

The Joint Commission

Journal on Quality and Patient Safety

Improvement from
Front Office to Front Line

April 2009
Volume 35 Number 4



*From a study of
160 patient safety
recommendations, the
authors identify the five
recommendations most
likely to be followed.*

(p. 206)

 **Joint Commission
Resources**

How Valuable Are Patient Safety Recommendations for Consumers?

Ernest A. Codman Awards

Multiple Organization

- A Comprehensive Hand Hygiene Approach to Reducing MRSA Health Care–Associated Infections

Hospital

- Early Goal-Directed Therapy: Improving Mortality and Morbidity of Sepsis in the Emergency Department
- Reducing Surgical Site Infections at a Pediatric Academic Medical Center
- Rescue Me: Saving the Vulnerable Non-ICU Patient Population

Features

Patient and Family Involvement

- Rating Recommendations for Consumers About Patient Safety: Sense, Common Sense, or Nonsense?

Performance Improvement

- Reducing Hyperglycemia Hospitalwide: The Basal-Bolus Concept

Organizational Change and Learning

- The Final Steps in Converting a Health Care Organization to a Latex-Safe Environment

Human Factors Engineering

- Legibility of a Volumetric Infusion Pump in a Shock Trauma ICU

Codman Awards

Early Goal-Directed Therapy: Improving Mortality and Morbidity of Sepsis in the Emergency Department

Anne Focht, R.N., M.S.N.; Alan E. Jones, M.D.; Timothy J. Lowe, Ph.D.

Carolinas Medical Center (CMC), located in Charlotte, North Carolina, is the flagship hospital of Carolinas HealthCare System (CHS), the third-largest health care system in the United States. With more than 800 beds, this public, not-for-profit, tertiary and Level 1 trauma center supports various residency programs, as well as numerous large multispecialty private medical groups. CMC is the only indigent-care hospital in Charlotte, providing care for more than 1 million patients annually. The emergency department (ED) evaluates more than 100,000 patients each year. The high acuity of illness of those presenting in the ED results in an annual admission rate of approximately 14% of all visits. Of these admissions, approximately 1% are due to septicemia, the incidence of which, following national estimates, is projected to increase by 1.5% each year.¹

The implementation of early goal-directed therapy (EGDT) on November 15, 2005, for the treatment of severe sepsis/septic shock in the ED was a priority to potentially reduce morbidity and mortality in our patients with sepsis. Before we implemented the EGDT protocol, our in-hospital mortality rate for those patients presenting in the ED was approximately 27%, in contrast with the 30% mortality rate reported in national studies.^{1,2} Because approximately 50% of our hospital sepsis cases originated in the ED, a significant number of lives could be saved by initiating an effective intervention.

Methods

CODE SEPSIS TASK FORCE

Following Institutional Review Board approval, CMC's ED physicians began identifying and tracking patients who presented with symptoms of severe sepsis or septic shock in August 2004. A code sepsis task force composed of ED, ICU, internal medicine, and infectious disease physicians; ED and ICU nurses; and a pharmacist was formed to address the following objectives:

1. Critically evaluate the evidence supporting EGDT
2. If evidence supports this therapy, develop an acceptable

Article-at-a-Glance

Background: The growing number of patients with severe sepsis or septic shock and the resulting mortality rate (30%) require changes in the current protocols used to treat these conditions. Through adaptation of early goal-directed therapy (EGDT), Carolinas Medical Center developed a process improvement strategy for decreasing mortality associated with severe sepsis and septic shock. Before implementing the EDGT protocol, the ED did not follow a written management protocol for septic patients.

Methods: Following establishment of an interdisciplinary team, several process improvement activities were conducted, including the development of a standardized algorithm and treatment protocol, a physician order sheet, a nursing flow sheet, and a code sepsis response team.

Results: A total of 381 patients were enrolled: 79 in the pre-intervention phase and 302 in the postintervention phase. Mortality rates decreased from 27% pre-intervention to 19% postintervention (–8% absolute mortality; 95% confidence interval [C.I.], 7–9; $p = .2138$). There were significant differences between the pre- and postintervention groups for endotracheal intubation (17%, $p = .0012$), crystalloid infusion (1.4 L, $p < .0001$), vasopressor administration (33%, $p < .0001$), and packed red blood cells (34%, $p < .0001$). Both groups were generally similar in their demographics, comorbidities, and vital signs.

