborative.pdf

3b.2. Provide rationale for why the measure performance results are meaningful, understandable, and useful for quality improvement. If usefulness was demonstrated *(e.g., QI initiative),* describe the data, method and results:
Henry Ford Hospital, Society for Critical Care Medicine, Infectious Diseases Society of America, and the Insititue for Healthcare Improvement believe that the use of the severe sepsis and septic shock early management bundle in continuous quality improvement initiatives is a beneficial way to gather scientific data with which to improve facility performance. This is appropriate since the measure has been tested and found to be reliable and valid. NQF endorsement will facilitate our ongoing progress toward this quality improvement objective.

3d. Decomposition of Composite

3d.1 Describe the information that is available from decomposing the composite into its components
See Supplemental Information attached under "Scientific Acceptability" entitled:
NQF 0500 Forest plots and tables. See also section 2a2.3 "Reliability Testing Results" for a summary of the reliability of the component measures making up the composite. Finally, the component results as regards compliance and mortality have been individually described in "Levy MM, Dellinger RP, Townsend SR, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Critical Care Medicine 201 0;38:367-74." Some component level details on compliance related to usability from that publication´s Table 3 are reproduced below for consideration:

.....Initial....Final.....p value.....Remaining..p value.
.....Quarter....Quarter....Compared....Quarters...Compared
.....%Achieved..%Achieved..w/.Initial..%Acheived

Measure lactate.....61.0.....78.7.....<=.0001.....72.5.....<=.0001.
Blood cultures
.....before antibiotics...64.5.....78.3.....<=.0001.....76.3.....<=.0001.
Broad-spectrum abx.....60.4.....67.9.....0002.....67.0.....<=.0001.
Fluids and vasopressors.59.8.....77.0.....<=.0001.....71.1.....<=.0001.
CVP >8 mm Hg.....26.3.....38.0.....<=.0001.....33.9.....<=.0001.
ScvO2 >70%.....13.3.....24.3.....<=.0001.....21.7.....<=.0001.

All.....10.9.....21.5.....<=.0001.....21.1.....<=.0001.

3e. Achieved Stated Purpose

3e.1 Describe how the scores from testing or use reported in 2f demonstrate that the composite achieves the stated purpose

Overall, to what extent was the criterion, *Usability*, met? H☐ M☐ L☐ I ☐
Provide rationale based on specific subcriteria:

4. FEASIBILITY

Extent to which the required data are readily available, retrievable without undue burden, and can be implemented for performance measurement. (evaluation criteria)

4a. Data Generated as a Byproduct of Care Processes: H☐ M☐ L☐ I ☐

4a.1-2 How are the data elements needed to compute measure scores generated? *(Check all that apply).*
Data used in the measure are:
generated by and used by healthcare personnel during the provision of care, e.g., blood pressure, lab value, medical condition, Coded by someone other than person obtaining original information (e.g., DRG, ICD-9 codes on claims), Abstracted from a record by someone other than person obtaining original information (e.g., chart abstraction for quality measure or registry)

4b. Electronic Sources: H☐ M☐ L☐ I ☐

4b.1 Are the data elements needed for the measure as specified available electronically *(Elements that are needed to compute measure scores are in defined, computer-readable fields)*: Some data elements are in electronic sources

4b.2 If ALL data elements are not from electronic sources, specify a credible, near-term path to electronic capture, OR provide a rationale for using other than electronic sources:

4c. Susceptibility to Inaccuracies, Errors, or Unintended Consequences: H☐ M☐ L☐ I ☐

4c.1 Identify susceptibility to inaccuracies, errors, or unintended consequences of the measurement identified during testing and/or operational use and strategies to prevent, minimize, or detect. If audited, provide results:
We are not aware of any unintended consequences related to this measurement.

4d. Data Collection Strategy/Implementation: H☐ M☐ L☐ I ☐

A.2 Please check if either of the following apply (*regarding proprietary measures*): Proprietary measure
4d.1 Describe what you have learned/modified as a result of testing and/or operational use of the measure regarding data collection, availability of data, missing data, timing and frequency of data collection, sampling, patient confidentiality, time and cost of data collection, other feasibility/implementation issues *(e.g., fees for use of proprietary measures)*:
This measure was found to be reliable and feasible for implementation.

Overall, to what extent was the criterion, *Feasibility*, met? H☐ M☐ L☐ I ☐
Provide rationale based on specific subcriteria:

OVERALL SUITABILITY FOR ENDORSEMENT

Does the measure meet all the NQF criteria for endorsement? Yes☐ No☐
Rationale:

If the Committee votes No, STOP.
If the Committee votes Yes, the final recommendation is contingent on comparison to related and competing measures.

5. COMPARISON TO RELATED AND COMPETING MEASURES

If a measure meets the above criteria and there are endorsed or new related measures (either the same measure focus or the same target population) or competing measures (both the same measure focus and the same target population), the measures are compared to address harmonization and/or selection of the best measure before a final recommendation is made.

5.1 If there are related measures *(either same measure focus or target population)* or competing measures *(both the same measure focus and same target population*), list the NQF # and title of all related and/or competing measures:

5a. Harmonization

5a.1 If this measure has EITHER the same measure focus OR the same target population as NQF-endorsed measure(s): Are the measure specifications completely harmonized?

5a.2 If the measure specifications are not completely harmonized, identify the differences, rationale, and impact on interpretability and data collection burden:

5b. Competing Measure(s)

5b.1 If this measure has both the same measure focus and the same target population as NQF-endorsed measure(s): Describe why this measure is superior to competing measures *(e.g., a more valid or efficient way to measure quality);* OR provide a rationale for the additive value of endorsing an additional measure. *(Provide analyses when possible)*:

CONTACT INFORMATION

Co.1 Measure Steward (Intellectual Property Owner): Henry Ford Hospital, 2799 W. Grand Boulevard, 270 Clara Ford Pavillion, Detroit, Michigan, 48202

Co.2 Point of Contact: Emanuel, Rivers, MD, MPH, erivers1@hfhs.org, 313-916-1801-

Co.3 Measure Developer if different from Measure Steward: Henry Ford Hospital, 2799 W. Grand Boulevard, 270 Clara Ford Pavillion, Detroit, Michigan, 48202

Co.4 Point of Contact: Emanuel, Rivers, MD, MPH, erivers1@hfhs.org, 313-916-1801-

Co.5 Submitter: Emanuel, Rivers, MD, MPH, erivers1@hfhs.org, 313-916-1801-, Henry Ford Hospital

Co.6 Additional organizations that sponsored/participated in measure development:
Henry Ford Hospital System(HFHS)
California Pacific Medical Center/Sutter Health (CPMC)
Society of Critical Care Medicine (SCCM)
Infectious Diseases Society of America (IDSA)
Institute for Healthcare Improvement (IHI)
Surviving Sepsis Campaign (SSC)
Ohio State University (OSU)

Co.7 Public Contact: Emanuel, Rivers, MD, MPH, erivers1@hfhs.org, 313-916-1801-, Henry Ford Hospital

ADDITIONAL INFORMATION

Workgroup/Expert Panel involved in measure development

Ad.1 Provide a list of sponsoring organizations and workgroup/panel members' names and organizations. Describe the members' role in measure development.

