


Adherence to Early Resuscitation Bundle for Severe Sepsis;

a multi-hospital system review

Rosemarie P. Linton, MPH
Kevin D. Masick, PhD
Carol Cross, MBA
Marcella De Geronimo, MS
Anne M. Fried, RN, DNP
Yosef D. Dlugacz, PhD



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Presenter Disclosures

Rosemarie P. Linton, MPH

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose

Objectives

- Discuss implementation of Sepsis Initiative at North Shore-LIJ Health System
 - Intervention: Institution of IHI Modified Severe Sepsis 3-Hour Resuscitation Bundle
- Describe the development of a standardized database for evaluation of process and outcomes data
- Share results of a 2 year observational review of compliance rates and its effects on mortality and length of stay

Introduction

Sepsis and the Elderly

- Patients aged 65 years and older represent 2/3 of all sepsis or septicemia discharges in the United States (1).
- According to the National Center for Health Statistics, annual hospitalizations with septicemia or sepsis surpassed 1,000,000 in 2008 (1).
- Aging population – in 2000 persons 65 years and older represented 12.4% of population but by 2030 elderly population is expected to grow to 19% of total population (2).

(1) National Center for Health Statistics (http://www.aoa.gov/Aging_Statistics/).

(2) Administration of Aging (www.cdc.gov/nchs/data/databriefs/db62.htm).

Introduction

Sepsis and the Elderly

- According to a study published in Critical Care Medicine (2001), **severe sepsis incidence rates were projected to increase by 1.5% per annum.**(3)
- Analysis on the Nationwide Inpatient Sample (NIS) between 1993 and 2003 however, revealed that the hospitalization rate of severe sepsis outpaced the prediction (4)
- Prior to 2004, in-hospital mortality rates of severe sepsis ranged between 30% - 50% (3,5)
- Public Health concern

(3) Angus DC, Linde-Zwirble WT, Lidicker J et al. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001; Jul; 29(7): 1303-10.

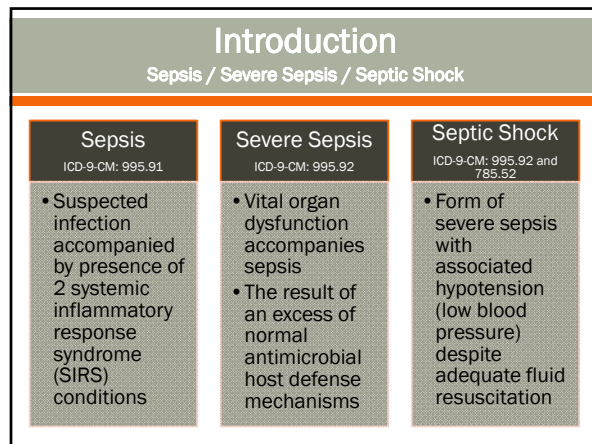
(4) Dombrovsky VY, Martin AA, Sunderram J, et al; Rapid increase in hospitalization and mortality rates for severe sepsis in the United States: A trend analysis from 1993 to 2003. Crit Care Med 2007; 35:1244-1250.

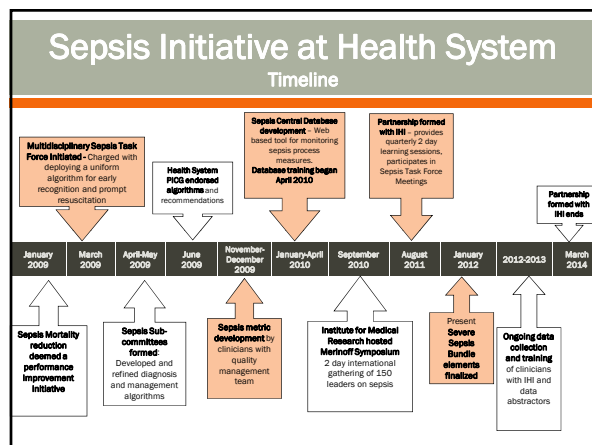
(5) Rivers E, Nguyen B, Haystack S, et al; Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Eng J Med 2001;345:1368-1377.