Discussion: As a result of this process improvement initiative, patients who might have received delayed and/or inadequate treatment for severe sepsis or septic shock are now receiving effective, life-saving treatment. Because of the emphasis on training, consistency in applying the protocol, relatively few changes in current ED practice, and low direct expenditures for equipment, the protocol can be easily integrated into existing ED environments to allow hospitals to quickly implement this successful, best-practice program.

protocol to implement EGDT in the ED

3. Create a process to evaluate the impact of the protocol on patient morbidity and mortality

After a review of the literature, the code sepsis task force agreed to adapt the Rivers et al.³ EGDT protocol and the 2004 Surviving Sepsis Campaign⁴ guidelines for the basis of our code sepsis initiative. This included developing an ED policy for severe sepsis and septic shock, a standard goal-directed resuscitation order sheet, a clinical algorithm,* and a nursing flow sheet to facilitate the patient's transfer from the ED to the ICU.

Rivers et al.³ reported a decrease in absolute in-hospital mortality of 16% and a decrease in relative in-hospital mortality of 30% through a resuscitation strategy aimed at hemodynamic optimization in the ED. In contrast to the original Rivers et al.³ protocol, our modified protocol was executed by the physicians and nurses who were providing clinical care to the patient (Rivers et al.³ provided additional physician staffing at the bedside). In addition, the protocol was initiated in the ED, and care was subsequently transitioned to the ICU where it was then discontinued at the discretion of the admitting attending physician (Rivers et al.³ continued care in the ED for six hours). Perhaps most important, the protocol was part of a larger, comprehensive diagnosis and treatment package that included educating staff to recognize the early signs of severe sepsis and septic shock (early recognition), identifying appropriate patients for intervention and then initiating the intervention quickly (early treatment), infusing appropriate antibiotic therapy (data- and protocol-driven intervention), and early source control (continuity of care).

Having met the original objectives for delivery of EGDT in the ED, the code sepsis task force has expanded the protocol to include hospital inpatients who develop severe sepsis or septic shock. The task force continues to serve as an oversight committee to facilitate changes to the protocol and to provide continuing education and ongoing monitoring for process improvement. It also serves as a resource to other CHS hospitals in the process of developing sepsis protocols.

PERFORMANCE IMPROVEMENT ACTIVITIES

The following key activities were performed during a nine-month period to establish our code sepsis program:

1. Examine the existing literature and use only evidence-based practices.
2. Develop an implementation plan including specific inclusion and exclusion criteria.

* Available from the author by e-mail request.

3. Design and develop a goal-directed resuscitation algorithm, ED order sheet, and nursing flow sheet for the treatment and documentation of severe sepsis/septic shock.

4. Procure a dedicated code sepsis resource cart to contain central line insertion supplies, hemodynamic monitoring equipment, and resource documents, including algorithm, orders, and flow sheet (these were the only direct costs incurred).

5. Form a code sepsis response team using a paging system.

6. Design, develop, and implement physician and staff training and evaluation materials.

7. Monitor and evaluate progress through continuous data analysis and chart review.

We began collecting demographic and clinical data on severe sepsis and septic shock patients on August 1, 2004, continuing until initiation of the EGDT protocol on November 15, 2005 (Figure 1, page 188). Since this time, all eligible patients consenting to treatment with the EGDT protocol have received the treatment and our data collection and analysis is ongoing.

Patients eligible for EGDT were identified by emergency physicians in the ED if they met the following inclusion criteria:

1. Age > 17 years
2. Suspected or confirmed infection
3. Two or more systemic inflammatory response syndrome criteria:
 - Heart rate > 90 beats/minute
 - Respiratory rate > 20 breaths/minute
 - Temperature > 100°F (38°C) or < 97°F (36°C)
 - White blood cell count (WBC) count > 12,000/ μ L or < 4,000/ μ L or > 10% bands
4. Systolic blood pressure (BP) < 90 mm Hg or mean arterial pressure < 65 mm Hg after a 20 mL/kg isotonic fluid bolus or anticipated need for ICU care and a serum lactate concentration \geq 4.0 micro mol/L

Exclusion criteria were as follows:

1. Age < 18 years
2. Need for immediate surgery (anticipated departure to the operating room in < six hours and thus could not receive six-hours of therapy in the ED and/or ICU)
3. Absolute contraindication for a chest central venous catheter

Patients with do-not-resuscitate orders at the time of eligibility were eligible for treatment with the protocol only after discussion with family and the admitting attending physician, and if both agreed on aggressive medical treatment.

