Sepsis in 2018:
"ED, ICU, Surgical Perspectives"

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Disclosures

- Protocol writing committee and study planning committee member for VICTAS, Vitamin C, Thiamine, and Steroids in severe sepsis with cardiac or pulmonary dysfunction
- No other relevant sepsis-related disclosures


Emergency & Trauma Center


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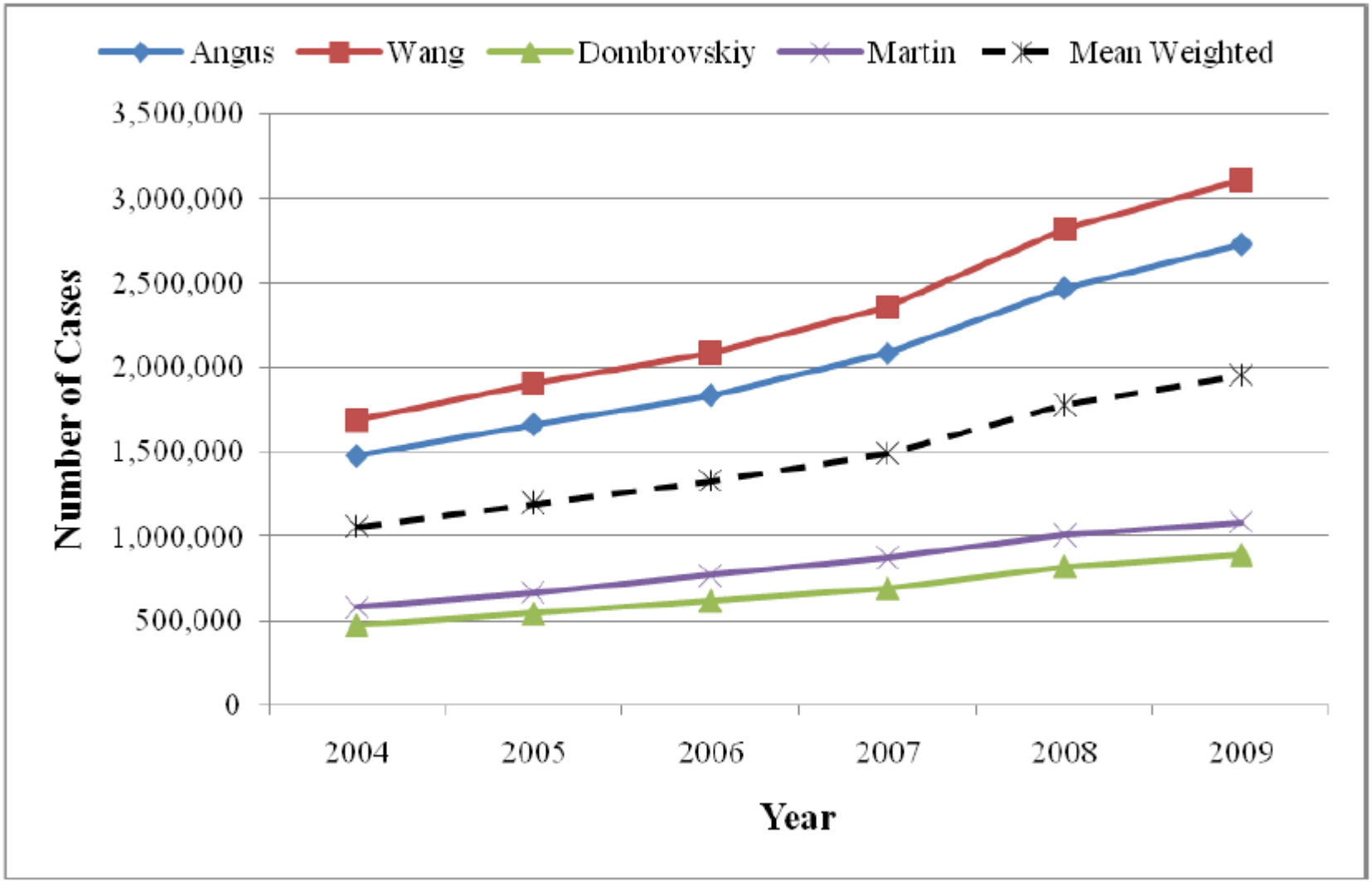
Critical Care

- Critical care is a concept

  not a location
- It is a way of treating patients that begins in the pre-hospital setting with EMS care, continues in the ED, and is completed in the ICU

