Predictors of Sepsis in Emergency Medicine Departments

Anwar Al-Awadhi, M.D, M.P.H, F.A.C.E.P

Department of Emergency Medicine

MKH – State of Kuwait

Friday, April 26th, 2019

Iemc conference 2019 – Antalya- Turkey

WHO –Sepsis
April 2018

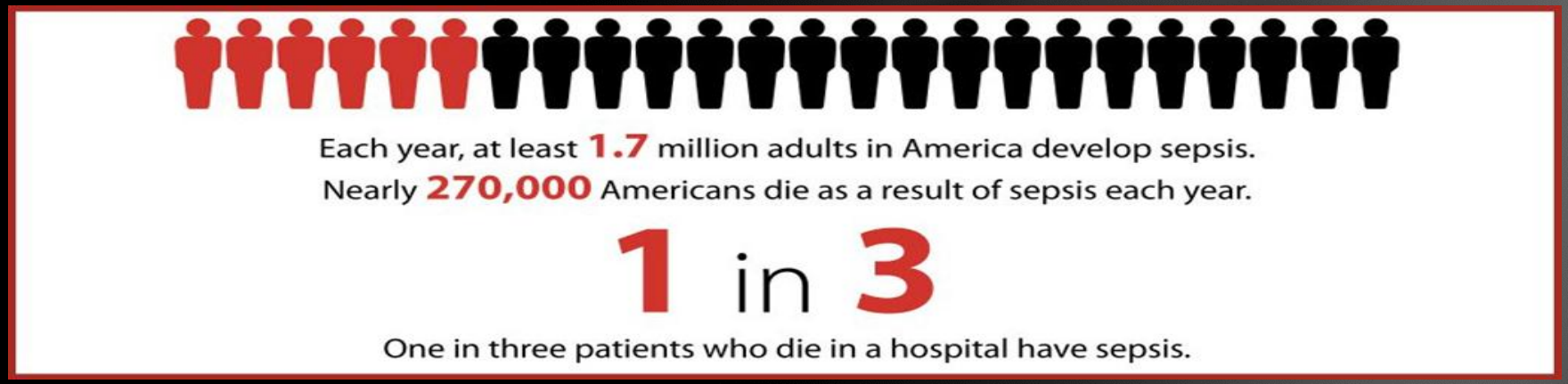
- The global epidemiological burden of sepsis is difficult to ascertain.
- > 30 million people worldwide affected annually.
- Potentially leading to 6 million deaths.
- The burden of sepsis is most likely highest in low- and middle-income countries.

WHO –Sepsis
April 2018 -Continue

- ~ 3 million newborns and 1.2 million children suffer from sepsis globally annually.
- ~ 30% of neonatal deaths are due to neonatal sepsis.
- 10% of pregnancy association deaths are due to maternal sepsis, in which ~ 95% in low-middle income countries.

Statistics

- In the United States of America > 1.7 million patients hospitalized for sepsis.
- Costing almost US$ 24 billion, representing 6.2% of total hospital costs in 2013.
- Studies in Europe and Canada have estimated the daily costs of hospital care of a septic patient to be between €710 and €1033, on the average.



Who is at risk?

- Anyone affected by an infection can progress to sepsis.