Before the implementation of the EGDT protocol, the ED had no written protocol for treatment of severe sepsis and sep-

Pre- and Postintervention Time Line, August 1, 2004–June 26, 2008

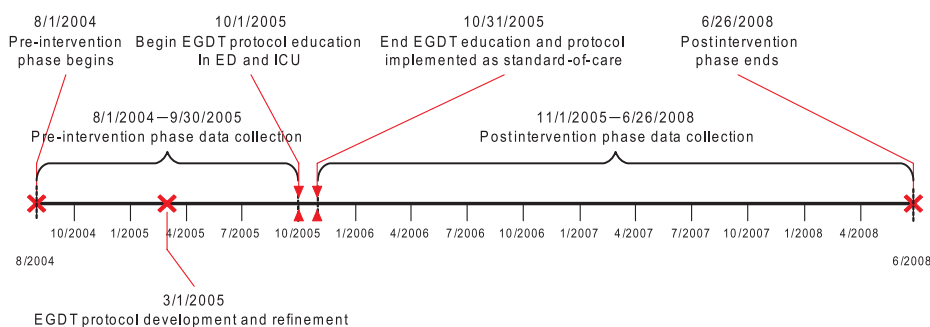


Figure 1. Since the end of the postintervention period, all consenting eligible patients have received the treatment. EGDT, early goal-directed therapy; ED, emergency department.

tic shock. The goal-directed resuscitation protocol required monitoring central venous pressure (CVP) and central venous oxygen saturation (ScvO₂), which were not routinely monitored in severe sepsis and septic shock patients in our ED before initiation of the EGDT protocol. Because the participation of the medical staff was critical to the implementation of this project, one month was allocated for the education and training of participating health care providers before the protocol's initiation. Educational resources included a physician-conducted seminar and computerized self-directed study materials for physicians. Nursing and support staff training included in-service training and a procedure checklist; a competency assessment checklist on ScvO₂ monitoring was also included for nurses.

Performance Measurement

Preliminary data were gathered from a review of patient medical records. Patients were selected on the basis of whether they met the specified inclusion and exclusion criteria. The records review provided insight into the current state of practice for patients presenting in the ED with suspected or confirmed sepsis. Standardization of the data elements recorded during the pre- and postintervention phases was achieved through the use of pocket cards given to the emergency medicine physicians that contained the patient inclusion and exclusion criteria, along with a Web-based, electronic data collection form. In the pre-intervention phase, only the leadership team was aware that the EGDT protocol was to be implemented, and neither the hospital nor any of the emergency medicine physicians, physician's aides, or nurses reported previously using the protocol described by Rivers et al.³

Additional data were collected through patient follow-up by a nurse clinical specialist [A.F.] from patient medical records and were compared with the data gathered by the electronic

data collection form to ensure accuracy. Data integrity was verified by the hospital epidemiologist [T.J.L.] through standard data cleaning and dispersion characteristics assessment procedures and by comparison with hospital administrative data.

The primary outcome was in-hospital mortality with a goal of a 30% relative mortality reduction, quantified by predefined mortality and morbidity indicators, of patients treated with the protocol compared with patients treated prior to protocol implementation. Secondary outcomes were measures of hospital resources used, including the mean number of ICU and hospital days and the mean number of ventilator days. Also recorded were whether any sepsis-specific therapies were administered, such as parenteral corticosteroids and activated protein C. The Sequential Organ Failure Assessment (SOFA) score as well as patient vital signs were recorded for all patients at the time of suspected or confirmed sepsis diagnosis.

Results

PATIENT GROUPS

We enrolled 381 patients: 79 in the pre-intervention (control) phase (August 1, 2004, to September 30, 2005), 77 in the Year 1 postintervention (treatment) phase (November 15, 2005, to November 14, 2006), 142 in the Year 2 postintervention (treatment) phase (November 15, 2006, to November 14, 2007), and 83 in the Year 3 postintervention (treatment) phase (November 15, 2007, to June 26, 2008 [partial year]). Patient demographic characteristics, comorbidities, and ED vital signs for the four groups are presented in Table 1 (page 189). In general, the groups were similar, with significant differences between the control group and the treatment groups for age, sex, end-stage renal disease and suspected source of infection. ED vital signs showed significant differences between systolic blood pressure, respiratory rate, temperature, oxygen satura-

Table 1. Comparison Between Patient Demographics, Clinical Characteristics and Physiologic Measurements for Control and Year 1, Year 2, and Year 3 Treatment Groups*