1. Emmanuel Rivers, MD, MPH, FACEP, Emergency Medicine and Surgical Critical Care, Henry Ford Hospital, Institute of

Medicine Fellow: measure developer, measure steward, review of current evidence, validty, reliability, usability, feasibilty, and update of measure
2. William Conway, MD, Chief Medical Officer, Henry Ford Hospital, measure steward, review of current evidence, validty, reliability, usability, feasibilty, and update of measure
3. Mitchell M Levy, MD, FCCM, Rhode Island Hospital, Society of Critical Care Medicine (SCCM) for the Surviving Sepsis Campaign (SSC): review of current evidence, validty, reliability, usability, feasibilty, and update of measure
4. R. Phillip Dellinger, MD, FCCM, Cooper University Medical Center, Society of Critcal Care Medicine (SCCM) for the Surviving Sepsis Campaign (SSC): reivew of current evidence and update of measure
5. Sean R. Townsend, MD, Institute for Healthcare Improvement (IHI), California Pacific Medical Center, San Fransisco: review of current evidence, validty, reliability, usability, feasibilty, and update of measure
6. Lawrence Martinelli, MD, Coventry Health Systems, Chair Quality Improvement Task Force, Infectious Diseases Society of America (IDSA): review of current evidence, validty, reliability, usability, feasibilty, and update of measure
7. Gary Phillips, MAS, Biostatician, Ohio State University Center for Biostatitics, for the Surviving Sepsis Campaign (SSC): statistical support for evaluation of current evidence, validity, and reliability.

Ad.2 If adapted, provide title of original measure, NQF # if endorsed, and measure steward. Briefly describe the reasons for adapting the original measure and any work with the original measure steward:

Measure Developer/Steward Updates and Ongoing Maintenance
Ad.3 Year the measure was first released: 2008
Ad.4 Month and Year of most recent revision: 06, 2012
Ad.5 What is your frequency for review/update of this measure? Annually for minor changes, every three years detailed review of evidence and test results.
Ad.6 When is the next scheduled review/update for this measure? 06, 2013

Ad.7 Copyright statement: Performance measures and related data specifications developed by the Henry Ford Hospital in collaboration with representatives from emergency medicine, critical care medicine (SCCM), and infectious diseases (IDSA).

Ad.8 Disclaimers: These performance measures are not clinical guidelines and do not establish a standard of medical care, and have not been tested for all potential applications. Neither the Henry Ford Hospital nor its affiliates or ageents shall be responsible for any use of the measures.

Ad.9 Additional Information/Comments:

Date of Submission (*MM/DD/YY*): 06/07/2012

EXHIBIT B

SAMPLE DATA COLLECTION FORM, IF APPLICABLE

SEVERE SEPSIS/SEPTIC SHOCK TREATMENT

DATA COLLECTION

□ **Severe Sepsis** **Wt:**_____
SIRS Criterial met: Date/time:_____
□ Temp. >38 °C □ Temp. <36°C
□ Heart Rate >90 □ Resp. Rate >20/min
□ WBC >12,000 □ WBC <4,000 □ Bands >10%

Organ Dysfunction: Date/time:_____
□ Arterial hypoxemia (PAO2/FiO2 <300)
□ Coag. abnormalities (INR>1.5 or aPTT>60sec)
□ Acute oliguria (<0.5ml/kg/hr)
□ Thrombocytopenia (Plts<100,000)
□ Hyperbilirubinemia (total bili>4) □ Altered Mentation
□ Creatinine (increase >0.5mg/dl) □ Ileus

Hypotension: Date/time:_____
□ SBP<90 mmHg □ MAP <65mmHg
□ SBP decreased >40mmHg from baseline
OR
□Lactate >4mmol/L
Value: _____ Date/time: _____

Date/time of first antibiotic dose_____

Blood cultures before antibiotics: □Yes □ No
Date/time: _____

Crystalloid administered ≥20 ml/kg □Yes □ No
First bolus Date/time:_____
Total volume: _____ml

MAP >65 after fluid bolus: □ Yes □ No

CVP > 8mmHg □Yes □ No □ Not obtained

Time/Date CVP >8 mmHg: _____

Vasopressor started: □Yes □ No
Date/time: _____

MAP >65mmHg after vasopressors: □Yes □ No

Hct:_____%
Transfusion: □Yes □ No

Scv02 ≥70 □Yes □ No □ Not obtained
Time/Date Scv02 ≥70:_____

Inotrope: Type: _____
Date/time: _____

Repeat lactate:
Value: _____ Date/time: _____

# of glucose values <90 between 6 and 24 hours after sepsis detection:_____ median:_____

Protective lung strategy:
Maintain **Median inspiratory plateau pressure** <30 during first 24 hours: □Yes □ No □ Not intubated

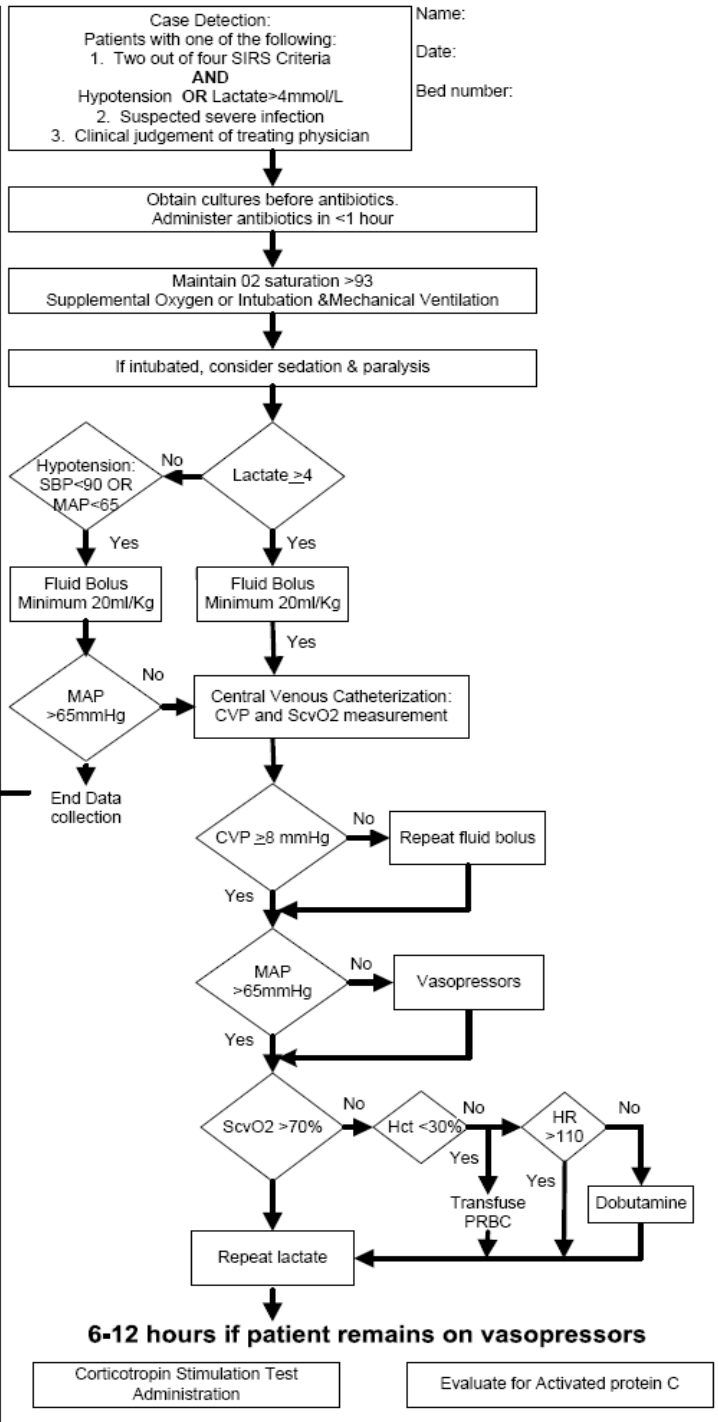
Low-dose steroids:
Steroid stimulation test administered:
□Yes (date/time _____) □ No
Steroids given:
□Yes (date/time _____) □ No
(if no, is documentation in chart stating why patient did not qualify for steroid treatment □Yes □ No)

