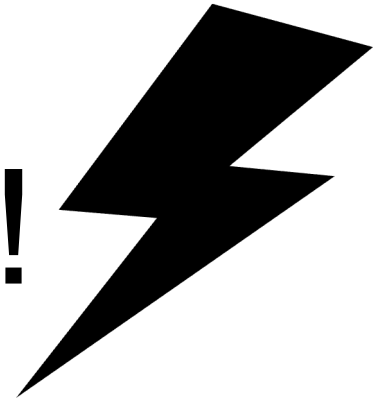
Sepsis & Shock!



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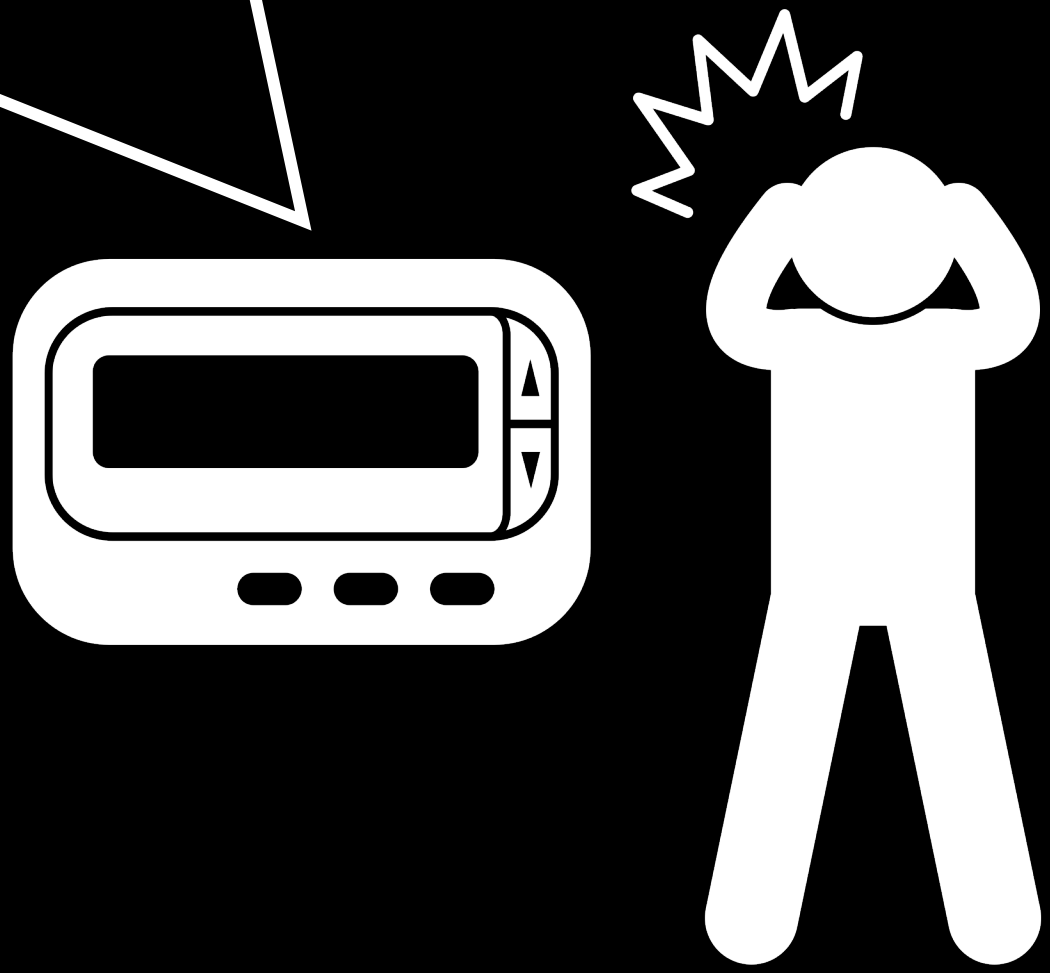
Disclosures

I have no commercial, non-commercial, or institutional financial interests or personal financial relationships to disclose regarding the material presented in this lecture.

“SEPSIS ALERT!”