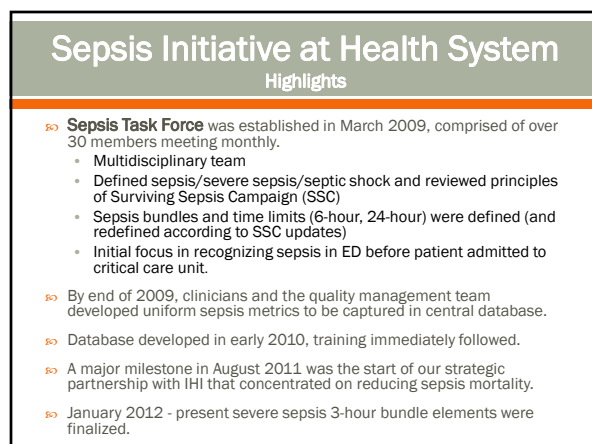
Introduction

Sepsis Initiative at Health System

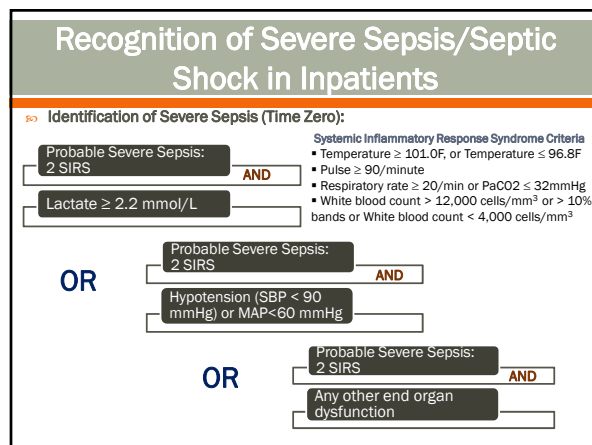
- **Surviving Sepsis Campaign (SSC) and Institute for Healthcare Improvement (IHI)**
- **CEO of North Shore-LIJ Health System, Michael Dowling**, prioritized sepsis mortality reduction as a performance improvement initiative
- **North Shore-LIJ Health System**
 - Health System serving 7 million people in Long Island, Queens, Manhattan, and Staten Island
 - **11 hospitals: 5 tertiary / 6 community**
 - Over 4,200 beds
 - Over 250,000 inpatient discharges per year
 - Over 500,000 ED visits per year