Variable	Control Group n = 79	Year 1 Treatment Group n = 77	Year 2 Treatment Group n = 142	Year 3 Treatment Group n = 83
Age	58 ±18	58 ±16	45 ±26 .01	45 ±29 .05
Race: White	40 (51)	46 (60)	70 (49)	42 (51)†
Nonwhite	39 (49)	31 (40)	72 (51)	37 (45)
Sex: Male	47 (59)	48 (62)	60 (42) .001	37 (45) .001
Female	32 (41)	29 (38) .001	82 (58) .001	46 (55) .001
Comorbidities				
Diabetes mellitus	23 (29)	22 (29)	32 (22)	31 (37)
COPD	12 (15)	17 (22)	24 (17)	14 (17)
HIV	8 (10)	5 (6)	20 (14)	4 (5)
End-stage renal disease	25 (32)	7 (9) .01	23 (16) .01	13 (16) .05
Cancer	9 (11)	14 (18)	16 (11)	6 (7)
Organ transplant	3 (4)	1 (1)	4 (3)	3 (4)
Indwelling vascular line	7 (9)	11 (14)	19 (13)	9 (11)
Nursing home resident	18 (23)	20 (26)	21 (15)	15 (18)
Do-not-resuscitate order	5 (6)	3 (4)	2 (1)	4 (5)
ED Vital Signs and Measures				
Lowest systolic BP, mm Hg	86 ±22	72 ±12 .001	72 ±18 .001	76 ±17 .01
Highest pulse rate, beats/min	118 ±27	122 ±26	119 ±24	121 ±23
Highest respiratory rate, breaths/min	26 ±9	30 ±10 .05	30 ±12 .01	28 ±9
Highest temperature, °F	101 ±3	101 ±3	102 ±26 .05	100 ±7 .05
Lowest oxygen saturation, %	93 ±0.1	92 ±8 .001	92 ±7 .001	92 ±7 .001
Lowest CVP, mm Hg‡		7 ±4	9 ±15	7 ±5
Highest CVP, mm Hg‡		13 ±6	13 ±6	16 ±7
Lowest ScvO ₂ , %‡		69 ±13	67 ±14	67 ±14
Highest ScvO ₂ , %‡		81 ±8	80 ±11	81 ±9
SOFA score	5 ±3	7 ±3 .01	7 ±4 .01	6 ±3
Lactate level, micro mol/L [§]	5 ±3	3 ±3	4 ±3 .01	6 ±4
Suspected source of infection				
Pulmonary	25 (32)	33 (43)	59 (41)	27 (32)
Urinary tract	21 (27)	24 (31)	37 (26)	18 (22)
Intra-abdominal	13 (16)	11 (14)	32 (22)	8 (10)
Skin/soft tissue	15 (19)	11 (14)	14 (10)	5 (6) .05
Blood (bacteremia)	2 (2)	8 (10)	13 (9) .05	3 (4)
Other	18 (23)	2 (3) .01	11 (8) .01	19 (23)
Absolute mortality	21 (27)	14 (18)	27 (19)	18 (22)

* Data are presented as mean ± standard deviation or no. (%) and *p* significance levels for differences from control group. COPD, chronic obstructive pulmonary disease; HIV, human immunodeficiency virus; ED, emergency department; BP, blood pressure; CVP, central venous pressure; ScvO₂, central venous oxygen saturation; SOFA, sequential organ failure assessment.

† Missing data.

‡ Not measured before protocol initiation.

§ Lactate concentration was available only in 34 of 79 patients in the pre-intervention group, 64 of 77 patients in the Year 1 (treatment) group, 122 of 142 patients in the Year 2 (treatment) group, and all patients in the Year 3 (treatment) group.

|| Some patients had more than one suspected source and thus the totals sum to more than 100%.

tion, SOFA score, and lactate concentration, indicating that, in general, patients in the treatment groups were experiencing a higher level of organ dysfunction.

ABSOLUTE MORTALITY

Absolute mortality decreased from 27% in the pre-intervention (control) group to 18% in the Year 1 postintervention

(treatment) group, 19% in the Year 2 postintervention (treatment) group, and 22% in the Year 3 postintervention (treatment) group. The increase in the absolute mortality rate during the three-year postintervention period was due, in part, to an increase in the number and acuity of septic patients transferred from other area hospitals that had become aware of CMC's code sepsis program.