Safar P. Critical care medicine---quo vadis? CCM. 1974;2:1-5

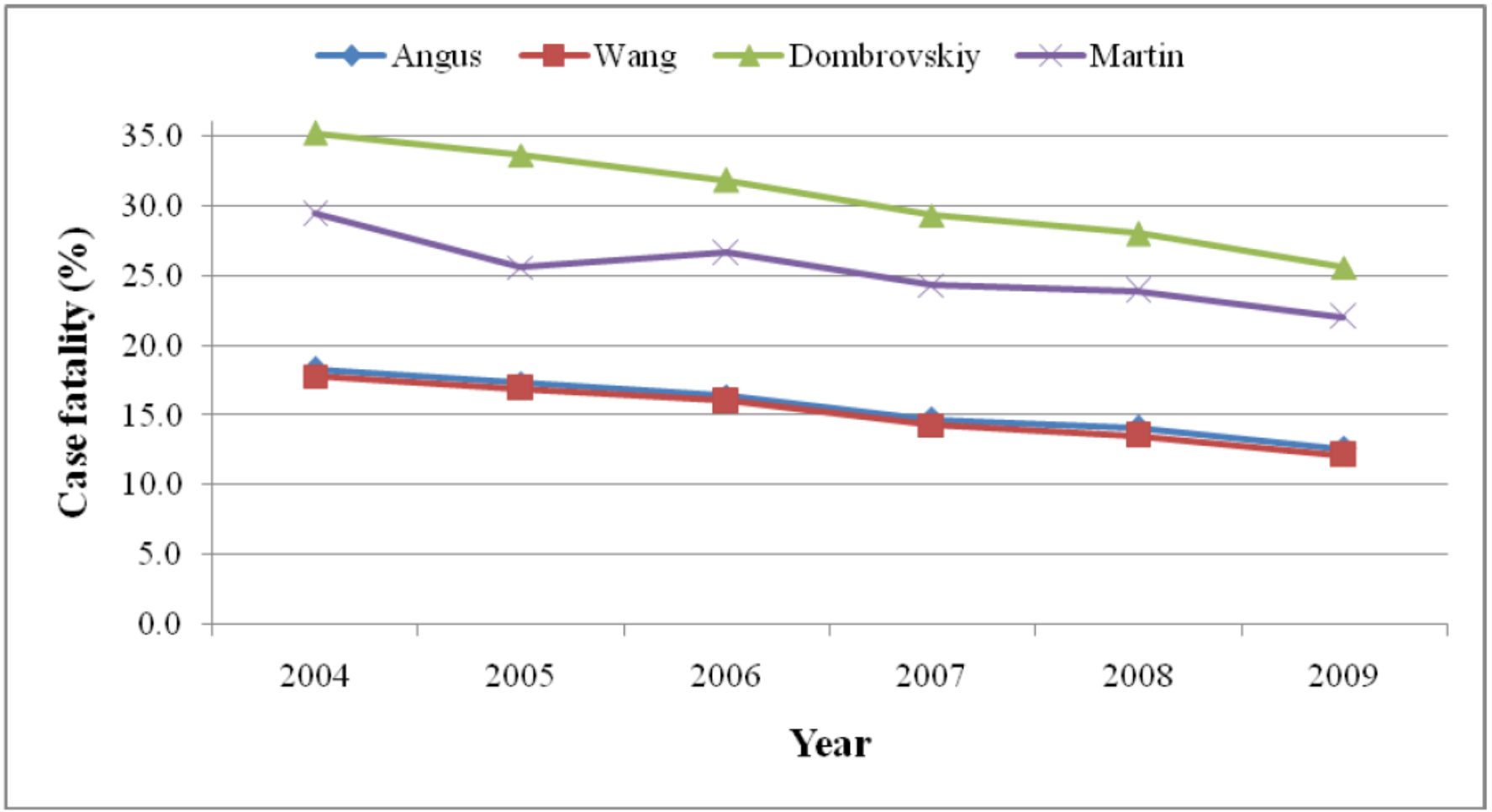
Figure 2a: Incidence of Severe Sepsis by Method Over 6-year Period[1]



[1] 95% CI < 1% of total for all data points and cannot be represented graphically.

Gaieski et al. CCM, 2013

Figure 2b: In-hospital Case Fatality of Severe Sepsis by Method[1]



[1] 95% CI < 1%.

The Continuum of Sepsis

SIRS → Sepsis → Severe Sepsis → Septic Shock

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Systemic Inflammatory Response Syndrome

SIRS criteria

- Temp < 96.8˚ or > 100.4˚ F
- HR > 90
- RR > 20 or PCO_2 < 32
- WBC < 4 or > 12 or bands > 10%