Objectives

Discuss the **diagnosis** & **diagnostic pitfalls** of sepsis

Develop a **framework for the management** of septic shock

Review post-sepsis care and **outcomes after the ICU**

AT LEAST 1.7 MILLION ADULTS IN THE U.S. DEVELOP SEPSIS EACH YEAR, AND NEARLY 270,000 DIE AS A RESULT.

GET AHEAD OF SEPSIS

KNOW THE RISKS. SPOT THE SIGNS. ACT FAST.

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA

CDC

CENTERS FOR DISEASE CONTROL AND PREVENTION

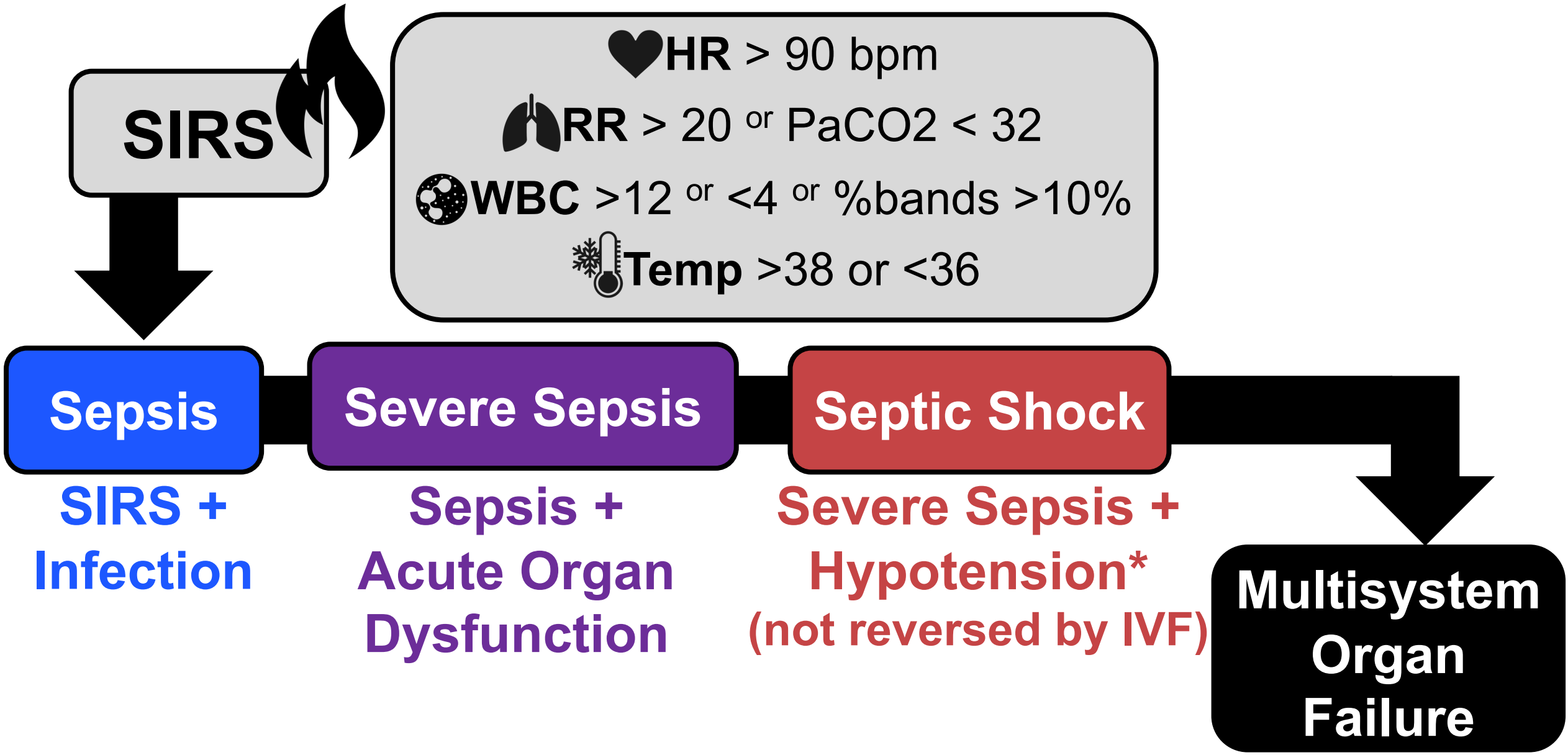
Objectives

Discuss the **diagnosis** & **diagnostic pitfalls** of sepsis

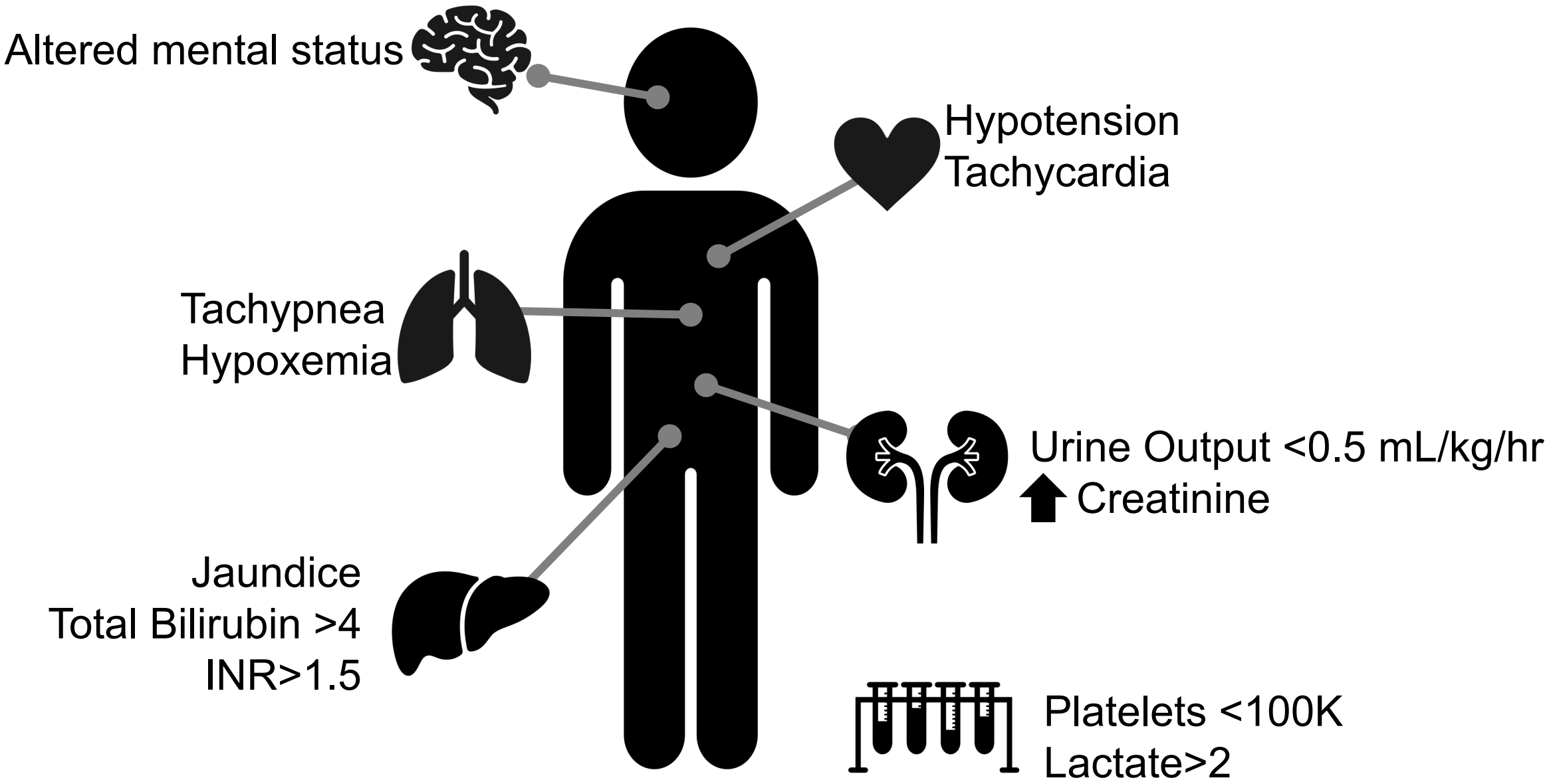
Develop a **framework for the management** of septic shock