Evaluated for Activated Protein C:
□Yes □ No
(if no, is documentation in chart stating why patient did not qualify for treatment □Yes □ No)

□**Alive** □**Deceased**

0-6 hours

MRN:
Name:
Date:
Bed number:



6-12 hours if patient remains on vasopressors

Corticotropin Stimulation Test Administration

Evaluate for Activated protein C

Evaluation for Severe Sepsis Screening Tool

<u>Instructions:</u> Use this optional tool to screen patients for severe sepsis in the emergency department, on the wards, or in the ICU.

1. Is the patient's history suggestive of a new infection?

- ☐ Pneumonia, empyema
- ☐ Urinary tract infection
- ☐ Acute abdominal infection
- ☐ Meningitis
- ☐ Skin/soft tissue infection
- ☐ Bone/joint infection
- ☐ Wound infection
- ☐ Bloodstream catheter infection
- ☐ Endocarditis
- ☐ Implantable device infection
- ☐ Other _____

___ **Yes** ___**No**

2. Are any two of following signs & symptoms of infection both present and new to the patient? <u>Note:</u> laboratory values may have been obtained for inpatients but may not be available for outpatients.

- ☐ Hyperthermia > 38.3 °C (101.0 °F)
- ☐ Hypothermia < 36 °C (96.8°F)
- ☐ Tachycardia > 90 bpm
- ☐ Tachypnea > 20 bpm
- ☐ Acutely altered mental status
- ☐ Leukocytosis (WBC count >12,000 µL–1)
- ☐ Leukopenia (WBC count < 4000 µL–1)
- ☐ Hyperglycemia (plasma glucose >120 mg/dL) in the absence of diabetes

___ **Yes** ___**No**

If the answer is yes to both either question 1 and 2, *suspicion of infection* is present:

- ✓ Obtain: **lactic acid**, **blood cultures**, CBC with differential, basic chemistry labs, bilirubin.
- ✓ At the physician's discretion obtain: UA, chest x-ray, amylase, lipase, ABG, CRP, CT scan.

3. Are any of the following organ dysfunction criteria present at a site remote from the site of the infection that are not considered to be chronic conditions? Note: the remote site stipulation is waived in the case of bilateral pulmonary infiltrates.

- ☐ SBP < 90 mmHg or MAP < 65 mmHg
- ☐ SBP decrease > 40 mm Hg from baseline
- ☐ Bilateral pulmonary infiltrates with a new (or increased) oxygen requirement to maintain SpO2 > 90%
- ☐ Bilateral pulmonary infiltrates with PaO2/FiO2 ratio < 300
- ☐ Creatinine > 2.0 mg/dl (176.8 mmol/L) or Urine Output < 0.5 ml/kg/hour for > 2 hours
- ☐ Bilirubin > 2 mg/dl (34.2 mmol/L)
- ☐ Platelet count < 100,000
- ☐ Coagulopathy (INR >1.5 or aPTT >60 secs)
- ☐ Lactate > 2 mmol/L (18.0 mg/dl)

___ **Yes** ___**No**

If *suspicion of infection* is present AND *organ dysfunction* is present, the patient meets the criteria for SEVERE SEPSIS and should be entered into the severe sepsis protocol.

For questions or concerns please contact the critical care fellow on call.

Place patient label here.

Cooper University Hospital

Signature_____

Date:____/____/___ Time of recognition:____:____(24 hr clock)

Individual Chart Measurement Tool:

Instructions: Attach this tool to each chart of a patient with severe sepsis, septic shock at the time of data abstraction. This tool can be used for concurrent, prospective, or retrospective data collection. However, individual hospitals are strongly encouraged to choose a single approach and maintain that collection over time. Once all Individual Chart Measurement Tools are gathered for a single month, complete the Monthly Measurement Worksheet to report results.

***Important: mark the date format you will be following: ____ (dd/mm/yy) ____ (mm/dd/yy)**

1. **Document whether the patient met criteria for severe sepsis or septic shock. Check only one answer. Because strict definitions apply it may be helpful to consult the Sepsis Definitions Tool or the Evaluation for Severe Sepsis Screening Tool to ensure accuracy.**

   _____ No, does not meet criteria for either severe sepsis or septic shock. Stop data collection.
   _____ Yes, met criteria for severe sepsis. Continue data collection.
   _____ Yes, met criteria for septic shock. Continue data collection.

2. **Record the patient identifier number _____**

3. **Question 3 establishes a uniform "time of presentation" for each patient depending upon their individual admission characteristics. The time of presentation will be the basis for answering subsequent questions and making calculations. Only one statement below (3a, 3b, or 3c) will apply to a single patient.**

   Note: A protocol, protocol form and protocol order set are recommended to facilitate the treatment process and the accurate recording of timelines.

   3a. For patients admitted to the ICU from the ED meeting criteria for severe sepsis or septic shock, record the time of triage in the emergency department as the time of presentation.

   _____ Not applicable. Proceed to 3b.
   _____ Applicable, record time of presentation below and proceed to question 4.

   3b. For patients transferred to the ICU from units other than the ED:

   - ***Preferred:* if the resuscitation and management of severe sepsis was annotated as beginning on the transferring unit, record the time and date of that annotation as the time of presentation.**
   - ***Default:* if the resuscitation and management of severe sepsis *was not* in annotated as beginning on the transferring unit, record the ICU admission date and time as the time of presentation.**

   Note: it is critical to establish whether there was reasonable and straightforward annotation of the time of initiation of efforts to manage severe sepsis on the ward prior to ICU transfer. Otherwise, no credit can be assigned for key interventions performed prior to the default time of presentation, the time of ICU admission. Annotation may include a practitioner's note, a practitioner's timed and dated orders, a nurse's timed and dated records documenting discussion of severe sepsis with a practitioner, timed records initiating referral to the ICU for severe sepsis.

_____ Not applicable. Proceed to question 3c.

_____ Applicable; the annotated time and date for the resuscitation and management of sepsis on the transferring unit is recorded below as the time of presentation. Proceed to question 4.

_____ Applicable; the ICU admission date and time is recorded below as the time of presentation. Proceed to question 4.

3c. For patients admitted to the ICU with a diagnosis other than sepsis and who subsequently develop severe sepsis or septic shock on the same ICU stay, record the annotated time and date of the beginning of the resuscitation and management of severe sepsis as the time of presentation.

_____ Not applicable. Stop data collection, time of presentation cannot be accurately determined. If data is being collected concurrently or prospectively, the patient may remain on the sepsis protocol without further data collection.