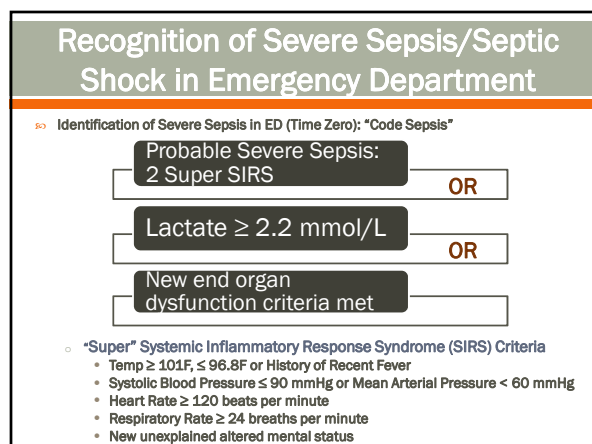


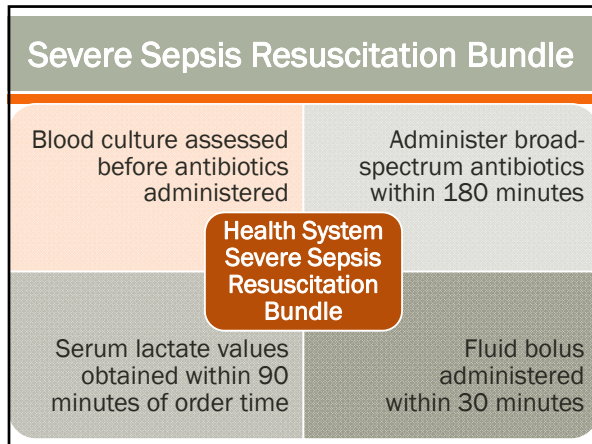


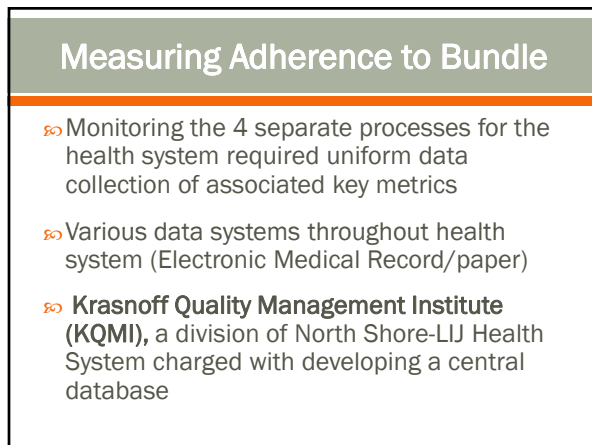


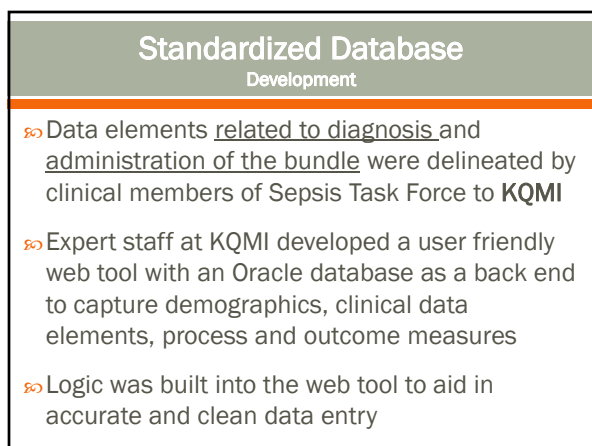












Severe Sepsis Bundle Adherence Study

- ↻ Retrospective 2-year observational cohort of patients 65 years or older discharged (2012-2013) with severe sepsis or septic shock
- ↻ **Elderly population - 70% of all severe sepsis cases**
- ↻ Exclusions:
 - ✧ Transfer patients
 - ✧ Cases with documented goals of care at the time of Sepsis identification that precluded compliance with the treatment bundle
- ↻ **N=8,059.** 7,753 (96.2%) admitted via the ED
- ↻ All-or-none bundle compliance computed as binary variable for each patient with severe sepsis.

Bundle Adherence

Results

| Component of Severe Sepsis Bundle | 2012-2013 | Difference 2013 vs. 2012 | | |
|-----------------------------------|--------------|--------------------------|-------|---------|
| | | 2012 | 2013 | P Value |
| Blood culture component adherence | 90.1% | 88.3% | 91.3% | <0.001 |
| Antibiotic component adherence | 85.1% | 81.8% | 87.4% | <0.001 |
| Lactate component adherence | 84.5% | 83.2% | 85.3% | 0.016 |
| Fluid bolus component adherence | 58.4% | 53.8% | 61.1% | <0.001 |

All-or-None Bundle Adherence

Results

All-or-none compliance with severe sepsis bundle

11 Health System hospitals (N=5,405)

41.9%

35.2% in 2012 and 45.7% in 2013 ($p<0.001$)

5 Tertiary hospitals (N=3,567)

40.3%

32.6% in 2012 and 44.5% in 2013 ($p<0.001$)

6 Community hospitals (N=1,838)

44.9%

39.9% in 2012 and 48.0% in 2013 ($p=0.001$)

Significant difference in Community and Tertiary rates, Chi-Square Difference $p<0.01$

Mortality and Bundle Adherence

Results

Primary Objective: To examine if an association existed between adherence to system's severe sepsis bundle and mortality

- Mortality rate for non-adherent set – **25.6%**
- Mortality rate for adherent set – **22.2%**
- **Mortality rate reduction - 3.4% (95% CI=1.1%,5.7%)**
- Difference in proportions tested with Z-test for independent proportions ($p=0.00385$)