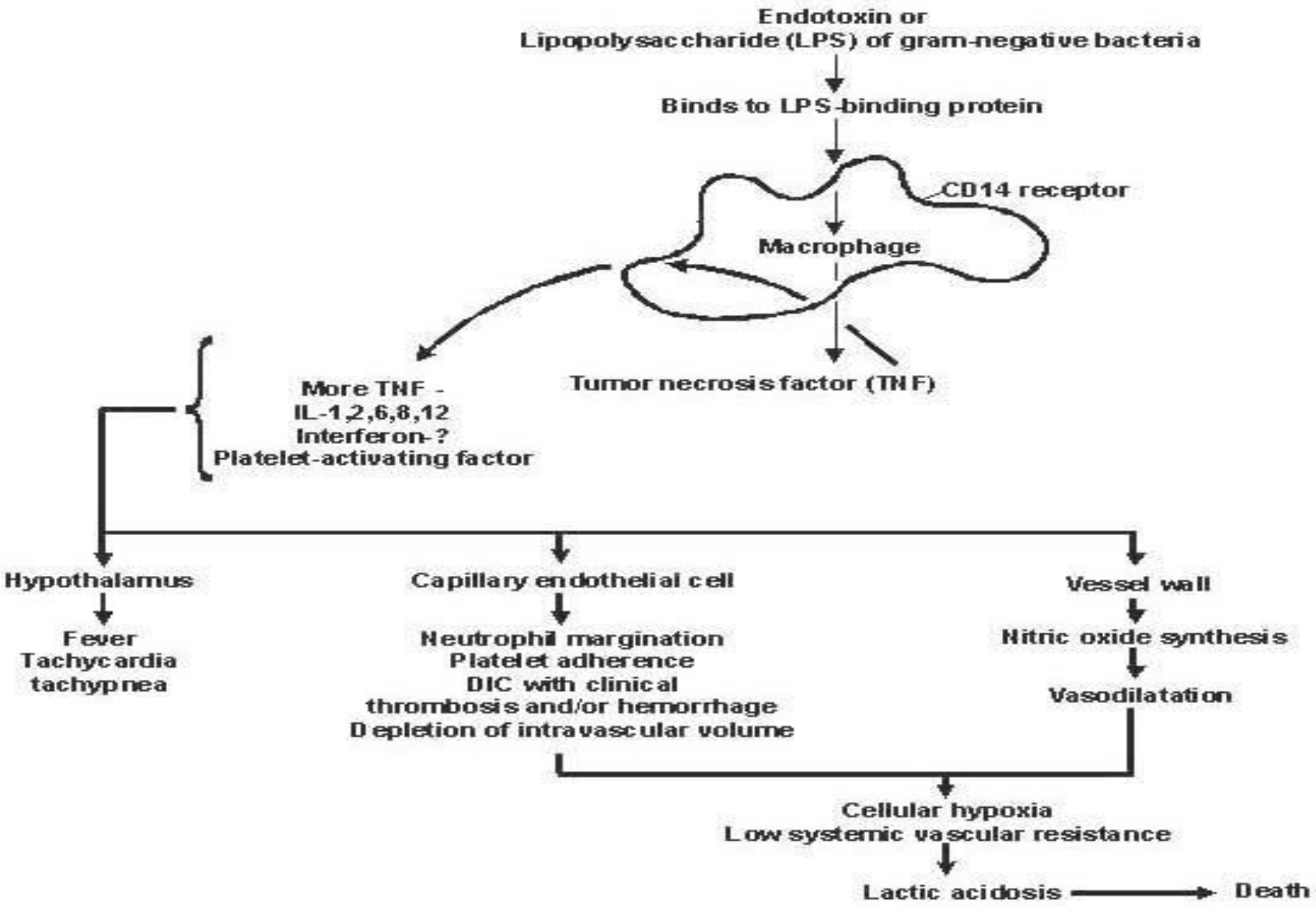
- **Vulnerable Populations:** elderly people, pregnant women, neonates, hospitalized patients, patients with HIV/AIDS, liver cirrhosis, cancer, kidney disease, autoimmune diseases, post splenectomy, and immuno-compromized patients.

Signs & Symptoms

- Include fever or low temperature and shivering, altered mental status, difficulty breathing/rapid breathing, increased heart rate, weak pulse/low blood pressure, low urine output, cyanotic or mottled skin, cold extremities, and extreme body pain or discomfort.

- Suspecting sepsis: is the first major step towards early recognition & diagnosis.

Sepsis Systemic Effect



Prevention

- There are two main steps to preventing sepsis :

1) Prevention of microbial transmission & infection.