Bone et al. Chest 1992

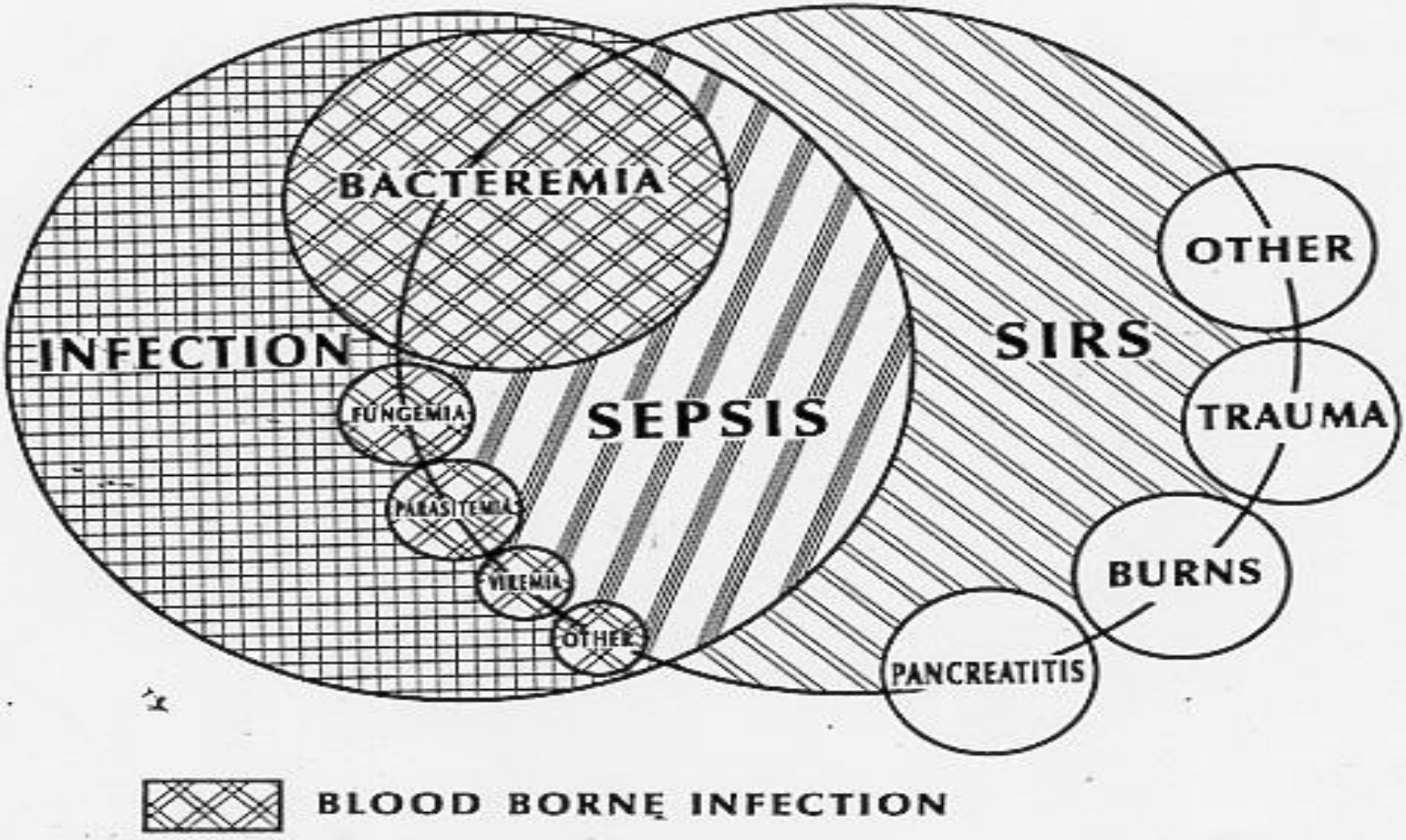


FIGURE 1. The interrelationship between systemic inflammatory response syndrome (SIRS), sepsis, and infection.

Bone et al. Chest 1992

The Continuum of Sepsis

SIRS Sepsis Severe Sepsis Septic Shock

Sepsis plus Organ Dysfunction

- Elevated Creatinine
- Elevated INR
- Altered Mental Status
- Elevated Lactate
- Hypotension that responds to fluid

Levy et al. Crit Care Med; 2003

The Continuum of Sepsis

SIRS Sepsis Severe Sepsis Septic Shock

Cryptic Shock

- Normotensive
- Lactate ≥ 4

Severe Sepsis and Hypotension

- Hypotension that does NOT respond to fluid (30 cc/kg bolus)

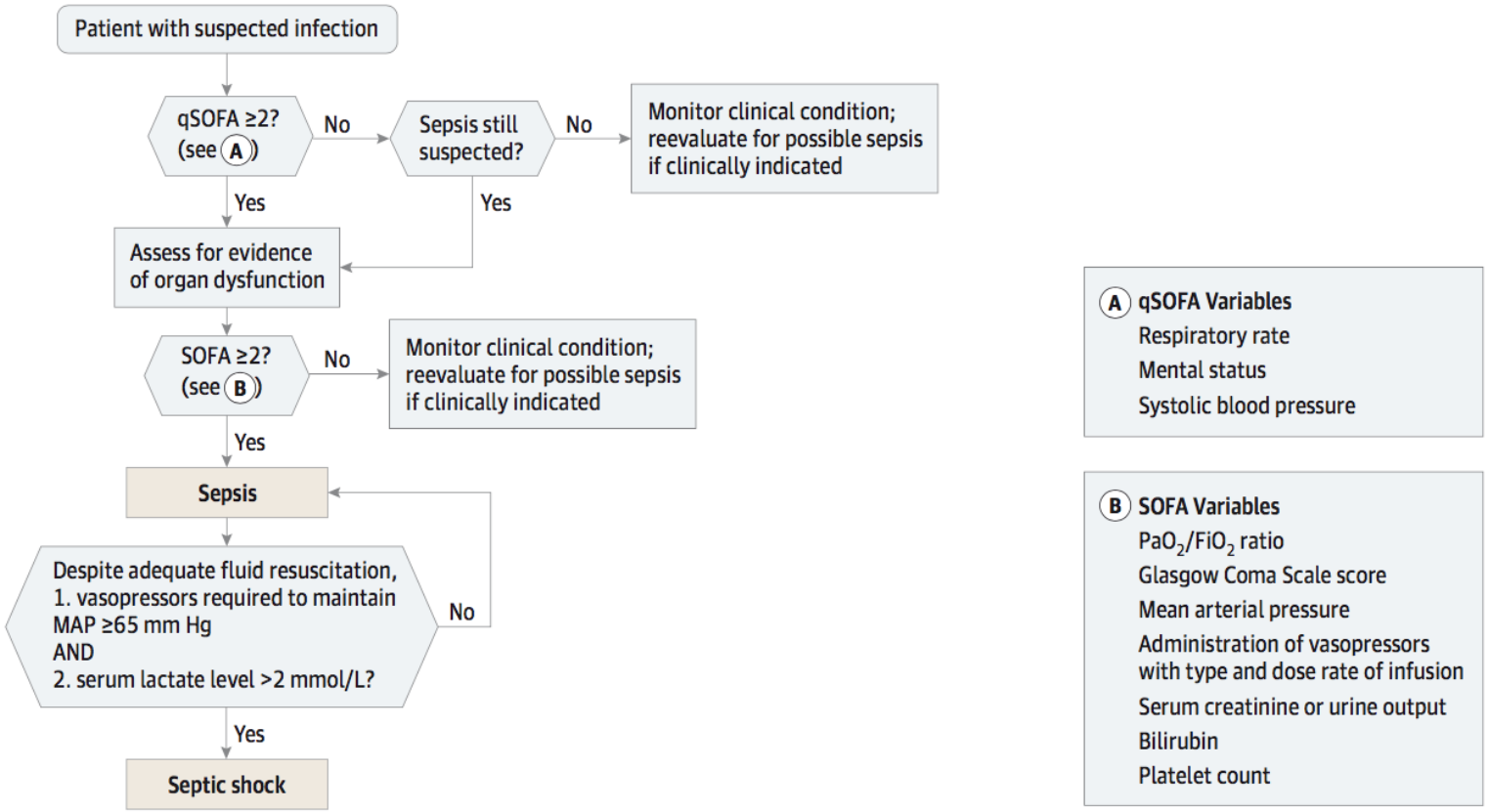
Bone et al. Chest, 1992

Rivers et al. NEJM, 2001

New Sepsis Definition, 2016

- **Sepsis** is now defined as “life-threatening organ dysfunction caused by a dysregulated host response to infection”
- No more SIRS!
- Organ dysfunction: acute change in total SOFA score ≥2 points due to the infection
- A SOFA score ≥2 reflects an overall mortality risk of approximately 10%

Figure. Operationalization of Clinical Criteria Identifying Patients With Sepsis and Septic Shock



The baseline Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score should be assumed to be zero unless the patient is known to have preexisting (acute or chronic) organ dysfunction before the onset of infection. qSOFA indicates quick SOFA; MAP, mean arterial pressure.

