



The Effect of SEP-1 Core Measure Compliance on Mortality and Hospital Length of Stay: A Retrospective Review

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Background

In October 2015, the Centers for Medicare and Medicaid Services required U.S. hospitals to report compliance with the SEP-1 core measure, intended to standardize treatment of severe sepsis and septic shock in accordance with evidence-based guidelines, shown in Table 1. The aim of this study is to measure the effect of compliance with the SEP-1 core measure on mortality and hospital length of stay (LOS) for adult UCDMC patients with severe sepsis and septic shock as defined by the core measure inclusion criteria.

Table 1. Summary of Core Measure Bundle Requirements

Bundle Requirements for Severe Sepsis	Bundle Requirements for Septic Shock (defined as Severe Sepsis + lactic acid >4 and/or persistent hypotension)
Within 3 hours:	Within 3 hours:
Initial lactic acid screening	Initial lactic acid screening
Blood culture collection	Blood culture collection
Broad-spectrum antibiotics	Broad-spectrum antibiotics
30 mL/kg of crystalloid fluid (only if initial hypotension present)	30 mL/kg of crystalloid fluid
Within 6 hours:	Within 6 hours:
Repeat lactic acid	Repeat lactic acid
	Vasopressors (only if persistent hypotension present)

Methods

- Identified 2,007 hospital encounters for severe sepsis and septic shock qualifying for the SEP-1 core measure between October 2015 and November 2016.
- Compliance calculated with the SEP-1 bundle overall as well as with the individual bundle components using an algorithm developed for this purpose.
- As seen in Table 2, encounter-level data collected included in-hospital mortality, LOS, admission severity of illness (SOI), and diagnoses of heart failure and end-stage renal disease (ESRD).
- Logistic and linear regression analyses were performed to predict the effect of SEP-1 compliance, admission SOI, heart failure and ESRD on mortality and LOS.

Table 2. Baseline Demographic Data for Patient Groups

Measure	Severe Sepsis (n=1560)	Septic Shock (n=447)
Average Age (years)	59.4	60.1
Average Admission SOI	3.22	3.57
Overall Mortality Rate	11.0%	32.8%
Median LOS (days)	6	7
Diagnosis of Heart Failure	27.5%	23.7%
Diagnosis of ESRD	10.1%	8.7%
Sepsis Onset in E.D.	64.0%	79.0%

Results

Mortality

- Logistic regression analysis found that admission SOI significantly predicted mortality for patients with severe sepsis and septic shock ($p < .001$).
- Heart failure and ESRD were not found to significantly predict mortality and were not included in the logistic regression model.
- As seen in Table 3, overall SEP-1 compliance was significantly associated with decreased mortality for patients with severe sepsis ($b = -.443, p = .014$). Compliance with the bundle decreased the odds of mortality by 64.8% for these patients.
- Overall compliance was not significantly associated with mortality for patients with septic shock.
- As seen in Table 3, compliance with initial lactic acid measurement ($b = -.854, p < .000$) and repeat lactic acid measurement ($b = -.526, p = .033$) were significantly associated with decreased mortality for severe sepsis patients.
- Compliance with initial and repeat lactic acid screening decreased the odds of mortality by 42.6% and 59.1%, respectively.
- Broad-spectrum antibiotics, 30 mL/kg fluid for initial hypotension, and blood cultures were not significantly associated with mortality for severe sepsis patients.

Table 3. Summary of Logistic Regression Analysis for Variables Predicting Mortality in Patients with Severe Sepsis and Septic Shock

Predictor	Severe Sepsis			Septic Shock		
	b	SE b	expb	b	SE b	expb
Admit Severity of Illness	1.195**	.158	3.305	.862**	.224	2.367
Overall Compliance	-.433*	.177	.648	-.009	.248	.991
Initial Lactic Acid	-.854**	.220	.426			
Blood Culture Collection	.173	.352	1.189			
Antibiotic Administration	-.553	.364	.575			
30 mL/kg fluids	.048	.179	1.050			
Repeat Lactic Acid	-.526*	.247	.591			
Vasopressors	-	-	-			

* Significance level < 0.05 ** Significance level < 0.001

Hospital Length of Stay

- A linear regression analysis was performed to predict hospital LOS based on SEP-1 compliance and admission SOI. LOS data was log transformed.
- For patients with severe sepsis, overall compliance was associated with an 8.4% decrease in median LOS, which translates to 0.5 days. This decrease was statistically significant, $p < .000$.
- Compliance was not associated with a significant decrease in LOS for patients with septic shock.

Limitations

- Survival curve was not utilized when calculating the decrease in LOS related to bundle compliance, so any decreases in LOS due to in-hospital death are not accounted for.
- Findings may not be generalizable to patients with a clinical presentation of severe sepsis and septic shock who do not meet the inclusion criteria for the SEP-1 core measure.
- Although the algorithm used to calculate compliance has been extensively validated and is updated frequently, but it is not as accurate as manual abstraction.

Conclusions

- After adjusting for admission severity of illness, compliance with the SEP-1 bundle overall and specifically with initial and repeat lactic acid screening is significantly associated with decreased mortality for patients with severe sepsis, but not septic shock.
- Overall compliance with the SEP-1 bundle is associated with a 0.5 day decrease in median hospital LOS for patients with severe sepsis.
- Given the association between lactic acid screening and decreased mortality for severe sepsis patients, it is possible that early recognition of severe sepsis may be more important than specific treatment recommendations for improving the odds of survival.

Future Directions

- It is possible that compliance with lactic acid screening is associated with increased compliance with other bundle components. This relationship should be explored further.
- Since compliance with SEP-1 targets for antibiotic and fluid administration were not found to be independently associated with mortality, it may be useful to analyze these as continuous rather than categorical variables (compliant/noncompliant).
- We currently utilize EMR tools to expedite lactic acid screening when SIRS and suspected infection are found. Future EMR enhancements should focus on methods of early detection of severe sepsis.

References

- Specifications Manual for National Hospital Inpatient Quality Measures v. 5.2a. Accessed from https://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures.aspx

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