_____ Applicable, record time of presentation below and proceed to question 4.

*****Time of Presentation: __ __ /__ __/ __ __ (date format as above) __ __ : __ __ (24 hour clock).*****

4. Document whether serum lactate was obtained:

_____ No. Proceed to question 5.

_____ Yes. Place a mark in Box 1 on line 16 of this document. Proceed to question 4a.

4a. Record the value serum lactate value if obtained: _____ mmol/L or ____ mg/dl

4b. Record date and time of serum lactate collection:

__ __ /__ __/ __ __ (date format as above) __ __:__ __ (24 hour clock).

5. Document whether the patient received a broad-spectrum antibiotic:

____ No. Proceed to question 7.

____ Yes. Proceed to question 5a.

5a. Name of Antibiotic(s): _____

5b. Date and time of first broad-spectrum antibiotic administration:

__ __ /__ __/ __ __ (date format as above) __ __ : __ __ (24 hour clock).

5c. Calculate the difference between line 3, time of presentation above, and line 5b in hours and minutes: Difference: __ __ hours __ __ minutes

5d. Multiply the HOURS ONLY on line 5c above x 60 ____

5e. Time in minutes to broad spectrum antibiotic administration for this patient: add the total of line 5d above to the number of MINUTES ONLY listed on line 5c above: _____

5f. If item 3a above is marked applicable, was the number of minutes on line 5e above ≤ 180 minutes:

____ No. Proceed to question 6.

____ Yes. Place a mark in Box 3 on line 16 of this document. Proceed to question 6.

5g. If item 3b or 3c is marked applicable, was the number of minutes on line 5e above ≤ 60 minutes:

____ No. Proceed to question 6.

____ Yes. Place a mark in Box 3 on line 16 of this document. Proceed to question 6.

6. Document date and time of blood culture collection.

____ If not collected, enter "No" on 6a and proceed to question 7.
__ __ /__ __/ __ __ (date format as above) __ __:__ __ (24 hour clock). Proceed to question 6a.

6a. Document whether the time and date listed on 6 above is earlier than the time and date listed on line 5b above:

_____ No. Proceed to question 7.
_____Yes. Place a mark in Box 2 on line 16 of this document. Proceed to question 7.

7. Answer the following questions regarding resuscitation of severe sepsis or septic shock:

7a. Document whether the patient was hypotensive and/or if serum lactate was > 4 mmol/L (36 mg/dl) on line 4a of this document:

____ No. Place a mark in Box 4, 5, 6, 7 on line 16 of this document. Place a mark in Box A on line 17 of this document. Proceed to question 11.
____ Yes. Proceed to question 7b.

7b. Document the basis for the diagnosis of hypotension, if present:

____ SBP < 90 mm Hg
____ MAP < 65 mm Hg **Note:** *MAP = (2 x diastolic pressure + systolic pressure) / 3*
____ SBP decrease of ≥ 40 mm Hg from known baseline

7c. Document whether initially the patient received ≥ 20 ml/kg of crystalloid or ≥ an equivalent amount of colloid in response to hypotension or lactate > 4 mmol/L (36 mg/dl):

Cyrstalloid/Colloid Equivalency Chart:[1]	
Normal Saline	20 ml/kg
Lactated Ringer's Solution	20 ml/kg
Albumin 4-5% Albumin 20-25% Albumin	0.24 grams/kg 5.2 ml/kg 1.1 ml/kg
Hetastarch 3% Hetastarch 6% Hetastarch 10% Hetastarch	0.29 grams/kg 9.7 ml/kg 4.8 ml/kg 2.9 ml/kg
Pentastarch 10% Pentastarch	0.30 grams/kg 3 ml/kg
10% Dextran-40	0.30 grams/kg (3ml/kg)
3% Dextran-60, 6% Dextran-70 3% Dextran-60 6% Dextran-70	0.19 grams/kg 6.3 ml/kg 3.1 ml/kg
Gelatins (succinylated & crosslinked 2.5, 3.0, 4.0%; urea-linked 3.5%)	0.23 grams/kg

[1] Adapted from: Evidence-based Colloid Use in the Critically Ill: American Thoracic Society Consensus Statement. Am J Respir Crit Care Med. 2004. Vol 170:1247-1259. For percentage solutions, listed ml/kg are calculated from the g/kg data.

____ No. Record "No" on lines 7f, 8b, 9b and 10 below. Proceed to question 11.

____ Yes. Place a mark in Box 4 on line 16 of this document. Proceed to question 7d.

7d. Document whether MAP remained ≥ 65 in response to the initial fluid resuscitation described in 7c:

i. ____ No. Proceed to question 7e.
ii. ____ Yes, if lactate was ≤ 4 mmol/L (36 mg/dl) on line 4a of this document place a mark in Box 5, Box 6 and Box 7 on line 16 of this document. Proceed to question 10.
iii. ____ Yes, if lactate was > 4 mmol/L (36 mg/dl) on line 4a of this document, proceed to question 8.

7e. Document whether the patient received vasopressors:

____ No. Record "No" on lines 7f, 8b, 9b and 10 below. Proceed to question 11.
____ Yes. Place a mark in Box 5 on line 16 of this document. Proceed to question 7f.

7f. Document whether the MAP remained ≥ 65 mm Hg without the use of vasopressors:

Note: If no evidence for removal of vasopressors can be found, mark item 7f "no" and proceed to question 8.

i. ____ No. Proceed to question 8.
ii. ____ Yes, if lactate was ≤ 4 mmol/L (36 mg/dl) on line 4a of this document place a mark in Box 6 and Box 7 on line 16 of this document. Proceed to question 10.
iii. ____ Yes, if lactate was > 4 mmol/L (36 mg/dl) on line 4a of this document, proceed to question 8.

8. Document date and time CVP first ≥ 8 mm Hg within 24 hours:

____ CVP not obtained or never ≥ 8 mm Hg within 24 hours. Record line 8b as "No" and proceed to question 9.

Date: __ __ /__ __/ __ __ (date format as above) **Time**: __ __ : __ __ (24 hour clock).
Proceed to question 8a.

8a. Calculate the difference between line 3, time of presentation, and line 8 above in hours and minutes: Difference: __ __ : __ __ (hours:minutes).

8b. Document whether line 8a is ≤ 6 hours.

____ No. Proceed to question 9.
____ Yes. Place a mark in Box 6 on line 16 of this document. Proceed to question 9.

9. Document date and time $ScvO_2$ first ≥ 70% (or SvO_2 ≥ 65%) within 24 hours:

____$ScvO_2$ not obtained or never ≥ 70% (or SvO_2 ≥ 65%) within 24 hours. Record line 9b as "No" and proceed to question 10.

Date: __ __ /__ __/ __ __ (date format as above) **Time**: __ __ : __ __ (24 hour clock).
Proceed to question 9a.

9a. Calculate the difference between line 3, time of presentation, and line 9 above in hours and minutes: Difference: __ __ : __ __ (hours:minutes).

9b. Document whether line 9a is ≤ 6 hours.

____ No. Proceed to question 10.

____ Yes. Place a mark in Box 7 on line 16 of this document. Proceed to question 10.

10. Answer the following questions regarding low-dose steroids administration:

10a. Document whether line 7d or line 7f above has been answered affirmatively:

____ Yes. The bundle element is not applicable because the patient's MAP was ≥ 65 and did not have persistent arterial hypotension. Place a mark in Box A on line 17 and proceed to question 11.

____ No. Proceed to question 10b.

10b. Document whether there is a standardized ICU policy regarding low-dose steroid administration for septic shock:

____ No. Proceed to question 11.

____ Yes. Proceed to question 10c.

10c. Indicate whether there is documentation that the patient did not merit low-dose steroids based upon the standardized protocol:

____ No documentation is present. Proceed to question 10d.

____ Yes there is documentation present. Place a mark in Box A on line 17 below. Proceed to question 11.

10d. Document whether low-dose steroids were administered:

Note: low-dose steroids refer to a daily dose of 200–300 mg of hydrocortisone or equivalent.