2) Prevention of the evolution of an infection to sepsis.

Prevention - Continued

- Community: WASH Programs, such as hand washing, safe preparation of food, improving sanitation & water quality & availability.
- Providing access to vaccines, appropriate nutrition, including breastfeeding for newborns.
- Vaccinations prevent 2–3 million infection-associated deaths every year.

- Healthcare Facilities: infection prevention & control (IPC) programs & teams. Hand hygiene practice in health care can reduce infection by as much as 50% .

Diagnosis & Clinical Management

- Tissue perfusion: Early fluid resuscitation / Vasopressors to improve volume status.

- Repeated Exams & Diagnostics, including monitoring vital signs, to guide the appropriate management of sepsis over time.

- Cardiovascular, respiratory & immune systems support.

Septic Shock

- **Sepsis:** is a life-threatening organ dysfunction due to dysregulated host response to infection.
- **Organ dysfunction:** is an acute change in total Sequential Organ Failure Assessment (SOFA) score greater than 2 points secondary to the infection cause.
- **Septic shock:** in a subset of patients with sepsis and comprises of an underlying circulatory and cellular / metabolic abnormality that is associated with increased mortality.

- **Detrimental host responses:** from sepsis → severe sepsis → septic shock → multiple organ dysfunction syndrome (MODS) → (MOFS)→ death.

Shock Classification, Terminology & Staging

- **Shock:** is identified in most patients by hypotension and inadequate organ perfusion, by either low cardiac output or low systemic vascular resistance.
- Circulatory shock classes:

1) Hypovolemic shock

2) Obstructive shock

3) Distributive shock: anaphylactic, neurogenic & sepsis.

4) Cardiogenic shock

Multiple Organ Dysfunction Syndrome (MODS)

- **(MODS):** is altered organ function in a patient who is acutely ill and in whom homeostasis, oxygenation & ventilation cannot be maintained without intervention.

- MODS may eventually lead to multiple organ failure syndrome (MOFS).

- **Mortality Rates:** in severe sepsis, septic shock & MODS ranging from 20% to 50%.

Systemic Inflammatory Response Syndrome (SIRS)

- Temperature: > 38°C (100.4°F) or < 36°C (96.8°F).
- Heart rate (HR): > 90 beats/min.
- Respiratory rate (RR): > 20 breaths/min or arterial carbon dioxide tension (PaCO2) < 32 mm Hg.
- White blood cell (WBC) count: > 12,000/µL or < 4000/µL or with 10% immature (band) forms.