Table 2. Comparison Between Pre- and Postintervention Groups for Target Early Goal-Directed Therapy (EGDT) Measures*

Variable	Pre-Intervention Group n = 79	Postintervention Group n = 302	Difference	p Value
Endotracheal intubation	7 (9)	77 (26)	17%	.0012
Crystalloid volume, L	3.3 ±3	4.7 ±2	1.4 L	< .0001
Vasopressor administration	27 (34)	204 (67)	33%	< .0001
Dobutamine administration	1 (1)	17 (6)	5%	.1382
Packed RBC transfusion [†]	2 (2)	109 (36)	34%	< .0001
Time to initial antibiotic, minutes	204 ±296	132 ±122	-72 min	.8212
Steroid administration [‡]	5 (6)	122 (40)	34%	<.0001
Activated protein C administration [§]	3 (4)	6 (2)	-2%	.4006
ICU length of stay, days	2 ±3	4 ±5	2 days	< .0001
Mechanical ventilation, days	1 ±2	2 ±4	1 day	.0018
Total hospital days, days	8 ±6	10 ±9	2 days	.0499
ARDS mortality	3 (50)	1 (20)	-30%	.0127
ARF mortality	8 (32)	20 (29)	-3%	.1058
Total mortality	21 (27)	59 (19)	-8%	.2138

* Statistical analysis included Mann-Whitney U, Chi-Square, or Fisher exact tests, as appropriate. The data are presented as mean ± standard deviation or no (%), as appropriate. RBC, red blood cells; ARDS, acute respiratory distress syndrome; ARF, acute renal failure.

[†] Administered during the initial 6 hours of treatment.

[‡] Administered during the initial 24 hours of treatment.

[§] Sepsis-specific variables that were followed but were not part of the EGDT intervention protocol. Activated protein C was never administered in the emergency department or during the initial 6 hours of therapy. Steroid administration was at the discretion of the attending physician in the ED or ICU but was not part of the EGDT protocol.

PRE- VERSUS POSTINTERVENTION GROUPS

Table 2 (above) compares the pre-intervention group (control) to the postintervention group (treatment; years 1, 2, and 3 groups combined) receiving the EGDT protocol. Because of the sampling frame chosen (time periods in contrast to a numerically determined and randomly selected sample), continuous data are presented as mean and ± standard deviation (S.D.) and were compared for statistical differences using Mann-Whitney U tests. Categorical data were compared for statistical differences using chi-square or Fisher exact tests, as appropriate. For all statistical tests, $p < .05$ was considered significant.

Significant differences were found between the pre-intervention and postintervention groups for endotracheal intubation (17%, $p = .0012$), crystalloid infusion (1.4 L, $p < .0001$), vasopressor administration (33%, $p < .0001$), and packed red blood cells (34%, $p < .0001$). Mortality rate decreased from 27% pre-intervention to 19% postintervention, representing a mean decrease in absolute mortality of 8% (95% C.I., 7–9; $p = .2138$) during the three-year postintervention period and a decrease in in-hospital relative mortality of 30%.

An analysis of secondary outcomes showed an increase of two days in ICU use ($p < .0001$), one day in ventilator utilization ($p = .0018$), and two days in total hospital days ($p = .0499$; see

Table 2). Additional treatments given to patients that were not part of the original EGDT protocol showed that there was a 34% increase in steroid administration ($p < .0001$) and a 2% decrease in activated protein C administration ($p = .4006$). In addition, our mortality rate for septic patients with acute respiratory distress syndrome (ARDS) decreased by 30% ($p = .0127$), and acute renal failure (ARF) decreased by 3% ($p = .1058$).

Patients not treated with the EGDT protocol (control group) had a higher relative risk (RR) of mortality of 1.36 (95% CI, .88–2.10, $p = .1624$). Overall, 243 of 302 patients survived after implementation of the EGDT protocol, as opposed to 58 of 79 patients in the pre-intervention cohort (-8% absolute mortality). This translates to a number needed to treat (1/absolute mortality reduction) of 12 patients.

Discussion

For our hospital, the code sepsis protocol is a new technique for identifying and treating severe sepsis and septic shock. Our modification of the original Rivers et al.³ protocol has allowed us to develop a larger, more comprehensive approach to identification and treatment of patients presenting in the ED with suspected or confirmed sepsis and has resulted in a decrease in our in-hospital rates of absolute and relative mortality. This places our hospital 11% lower than the reported United States

mortality rate for septic patients.^{1,2} We exceeded our goal of 30% relative mortality reduction in the first year of the intervention (9% absolute mortality reduction; 33% relative mortality reduction). In subsequent years we have experienced an increase in our mortality rate for severe sepsis and septic shock, reflecting the fact that we have received a greater number of highly acute patients transferred from other area hospitals.