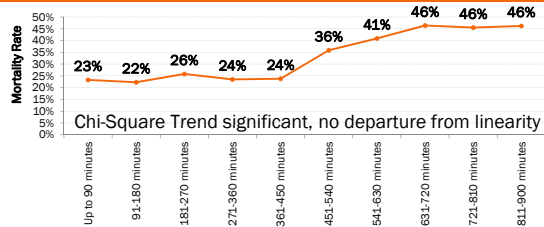
Mortality and Bundle Components

Results

Results of five separate logistic regression models of hospital mortality each adjusted for age, weight (kg), and admission unit (Inpatient, Intermediate, Critical, or Other).

| Variable | Value | Adjusted Odds Ratio (95% confidence interval) | P Value |
|---|--------------------------|--|---------|
| Blood cultures before antibiotics | Non-Adherent Adherent | 0.97 (0.79, 1.21) Referent | 0.811 |
| Broad spectrum antibiotics within 180 minutes | Non-Adherent Adherent | 1.29 (1.10, 1.52) Referent | 0.002 |
| Lactate result within 90 minutes | Non-Adherent Adherent | 1.18 (1.01, 1.38) Referent | 0.038 |
| Fluid bolus within 30 minutes | Non-Adherent Adherent | 1.02 (0.90, 1.17) Referent | 0.717 |
| Complete Severe Sepsis Resuscitation Bundle | Non-Adherent Adherent | 1.22 (1.06, 1.40) Referent | 0.007 |

Mortality and Time to Antibiotic Administration



(Excluding patients on current episode of antibiotics at Time 0)
 Pearson Chi-Square = 25.402, 9 df, $p=0.003$
 Chi-Square Trend = 11.905, 1 df, $p=0.001$
 Chi-Square Linearity = 13.497, 8 df, $p=0.096$

Length of Stay and Bundle Adherence

Results

Secondary Objective: To examine if morbidity was improved via adherence to severe sepsis bundle, evidenced by significant reduction in length of stay

- ALOS for non-adherent set – **10.3**
- ALOS for adherent set – **9.1**
- **ALOS reduction - 1.2 days (95% CI=0.6, 1.9)**
- Difference in ALOS tested with independent samples Student's t-test ($p < 0.001$)

Exploratory Analysis: Mortality and Blood Cultures for Patients on Antibiotics at Sepsis Diagnosis

Patients on current episode of antibiotics at Time Zero

| Blood Culture Component of Bundle | Expired | Survived | Total |
|-----------------------------------|-------------|-------------|-------|
| Not received | 49 (41.2%) | 70 (58.8%) | 119 |
| Received | 114 (26.0%) | 324 (74.0%) | 438 |
| Total | 163 (29.3%) | 394 (70.7%) | 557 |

- Odds ratio=1.99 (1.30, 3.04), $p=0.001$
- Adjusted odds ratio=1.92 (1.22, 3.02), $p=0.005$

Based on these findings, **all patients even those with a pre-hospital administration of antibiotics should have a culture taken prior to administering antibiotics**

Limitations

As an observational study only association between bundle completion and mortality can be assessed. **Causal relationship cannot be inferred.**

Missing date/time values

Would be best not to include patients that had clinical reasons for exclusions from analysis, and note reasons for exclusions

Conclusion

- ✎ Analysis not a pre-post intervention study but observational review of all-or-none adherence, 2012-2013
 - Intervention of clinical education of bundle ongoing process throughout cohort period
- ✎ Severe sepsis/septic shock mortality at the Health system was over 30% in 2010. In 2013, the overall in-hospital mortality rate was 22.6%
- ✎ Complete adherence associated with lower mortality and LOS
- ✎ For patients on pre-hospital administration of antibiotics, hypothesis is that they are on inappropriate antibiotic entering hospital
- ✎ While examination is underway, recommended to obtain blood cultures on **all** patients meeting severe sepsis criteria

Questions ?

Contact: Rosemarie P. Linton, MPH
 Research Statistics Analyst
RLinton2@nshs.edu
 Krasnoff Quality Management Institute,
 a division of North Shore-LIJ Health System

Thank you!