SOFA

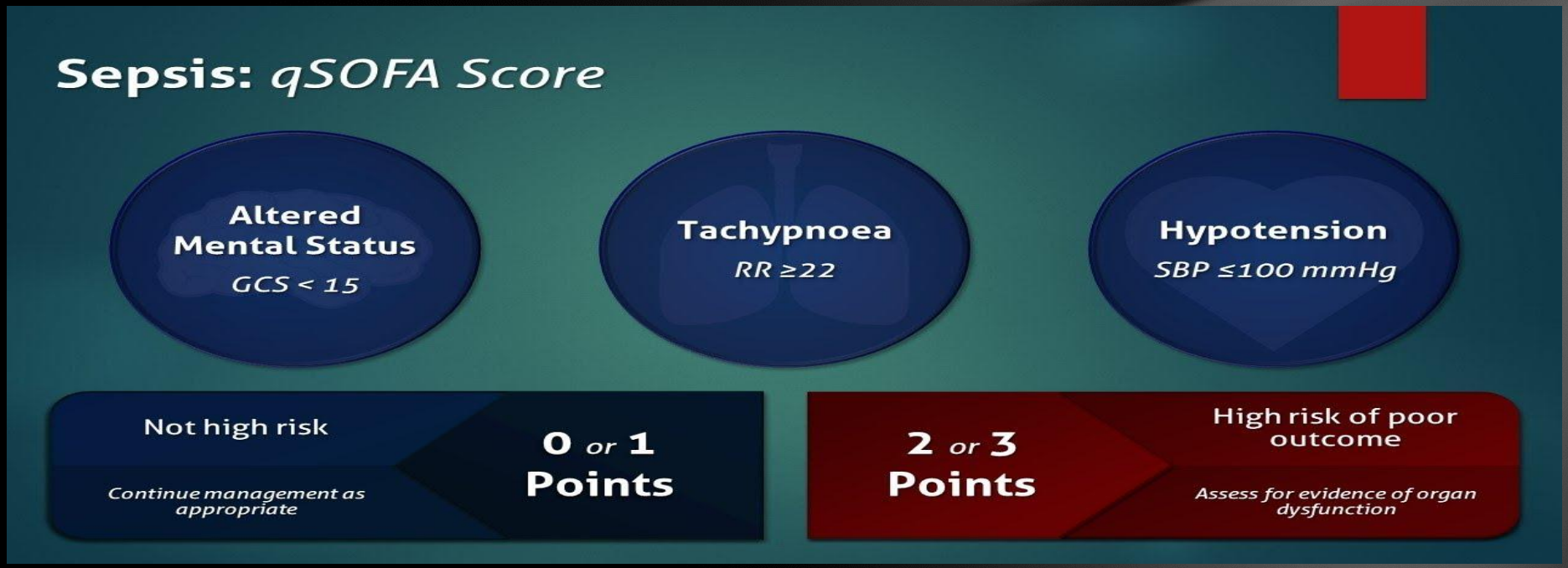
THE SEQUENTIAL ORGAN FAILURE ASSESSMENT (SOFA) SCORE

SYSTEM	0	1	2	3	4
Respiration PaO2/FIO2 mm Hg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation Platelets ×10³/uL	≥150	<150	<100	<50	<20
Liver Bilirubin mg/dL (umol/L)	<1.2 (20)	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (204)
Cardiovascular	MAP ≥70mmHg	MAP <70mmHg	Dopamine <5 or Dobutamine (any dose)	Dopamine 5.1 - 15 or Epinephrine ≤ 0.1 or Norepinephrine ≤ 0.1	Dopamine >15 or Epinephrine >0.1 or Norepinephrine >0.1
CNS GCS Score	15	13-14	10-12	6-9	<6
Renal Creatinine, mg/dl (umol/L) **Urine Output, ml/d**	<1.2 (110)	1.2 -1.9 (110-170)	2.0 - 3.4 (171-299)	3.5 - 4.9 (300 -440) <500	> 5.0 (440) <200

Catecholamine Doses = ug/kg/min for at least 1hr

qSOFA

1) Respiratory Rate: ≥22/minute
2) Altered mental Status (AMS): GCS < 15
3) Systolic Blood Pressure: ≤1 00 mmHg