Singer et al. JAMA, 2016

Sensitivity vs. Specificity

Most common keywords related to septic patients' symptom presentation

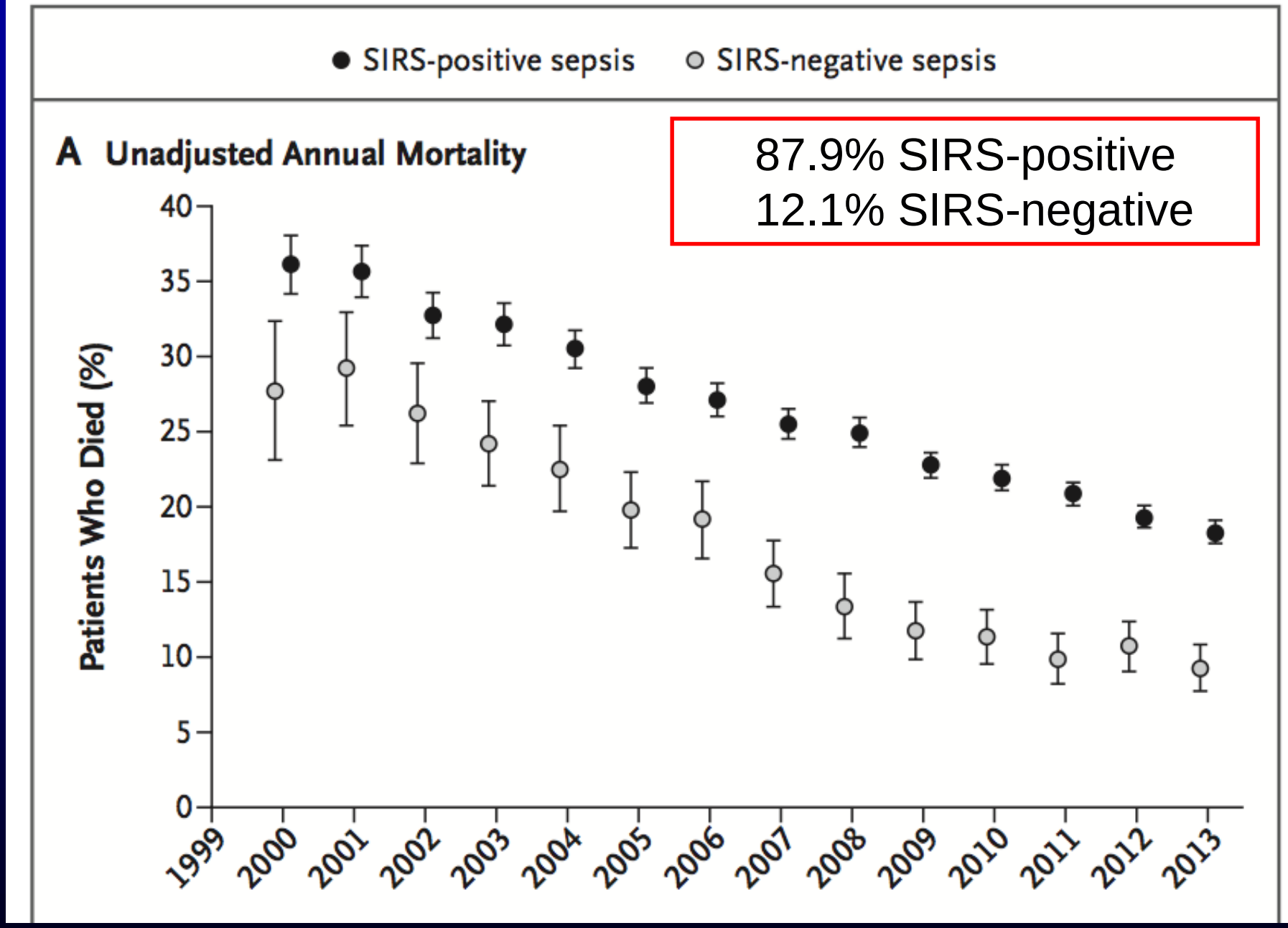
- Association between keywords and in-hospital mortality
  - abnormal/ suspected abnormal T° (64.1.%)
  - pain (38.4%)
  - acute altered mental status (38.2%)
  - weakness of the legs (35.1%)
  - breathing difficulties (30.4%)
  - loss of energy (26.2%)
  - gastrointestinal symptoms (24.0%)