Steroid Equivalency Chart:[2]	
Steroid:	**Equivalent TOTAL DAILY dose:**
Hydrocortisone	200 – 300 mg
Dexamethasone	8 – 12 mg
Prednisone	50 – 75 mg
Prednisolone	50 – 75 mg
Methylprednisolone	40 – 60 mg
Cortisone	250 – 375 mg
Triamcinolone	40 – 60 mg
Betamethasone	6 – 10 mg

[2]Adapted from: Knoben JE, Anderson PO. *Handbook of Clinical Drug Data*, 6th ed. Drug Intelligence Pub, Inc. 1988.

____ No. Proceed to question 11.

____ Yes. Record date and time below. Proceed to question 10e.

__ __ /__ __/ __ __(date format as above) __ __ : __ __ (24 hour clock)

10e. Time of presentation: from line 3 above:

__ __ /__ __/ __ __(date format as above) __ __ : __ __ (24 hour clock)

10f. Document whether the time and date on 10d is ≤ 24 hours from the time of presentation listed on item 10e.

____ No. Proceed to question 11.

____ Yes. Place a mark in Box A on line 17 and proceed to question 11.

11. Answer the following questions regarding Drotrecogin alfa (activated) administration:

11a. Document whether there is a standardized ICU policy regarding Drotrecogin alfa (activated) administration:

____ No. Proceed to question 12.

____ Yes. Proceed to question 11b.

11b. Indicate whether there is documentation that the patient did not merit Drotrecogin alfa (activated) administration based upon the standardized protocol:

____ No documentation is present. Proceed to question 11c.

____ Yes there is documentation present. Place a mark in Box B on line 17 below. Proceed to question 12.

11c. Document whether Drotrecogin alfa (activated) was administered:

____ No. Proceed to question 12.

____ Yes. Record date and time below. Proceed to question 11d.

__ __ /__ __/ __ __(date format as above) __ __ : __ __ (24 hour clock)

11d. Time of presentation: from line 3 above:

__ __ /__ __/ __ __(date format as above) __ __ : __ __ (24 hour clock)

11e. Document whether the time and date on 11c is ≤ 24 hours from the time of presentation listed on item 11d.

____ No. Proceed to question 12.

____ Yes. Place a mark in Box B on line 17 and proceed to question 12.

12. Document the median glucose* value within 24 hours of the time of presentation:

Median glucose: _____ mg/dl or ____ mmol/L

If and only if median glucose is < 150 mg/dl (8.3 mmol/L) place a mark in Box C on line 17 of this document. Proceed to question 12a.

12a. Document the lower limit of normal for serum glucose at your institution: ____

12b. Document the total number of measurements that fell below the lower limit of normal within 24 hours from the time of presentation for this patient: ____

* Refer to the optional *Median Glucose Tool,* if necessary.

13. Document the median inspiratory plateau pressure (IPP)* achieved within 24 hours of time of presentation:

____ Not applicable because the patient was not mechanically ventilated. Place a mark in Box D on line 17 of this document. Proceed to question 14.

Median IPP: _____ If and only if < 30 cm H_20, place a mark in Box D on line 17 of this document.

* Refer to the optional *Median IPP Calculation Tool,* if necessary.

14. Date and time of hospital discharge:

__ __ /__ __/ __ __(date format as above) __ __ : __ __ (24 hour clock)

15. Status at hospital discharge: ____ Alive ___ Deceased

16. Boxes 1 through 7:

Box 1	Box 2	Box 3	Box 4	Box 5	Box 6	Box 7

17. Boxes A through D:

Box A	Box B	Box C	Box D

Description of the proportion of the sites that met the resuscitation bundle (1) October 5, 2012

Table 1: Descriptive summary of proportion where the resuscitation bundle is yes by site quarters of participation

Quarters of participation	Number of sites	mean	sd	min	p25	p50	p75	max
1	218	0.101	0.180	0.000	0.000	0.000	0.125	1.000
8	88	0.205	0.197	0.000	0.000	0.183	0.354	0.667
16	8	0.158	0.102	0.000	0.096	0.136	0.255	0.295

- Site quarters are based on a quarter of participation based on when a site entered the SSC program
- Site quarters do not align with calendar quarters
- There were 218 sites that started the program
- After 2 years (8 quarters) there were 88 sites still participating
- After 4 years (16 quarters) there were 8 sites still participating

Table 2: Descriptive summary of proportion where the resuscitation bundle is yes by site quarters of participation

Delta	Number of sites	Description	mean	sd	min	p25	p50	p75	max
Decreased	21	Proportion	0.108	0.176	0.000	0.000	0.000	0.118	0.595
		Delta	0.247	0.246	0.021	0.059	0.200	0.334	1.000
Increased	67	Proportion	0.235	0.196	0.000	0.000	0.213	0.385	0.667
		Delta	0.175	0.164	0.000	0.000	0.158	0.326	0.600

- Delta is whether or not a site decreased or increased
- 21 sites (24%) decreased from the 1st quarter while 67 sites (76%) increased
- Description: Proportion is those that met the resuscitation bundle and delta is the size of either the increase or decrease

Description of the 8 sites with observations during site quarter 16

- All 8 improved from the 1st quarter to the 8th quarter the mean proportion was 0.153 and the mean change from 1st to 8th quarter was 0.136
- Then from the 8th to the 16th quarter 3 sites decreased a mean proportion of 0.131 and 5 sites increased with a mean proportion of 0.087

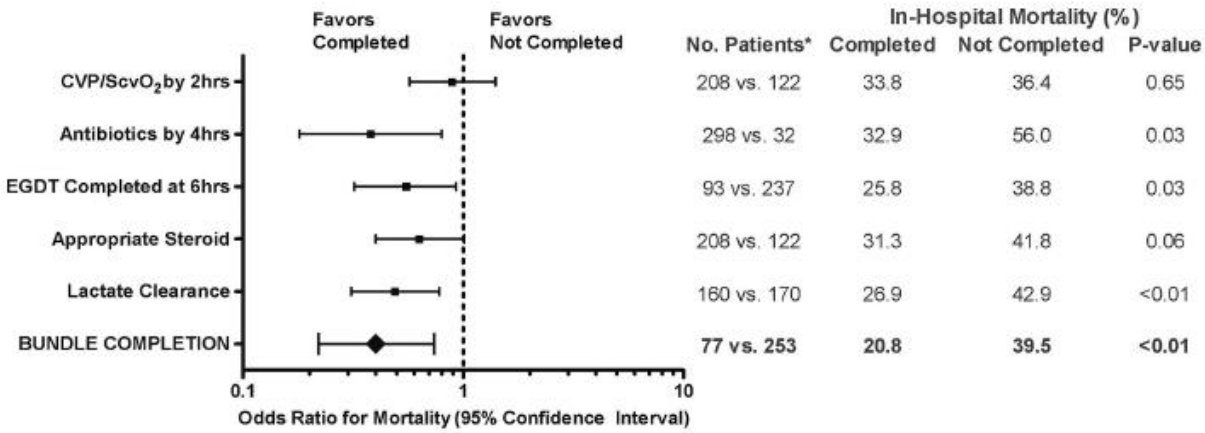
NQF Component Item /Measure Analysis to Justify Inclusion in Composite (2i.1-3, 2j.1-3)