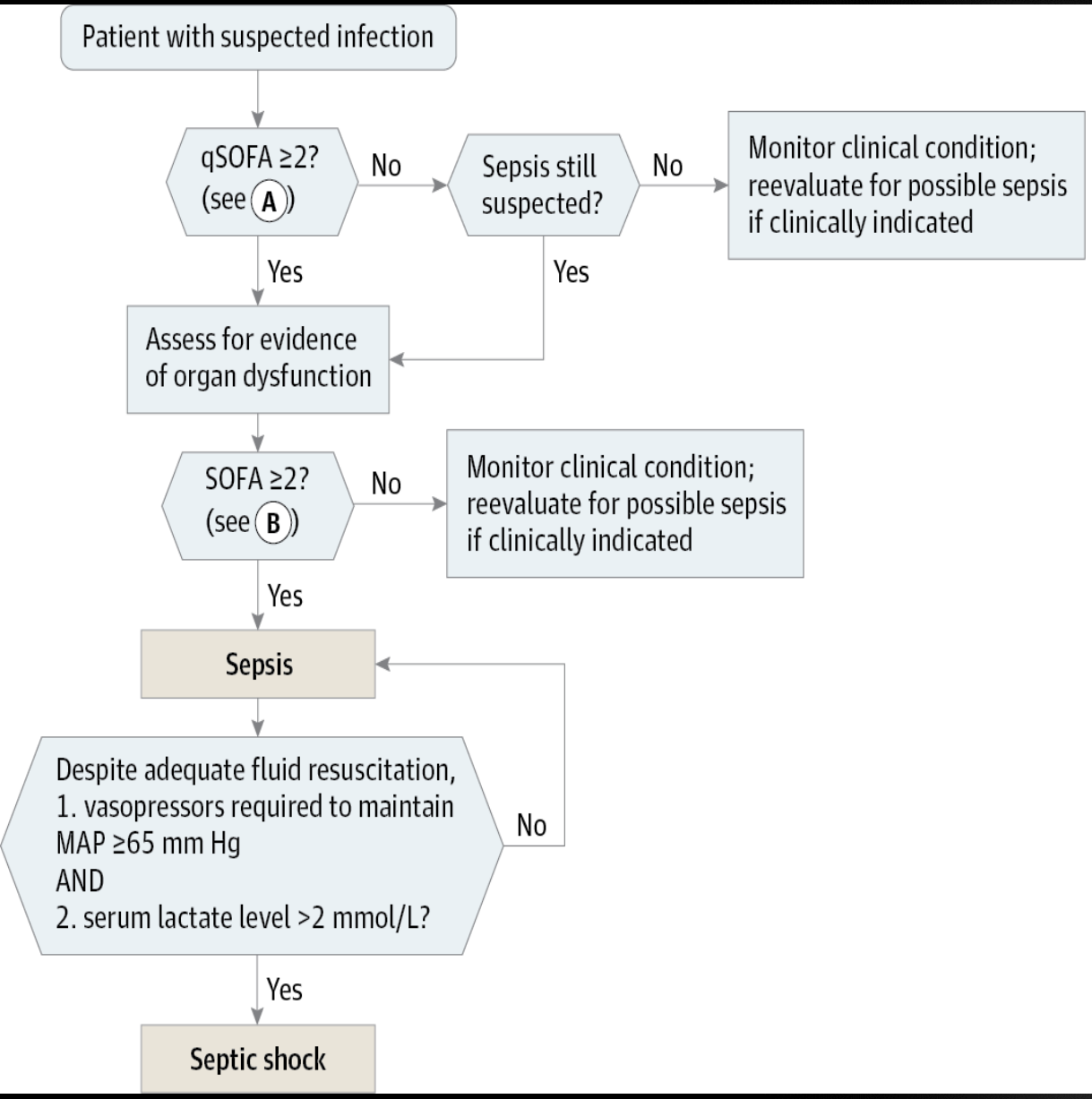
SIRS & qSOFA

Table 1. *SIRS criteria and qSOFA score*

SIRS criteria (≥ 2)	Body temperature > 38.0 °C or < 36.0 °C
	Heart rate of > 90/min
	Respiratory rate of > 20 breaths/min or $PaCO_2$ of < 4.3 kPa
	White blood cell count of < 4000 cells/mm^3 or > 12,000 cells/mm^3 or > 10% immature bands
qSOFA score (≥ 2)	Respiratory rate ≥ 22 breaths/min
	Systolic blood pressure ≤ 100 mmHg
	Altered mental state

SIRS = systemic inflammatory response syndrome; qSOFA = quick sequential organ failure assessment.

qSOFA & SOFA



A qSOFA Variables

- Respiratory rate
- Mental status
- Systolic blood pressure

B SOFA Variables

- PaO_2/FiO_2 ratio
- Glasgow Coma Scale score
- Mean arterial pressure
- Administration of vasopressors with type and dose rate of infusion
- Serum creatinine or urine output
- Bilirubin
- Platelet count