Wallgren et al. SJTREM, 2017

Diagnosis (%)†			
Medical condition		93.3	90.6
Pneumonia		39.5	38.5
Urosepsis		27.7	25.6
Peritonitis		4.2	3.4
Other		21.9	23.1
Surgical condition		6.7	9.4
Intraabdominal process		5.9	7.7
Source of sepsis — no. (%)			
Pneumonia	140 (31.9)	152 (34.1)	151 (33.1)
Urinary tract infection	100 (22.8)	90 (20.2)	94 (20.6)
Intraabdominal infection	69 (15.7)	57 (12.8)	51 (11.2)
Infection of unknown source	57 (13.0)	47 (10.5)	66 (14.5)
Skin or soft-tissue infection	25 (5.7)	33 (7.4)	38 (8.3)
Catheter-related infection	11 (2.5)	16 (3.6)	11 (2.4)
Central nervous system infection	3 (0.7)	3 (0.7)	4 (0.9)
Endocarditis	1 (0.2)	3 (0.7)	3 (0.7)
Other	28 (6.4)	31 (7.0)	26 (5.7)
Pneumonia	18 (38)		19 (40)
Urosepsis	11 (23)		10 (21)
Primary bacteremia	7 (15)		7 (15)
GI/biliary	6 (13)		6 (13)
Other	5 (11)		5 (11)

Rivers et al. NEJM, 2001
ProCESS. NEJM, 2015
Marik et al. CHEST, 2017

Early Recognition



Kaukonen et al. NEJM, 2015

tqSOFA

	Triage qSOFA<2 (n=2337)	Triage qSOFA≥2 (n=508)	p value
Age (yr)	56.2 ± 17.7	62.2 ± 17.8	<0.01
Male	53% (1243)	51% (261)	ns
Time to Antibiotics (min) (n=2796)	197 ± 162	125 ± 114	<0.01
Total IVF (mL) (n=2746)	2405 ± 1732	2750 ± 1857	<0.01
Mortality			
In hospital (n=2845)	11.7% (273)	26.4% (134)	<0.01
28 days (n=2459)	15.2% (308)	36.6% (159)	<0.01
ICU Admission, (Y) (n=2845)	70.7% (1651)	78.2% (397)	<0.01
Intubated (ED), (Y) (n=2836)	5.6% (130)	21.0% (106)	<0.01
ALI (SF ratio<452), (Y) (n=2845)	53.6% (1252)	77.8% (395)	<0.01
Vasopressor(s), (Y) (n=2844)	5.6% (131)	14.4% (73)	<0.01

- tqSOFA>=2 for In-hospital mortality:
- Sens= 33%; Spec= 87%
- AUC, tqSOFA: 0.57 (95% CI: 0.55-0.59)

Unpublished data

qSOFA

	qSOFA<2 (n=1478)	qSOFA≥2 (n=1362)	p value
Age (yr)	54.8 ± 17.7	60.0 ± 17.6	<0.01
Male	54.3% (802)	51.4% (700)	ns
Time to Antibiotics (min) (n=2791)	204 ± 167	162 ± 141	<0.01
Total IVF (mL) (n=2763)	2172 ± 1524	2785 ± 1934	<0.01
Mortality			
In hospital (n=2840)	8.5% (126)	20.6% (280)	<0.01
28 days (n=2457)	11.7% (150)	27.1% (316)	<0.01
ICU Admission, (Y) (n=2840)	64.7% (956)	80.0% (1090)	<0.01
Intubated (ED), (Y) (n=2830)	3.4% (50)	13.8% (187)	<0.01
ALI (SF ratio<452), (Y) (n=2839)	45.2% (668)	71.5% (974)	<0.01
Vasopressor(s), (Y) (n=2839)	2.5% (37)	12.3% (167)	<0.01

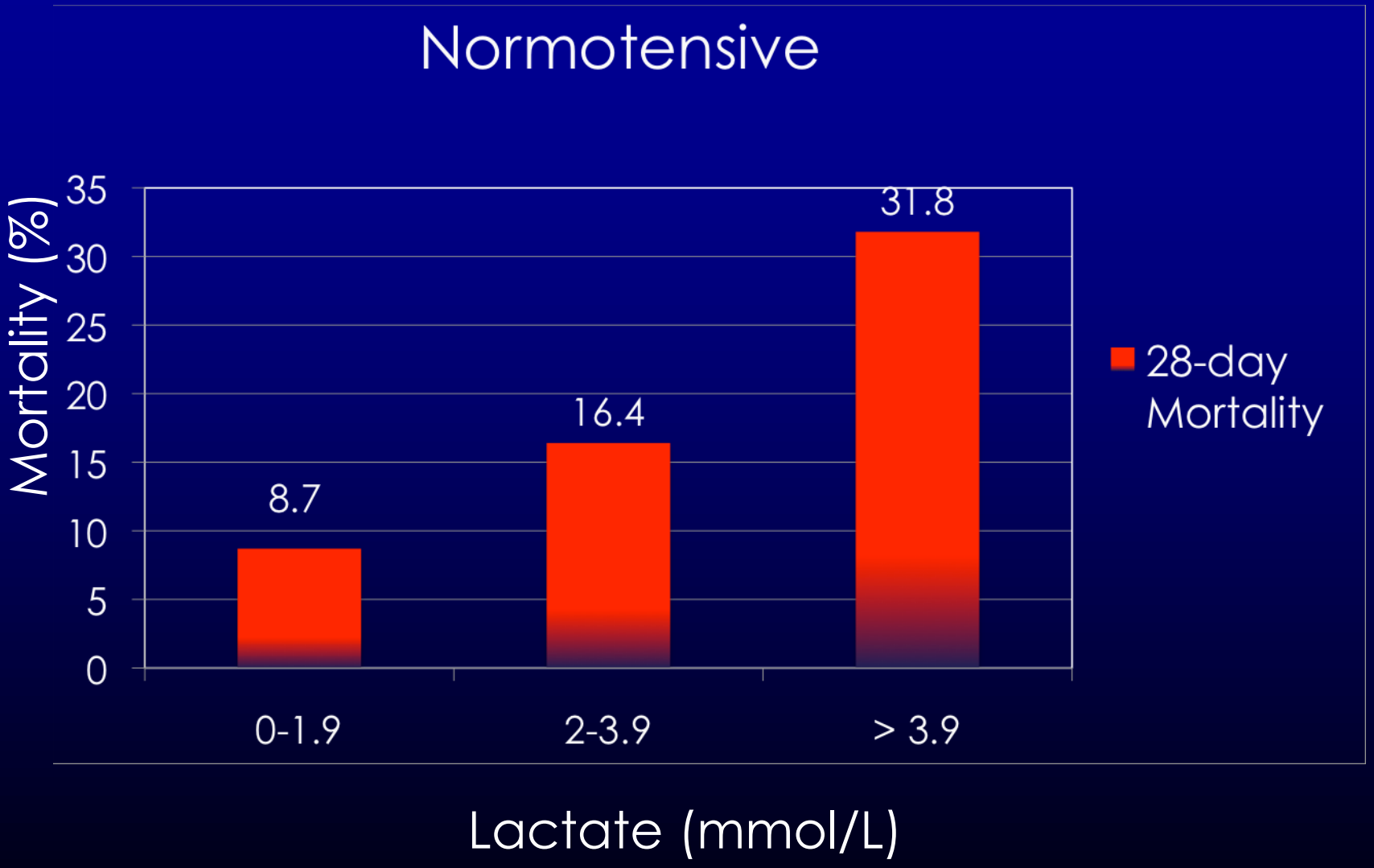
- qSOFA>=2 for In-hospital mortality:
- Sens= 70%; Spec= 56%
- AUC, qSOFA: 0.56 (95% CI: 0.55-0.57)