Table 5. Contribution of each sepsis bundle intervention to the reduction of risk of in-hospital mortality

	Odds Ratio[a] (95% Confidence Interval)	*p*
6-hr resuscitation bundle		
Serum lactate measured	0.74 (0.45–1.21)	.230
Rest of the bundle (for each remaining task accomplished)[b]	0.76 (0.64–0.90)	.002
Blood cultures before antibiotics	0.79 (0.50–1.26)	.324
Rest of the bundle (for each remaining task accomplished)[b]	0.75 (0.65–0.88)	.001
Early treatment with antibiotics	0.68 (0.43–1.09)	.109
Rest of the bundle (for each remaining task accomplished)[b]	0.77 (0.66–0.90)	.001
Intravenous fluids delivered	1.14 (0.60–2.14)	.694
Rest of the bundle (for each remaining task accomplished)[b]	0.71 (0.59–0.85)	.001
Mean arterial pressure ≥65 mm Hg achieved	0.74 (0.44–1.25)	.265
Rest of the bundle (for each remaining task accomplished)[b]	0.76 (0.64–0.91)	.003
Central venous pressure ≥8 mm Hg achieved	0.86 (0.48–1.53)	.604
Rest of the bundle (for each remaining task accomplished)[b]	0.74 (0.62–0.89)	.001
Central venous oxygen saturation ≥70% achieved	0.62 (0.38–0.99)	.048
Rest of the bundle (for each remaining task accomplished)[b]	0.79 (0.66–0.93)	.006
24-hr management bundle		
Low-dose steroids administered	0.72 (0.41–1.28)	.259
Rest of the bundle (for each remaining task accomplished)[b]	0.76 (0.53–1.09)	.139
Activated protein C administered	0.44 (0.11–1.69)	.229
Rest of the bundle (for each remaining task accomplished)[b]	0.78 (0.58–1.06)	.109
Glycemia ≤150 mg/dL	0.98 (0.62–1.56)	.948
Rest of the bundle (for each remaining task accomplished)[b]	0.62 (0.42–0.91)	.015
Plateau pressure <30 cm H_2O	0.52 (0.27–1.01)	.054
Rest of the bundle (for each remaining task accomplished)[b]	0.82 (0.59–1.14)	.247

Source: Castellanos-Ortega[4]

Implementation of a bundle of quality indicators for the early management of severe sepsis and septic shock is associated with decreased mortality:



Source: Nguyen[1]

TABLE 4. **Odds ratios for in-hospital mortality relative to completion of intervention and goal achievement of each resuscitation bundles**

		In-hospital mortality, %		
	OR (95% CI)	Yes	No	*P*
Adequate fluid challenge	0.356 (0.150–0.847)	8.3	20.3	0.020
Antibiotics by 4 h	0.861 (0.182–4.074)	11.7	13.3	0.851
Achievement of CVP goal	0.321 (0.089–1.162)	11.4	28.6	0.083
Achievement of MAP goal	0.085 (0.018–0.408)	10.2	57.1	0.002
Achievement of $ScvO_2$ goal	0.191 (0.063–0.579)	9.3	35.0	0.003
Achievement of all goals in resuscitation bundles	0.364 (0.144–0.921)	6.9	16.8	0.033

Source: Jeon[2]

TABLE 4. **Multivariate analysis of predictive factors for mortality in patients with severe sepsis receiving EGDT**

Variable*	Odds ratio (95% CI)	*P*
Log(sTREM-1)†	2.784 (1.116–6.945)	0.028
$Scvo_2$	0.931 (0.875–0.990)	0.022
SAPS II	1.055 (1.001–1.112)	0.048

The predictive power calculation was performed (AUC = 0.8737 [95% CI, 0.7883–0.9591]).
*Values at the time of admission (day 0) and pre-EGDT.
†Logarithmic transformation was performed because of skewed distribution.

Source: Jeon[3]

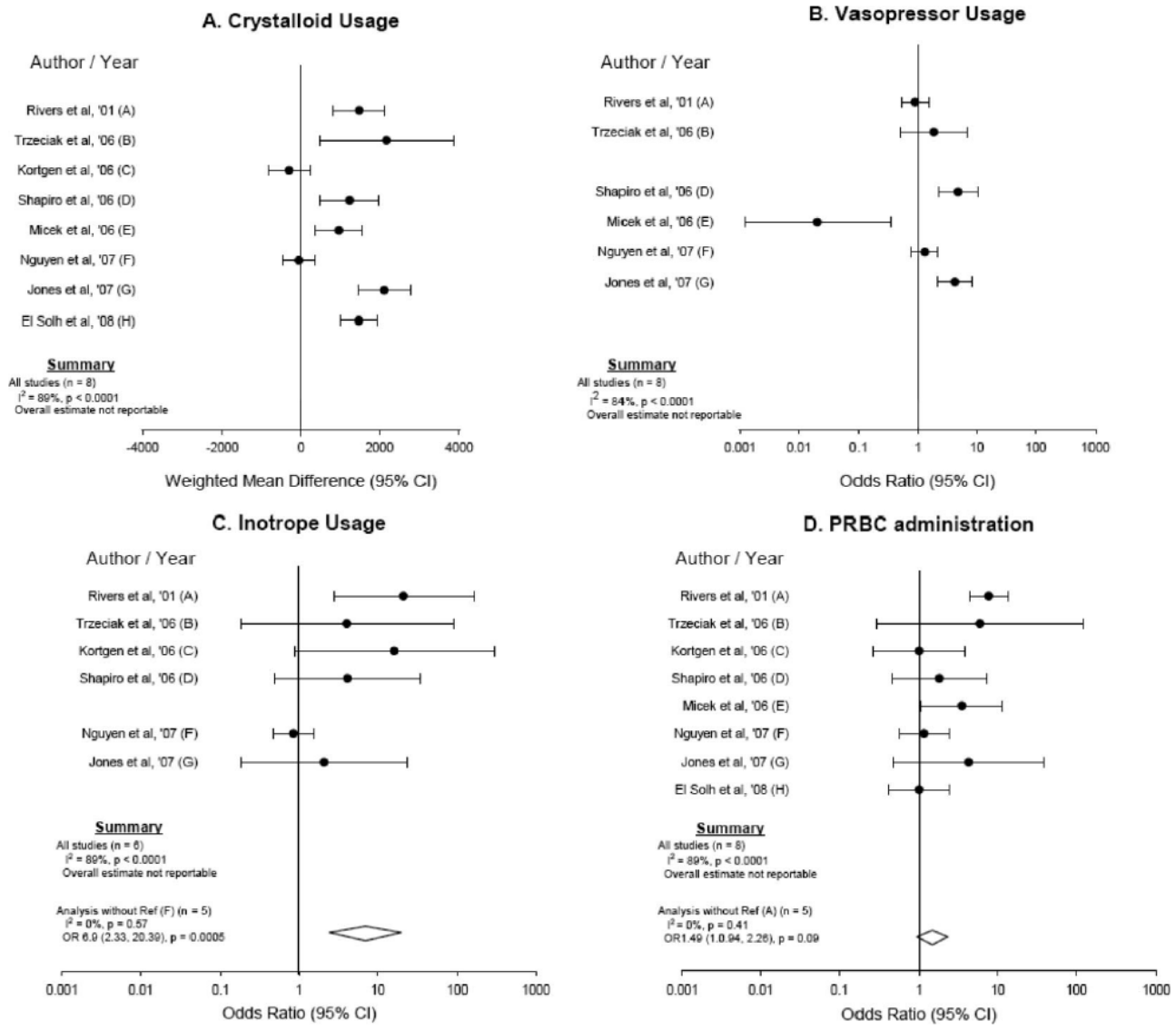
Surviving Sepsis Targets:

Bundle Target	Population	n	Unadjusted OR	Unadjusted *p*	Risk-Adjusted OR	Risk-Adjusted 95% CI	Risk-Adjusted *p*
Measure lactate	All[a]	15,022	0.86	<.0001	0.97	0.90, 1.05	.48
Obtain blood cultures before antibiotics	All[a]	15,022	0.70	<.0001	0.76	0.70, 0.83	<.0001
Commence broad-spectrum antibiotics	All[a]	15,022	0.78	<.0001	0.86	0.79, 0.93	<.0001
Achieve tight glucose control	All[a]	15,022	0.65	<.0001	0.67	0.62, 0.71	<.0001
Administer drotrecogin alfa	Multiorgan failure[b]	8733	0.90	.26	0.84	0.69, 1.02	.07
Administer drotrecogin alfa	Shock despite fluids[c]	7854	0.91	.30	0.81	0.68, 0.96	.02
Administer low-dose steroids	Shock despite fluids[c]	7854	1.06	.18	1.06	0.96, 1.17	.24
Demonstrate CVP ≥8 mm Hg	Shock despite fluids[c]	7854	1.08	.10	1.00	0.89, 1.12	.98
Demonstrate $Scvo_2$ ≥70%	Shock despite fluids[c]	7854	0.94	.24	0.98	0.86, 1.10	.69
Achieve low plateau pressure control	Mechanical ventilation[d]	7860	0.67	<.0001	0.70	0.62, 0.78	<.0001

OR, odds ratio; CI, confidence interval; CVP, central venous pressure; $Scvo_2$, central venous oxygen saturation.
[a]Model fit statistics: C = 22.2 with 18 *df*, $p = .22$, log-likelihood $R^2 = 28.1\%$, χ^2 dispersion = 1.05; [b]model fit statistics: C = 28.7 with 18 *df*, $p = .053$, log-likelihood $R^2 = 20.5\%$, χ^2 dispersion = 1.08; [c]model fit statistics: C = 24.3 with 18 *df*, $p = .15$, log-likelihood $R^2 = 11.4\%$, χ^2 dispersion = 1.00; [d]model fit statistics: C = 6.61 with 18 *df*, $p = .99$, log-likelihood $R^2 = 27.0\%$, χ^2 dispersion = 1.06.

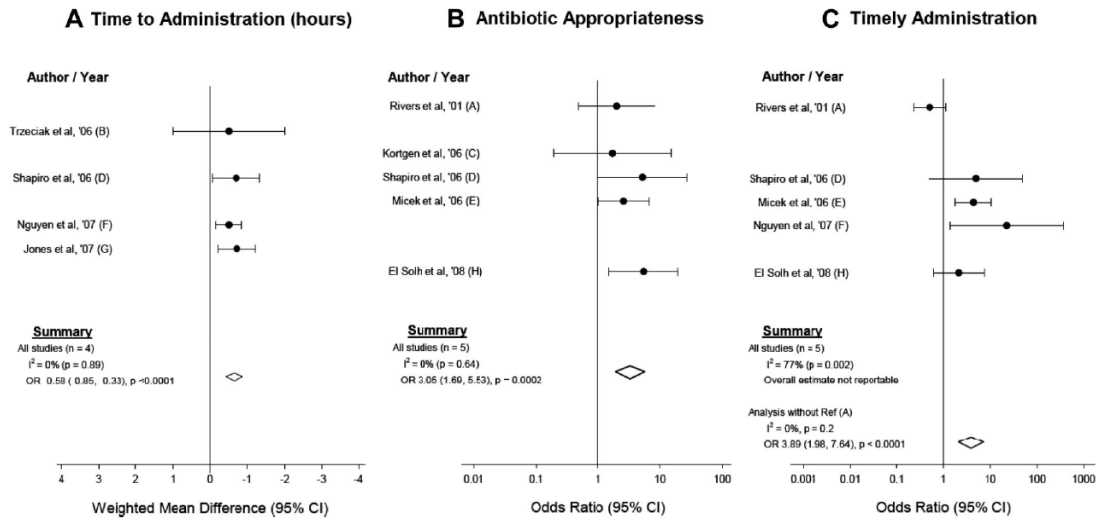
Source: Levy[5]

Meta-analysis of Eight Trials:



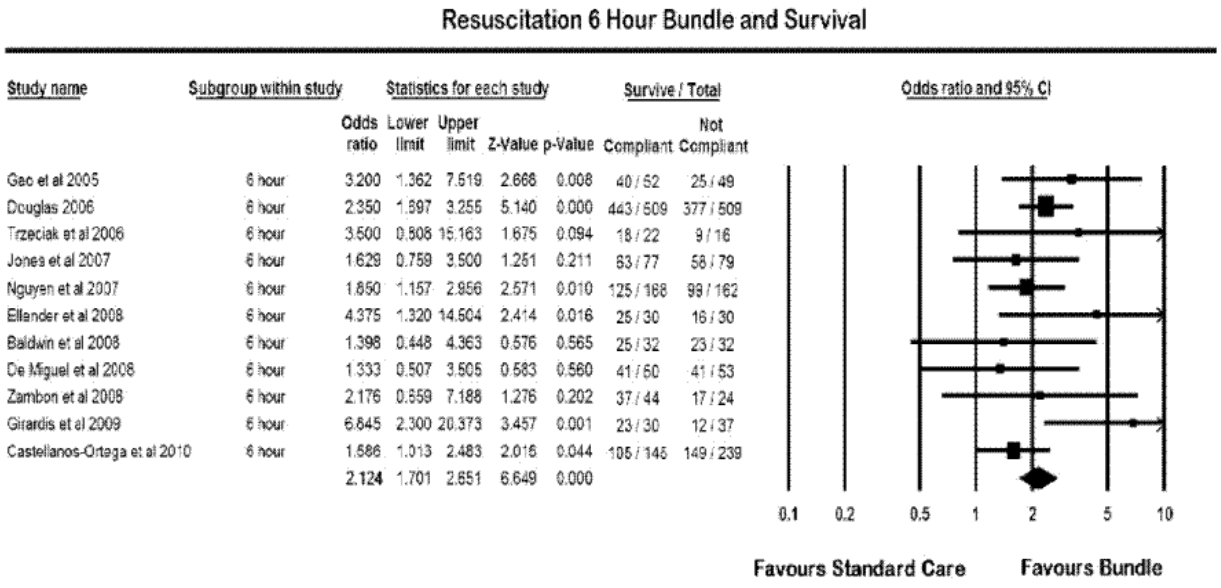
Source: Barochia[6]

Meta-analysis of Eight Trials (continued):