SIRS – APACHE II – SOFA - qSOFA

Variables	Whole cohort	Non-survivors	Survivors	p
Illness severity				
qSOFA	2.56±0.6	2.34±0.7	2.68±0.5	0.01
APACHE II	25.4±7.2	21.5±6.6	27.5±6.8	<0.0001
SOFA	9.29±3.0	7.1±2.5	10.4±2.6	<0.0001
SIRS	2.66±0.6	2.40±0.4	2.80±0.8	0.009
28-day mortality	65.2%	65.2%	0%	

qSOFA: quick sepsis-related organ failure assessment, APACHE II: acute physiology and chronic health evaluation II, SOFA: sepsis-related organ failure assessment, SIRS: systemic inflammatory response syndrome

Predictors of Sepsis & its outcome measures in the Emergency Departments

- In a 2018 meta-analysis of 38 studies that included patients from the ED, wards, and ICU, compared with SIRS criteria, qSOFA was poorly sensitive (61 v.s 88 %) but had a higher specificity (26 v.s 72 %) for predicting mortality from sepsis.

- Limitations of this analysis include the heterogeneous nature of the populations studied and differences in the timing of the measurement of mortality.

- The SOFA score helps predict morbidity rather than mortality, though individuals with a score of 15 or more had a mortality rate of 90%.

JAMA
Original Investigation Caring for the Critically Ill Patient
January 17, 2017

- Prognostic Accuracy of Sepsis-3 Criteria for In-Hospital Mortality Among Patients With Suspected Infection Presenting to the Emergency Department.

- JAMA. 2017;317(3):301-308. doi:10.1001/jama.2016.20329

Key Points

- **Question:** Does the quick Sequential Organ Failure Assessment (qSOFA) score more accurately predict in-hospital mortality than the systemic inflammatory response syndrome (SIRS) or severe sepsis criteria among emergency department patients with suspected infection?

- **Findings**: In this multicenter prospective cohort study involving 879 patients with suspected infection treated at the emergency department, the qSOFA was better at predicting in-hospital mortality with an area under the receiver operating curve (AUROC) of 0.80 than were SIRS (AUROC, 0.65) and severe sepsis (AUROC, 0.65).

Results & Conclusions

- Overall in-hospital mortality was 8%: 3% for patients with a qSOFA score lower than 2 vs 24% for those with qSOFA score of 2 or higher (absolute difference, 21%; 95% CI, 15%-26%).

- The qSOFA performed better than both SIRS and severe sepsis in predicting in-hospital mortality

- **Conclusions:** The use of qSOFA resulted in greater prognostic accuracy for in-hospital mortality than did either SIRS or severe sepsis.

American Journal of Emergency Medicine
ELSEVIER – Sept 17th, 2018

- Pre-hospital qSOFA as a predictor of sepsis and mortality.

- **Background:** The quick sequential organ failure assessment score (qSOFA) has been proposed as a simple tool to identify patients with sepsis who are at risk for poor outcomes.

- Its utility in the pre-hospital setting has not been fully elucidated.

Statistics & Conclusions

- **Methods:** This is a retrospective observational study of adult patients arriving by ambulance in September 2016 to an academic emergency department in Fresno, California.
- The qSOFA score was calculated from pre-hospital vital signs & the association of sepsis, ED diagnosis of infection and mortality, have been investigated.
- **Results**: of 2292 adult medical patients transported by ambulance during the study period, the sensitivity of qSOFA for sepsis and in-hospital mortality were 42.9% and 40.6%, respectively.
- Specificity of qSOFA for sepsis and mortality were 93.8% and 91.9%, respectively.

Statistics & Conclusions - Continued

- **Conclusions:** of those with an ED diagnosis of infection compared to all patients, the Pre-hospital qSOFA is specific, but poorly sensitive, for sepsis and sepsis outcomes, especially among patients with an ED diagnosis of infection.

- Higher qSOFA score was associated with worse outcomes.

ANY
QUESTIONS?

References

Listed below