Unpublished data

Organ Dysfunction?

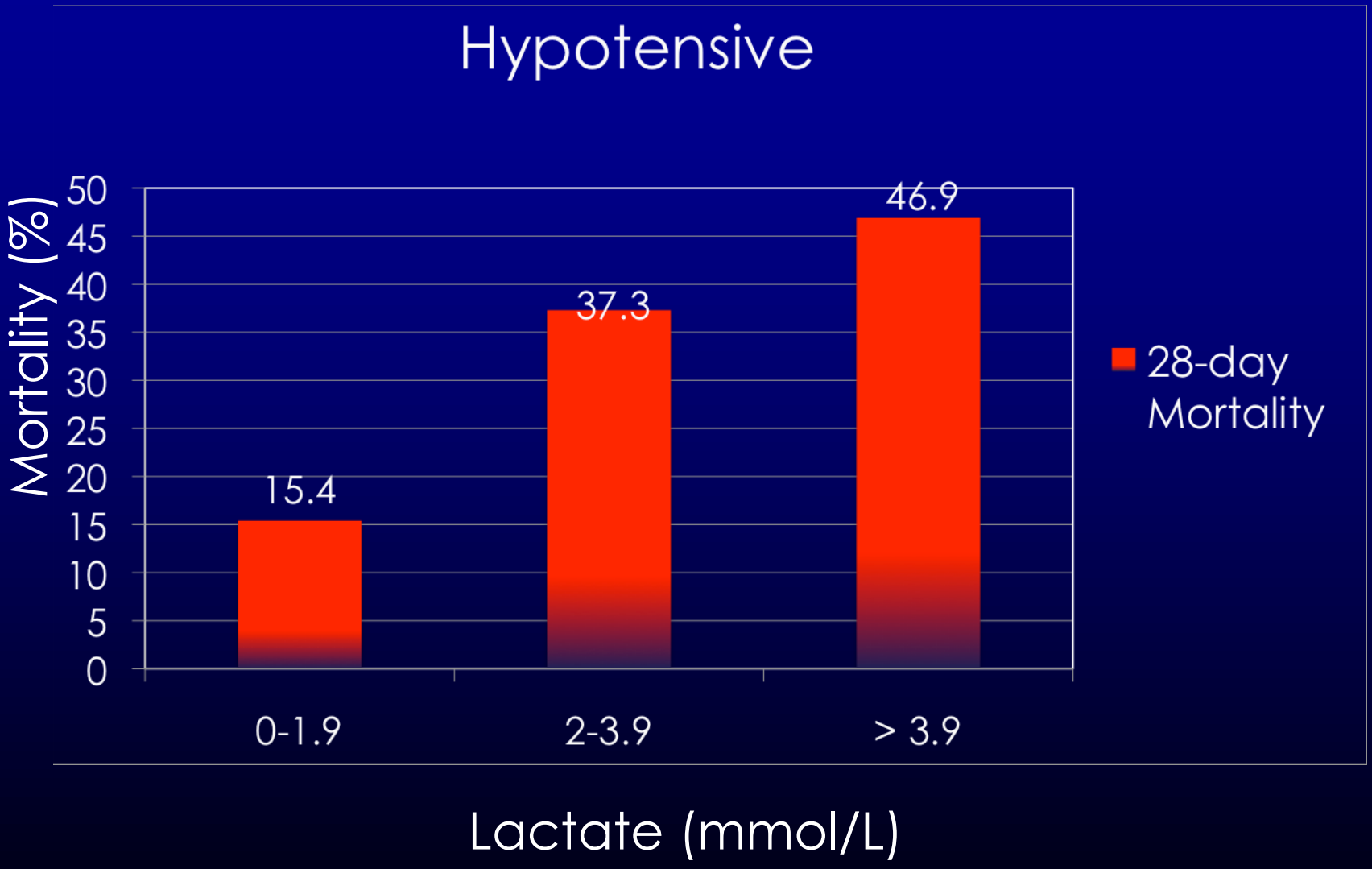

START

ED Lactate in Severe Sepsis



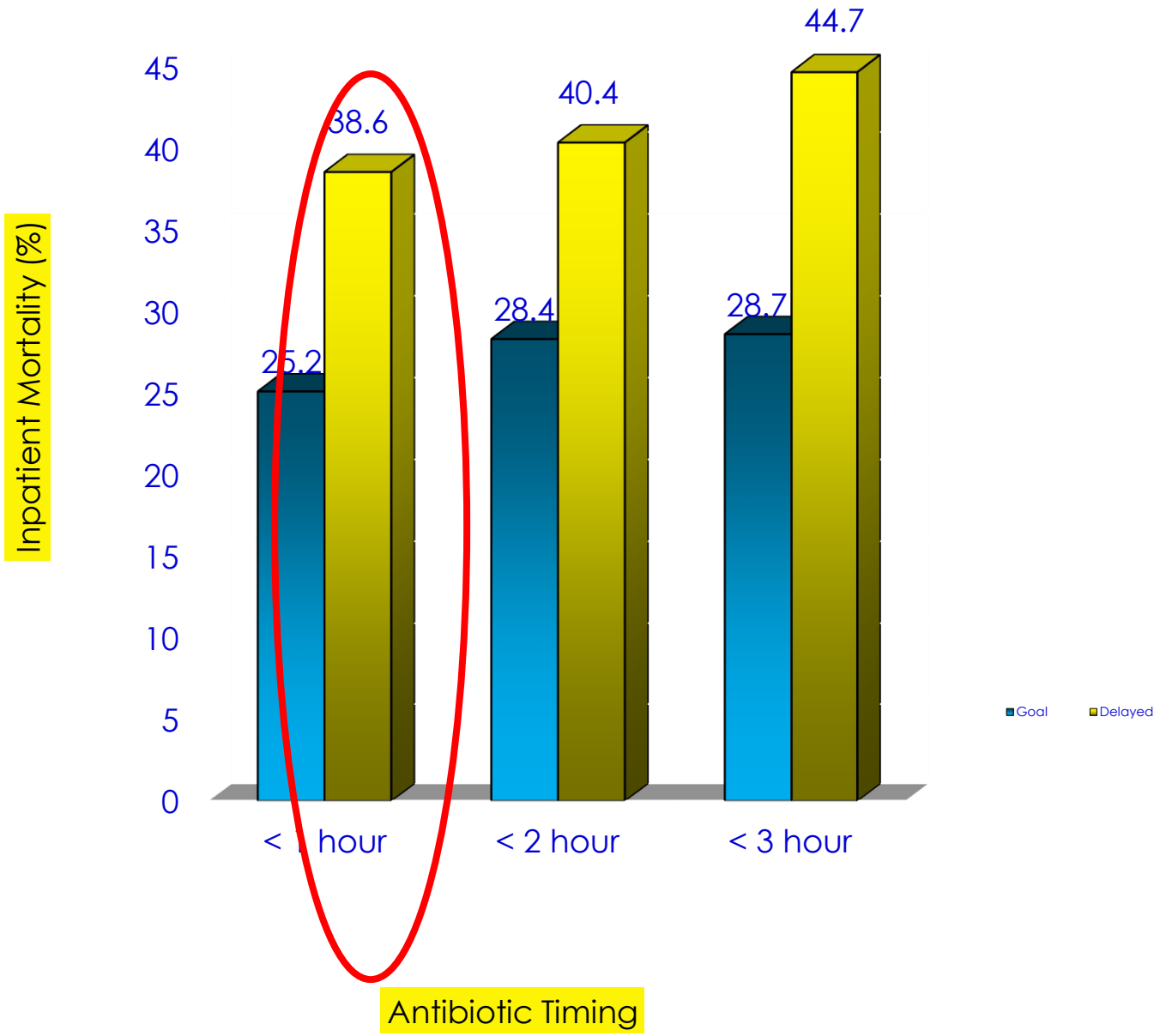
Mikkelsen et al. CCM, 2009

ED Lactate in Severe Sepsis