Before implementing the EDGT protocol, the ED did not follow a written management protocol for septic patients. After implementation of the code sepsis protocol, patients who might have received delayed and/or inadequate treatment are now getting cutting-edge, life-saving treatment. The code sepsis protocol's beneficial impact on septic patients with ARDS and ARF further adds to the improvement in quality of care. As a quality improvement (QI) project, the code sepsis project has exceeded all of our expectations and has presented us with an opportunity to significantly affect patient care within our hospital system as well as within other systems adopting the protocol. Because of the emphasis on training, consistency in applying the protocol, and relatively few changes in current ED practice, the protocol should be easily integrated into existing ED environments.

The reproducibility and sustainability of our improved performance is due to our standardized, comprehensive, evidence-driven treatment and monitoring protocol, coupled with continuous monitoring through data collection, analysis, and evaluation. To ensure continued compliance with the protocol, ED nurse competency is assessed annually through an evaluation process, all new hires are given a thorough orientation and evaluation, and all medical charts of those patients with a diagnosis of sepsis are audited to ensure consistent application of the protocol.

The project was designed to complement several other ongoing QI projects coordinated by other departments—for example, the development of order sets and clinical pathways for adult and pediatric patients (such as glucose monitoring, asthma, fever \leq 28 days) and the implementation and monitoring of treatment bundles for community-acquired pneumonia, ventilator-acquired pneumonia, and central venous line infections. These QI projects have substantially reduced patient mortality and morbidity and have proven to the staff not only that the changes in protocols and knowledge base have been effective but that each staff member, from the new graduate registered nurse to the seasoned administrator, is vitally important for the projects' success. This has allowed the staff to take ownership of the process improvement models and has resulted in little resistance to initiation of the code sepsis protocol, espe-

cially in the ED, where the lack of a formal policy for the treatment of severe sepsis and septic shock led to variations in care.

One difficulty that the project faced was in achieving 100% compliance with the measurement of variables recommended by national guidelines. This was especially true for recording serum lactate levels. Our solution to this problem was to have the respiratory therapist draw and record the lactate level. This had the added effect of encouraging improved compliance with the recording of other data through fostering a better "team effort" attitude.

The measurement of clinical outcomes is ongoing. Our infectious diseases staff have been reviewing the lab results of those patients receiving the code sepsis protocol to identify specific criteria for selection of an antibiotic. We are currently analyzing these laboratory data and will make appropriate changes to our protocol. In addition, we continue to collect data on vasopressor and inotropic medications, crystalloid and blood transfusions, activated protein C, and steroids for patients with adrenal suppression. Our preliminary data suggest that antibiotic therapy can and should be modified from a broad-spectrum agent to a narrow-spectrum agent following identification of a specific microorganism. This ongoing research will allow us to maintain the initial and continuing reduction in mortality for those patients presenting in our ED with suspected or confirmed sepsis and will assist in improving overall outcomes as the project is introduced to other system hospitals. **J**

Anne Focht, R.N., M.S.N., is Clinical Nurse Specialist, Pulmonary and Critical Care Medicine, Carolinas Medical Center, Charlotte, North Carolina; **Alan E. Jones, M.D.**, is Assistant Director of Research, Department of Emergency Medicine; and **Timothy J. Lowe, Ph.D.**, is Senior Scientist (Epidemiology), R. Stuart Dickinson Institute for Health Studies. Please address correspondence to Anne Focht, afocht@carolinashealthcare.org.

References

1. Angus D.C., et al.: Epidemiology of severe sepsis in the United States: Analysis of incidence, outcome, and associated costs of care. *Crit Care Med* 29:1303–1310, Jul. 2001.
2. Kochanek K.D., Smith B.L.: Deaths: Preliminary data for 2002. *Nat Vital Stat Rep* 52(13), National Center for Health Statistics, 2004.
3. Rivers E., et al.: Early Goal-Directed Therapy Collaborative Group: Early goal-directed therapy in the treatment of severe sepsis and septic shock. *N Engl J Med* 345:1368–1677, Nov. 8, 2001.
4. Dellinger R.P., et al.: Surviving Sepsis Campaign Management Guidelines Committee: Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock. *Crit Care Med* 32:858–873, Mar. 2004. Erratum in: *Crit Care Med* 32:1448, Jun. 2004. Correction of dosage error in text. *Crit Care Med* 32:2169–2170, Oct. 2004.