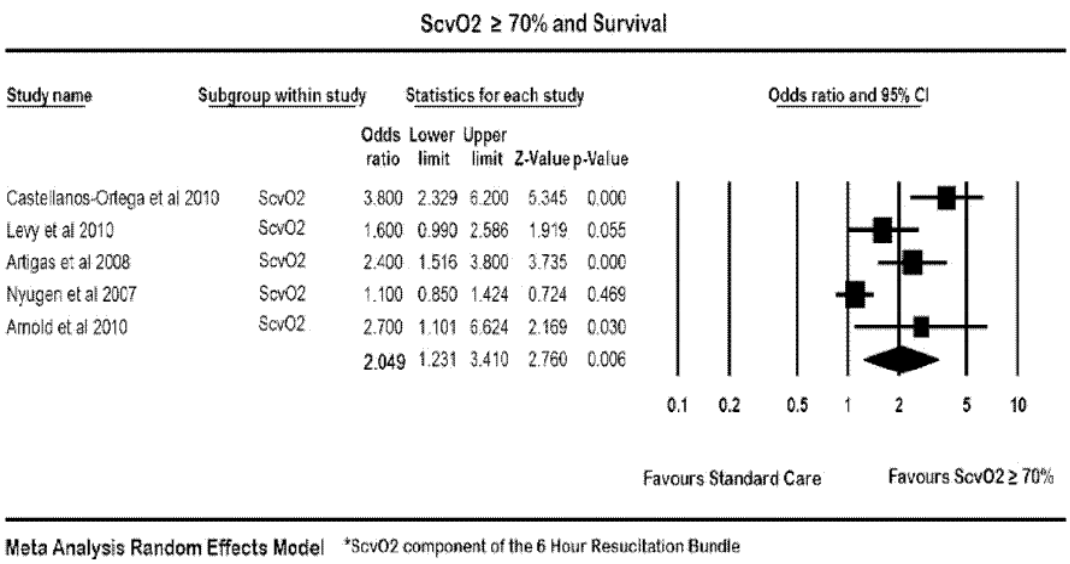
Source: Barochia[6]

Bundle Elements and Survival:



Source: Chamberlain7

Central Venous Oxygen Saturation and Survival:



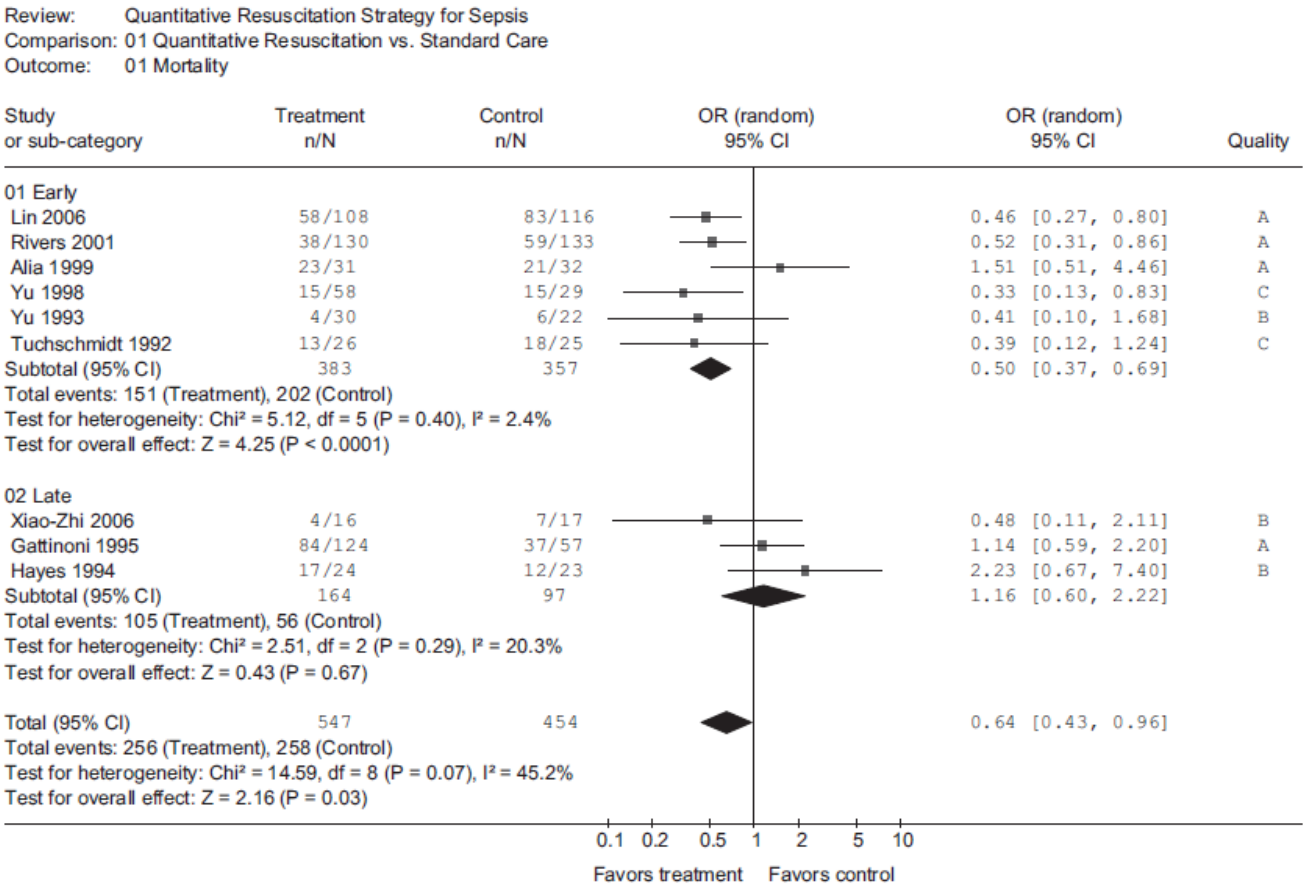
Source: Chamberlain[7]

Bundle Interventions:

Therapeutic Interventions	Variable in Data Base	Odds Ratio	95% Confidence Interval	p-value
6 hour resuscitation bundle				
Serum lactate measured	Lactate - 0 hours	2.18	(1.89-2.52)	<0.001
Blood cultures before antibiotics	Blood culture in ≤ 3 hours	1.01	(0.84-1.21)	0.92
Early treatment with antibiotics	Antibiotics in ≤ 3 hours	1.00	(0.85-1.18)	0.96
Intravenous fluids delivered	Fluid Challenge in ≤ 3 hours	1.26	(0.96-1.66)	0.09
Mean arterial pressure ≥ 65 mm Hg achieved	MAP ≥ 65 mmHg - 6 hours	0.59	(0.50-0.70)	<0.001
Central venous pressure ≥ 8 mm Hg	CVP ≥ 8 - 6 hours	1.17	(0.88-1.57)	0.28
Central venous oxygen saturation ≥ 70% achieved	ScvO2 ≥ 70% - 6 hours	0.75	(0.56-0.99)	0.047

Source: Cannon[8]

Early vs. Late Therapy



Source: Jones[10]

Early vs. Late Therapy

Variable	Odds Ratio	95% Confidence Interval	*P* Value
Broad-spectrum antibiotics			
0–1 h	0.67	0.50–0.90	0.008
1–3 h	0.80	0.60–1.06	0.127
3–6 h	0.87	0.62–1.22	0.419
Previous antibiotic	0.89	0.69–1.15	0.383
No antibiotic in the first 6 h	1		
Fluid challenge in the event of hypotension and/or lactate >36 mg/dl	1.01	0.73–1.39	0.966
Low-dose steroids for persistent hypotension despite fluid resuscitation and/or lactate >36 mg/dl	1.04	0.85–1.28	0.688
Drotrecogin alfa (activated) in multiorgan failure	0.59	0.41–0.84	0.004

Source: Ferrer[9]

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