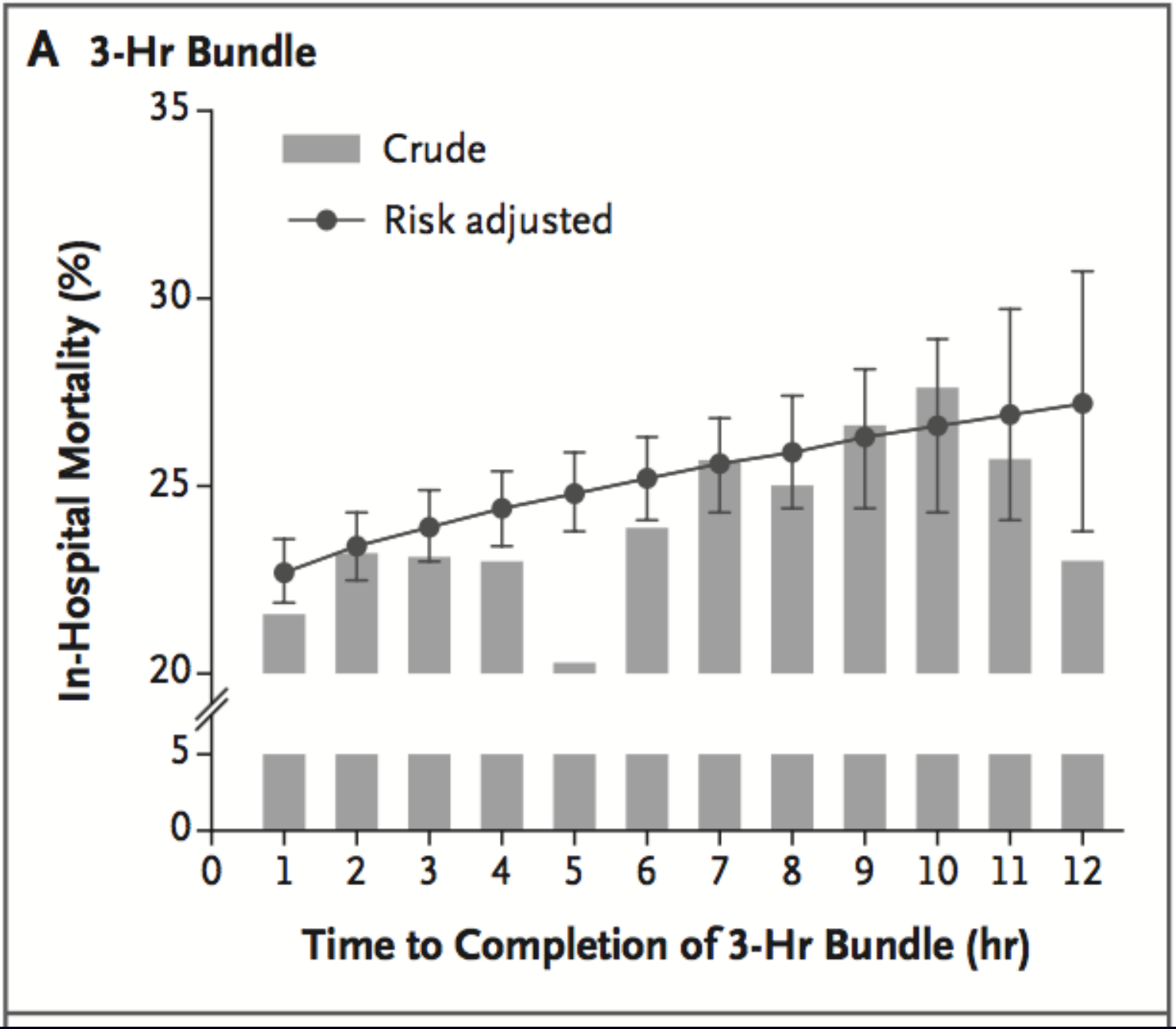


Mikkelsen et al. CCM, 2009

Time to Antibiotics



Gaieski et al. CCM, 2010



Seymour et al. NEJM, 2017


STOP

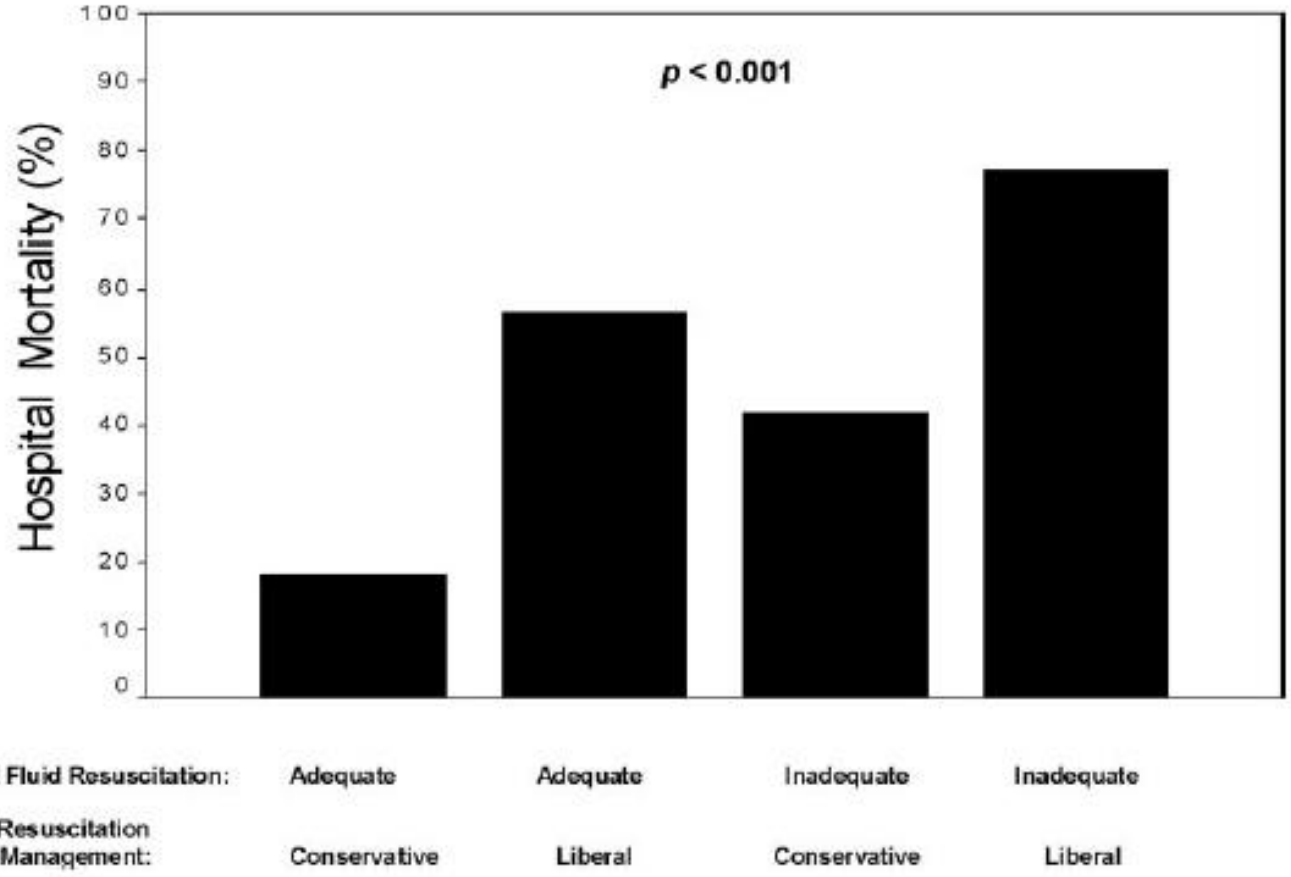


FIGURE 3. Hospital mortality according to whether or not patients achieved AIFR, CLFM, both, or neither.

AIFR: Adequate Initial Fluid Resuscitation
CLFM: Conservative Late Fluid Management

Murphy et al. CHEST, 2009