Review post-sepsis care and **outcomes after the ICU**

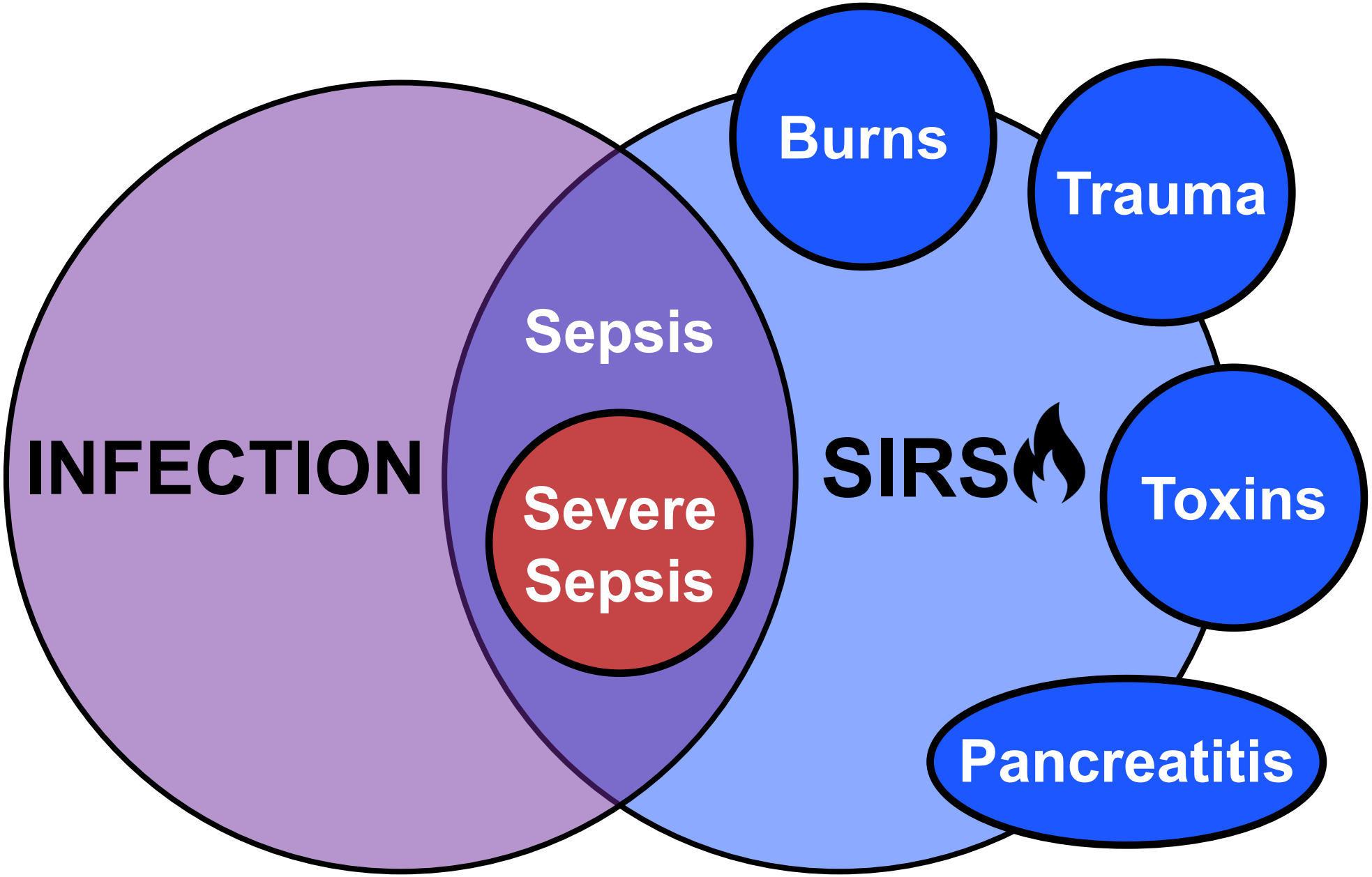
How **DID** We Define Sepsis?



Organ Dysfunction



The **Problem** with SIRS Criteria



Hypotension ≠ Septic Shock

BEWARE Sepsis Mimics**!**

Common Mimics

Hypovolemic
Hemorrhagic
Pulmonary Embolism
Cardiogenic
Tamponade

Uncommon

Anaphylaxis
Adrenal Crisis
Myxedema Coma
HLH
Toxidromes
Severe DRESS/SJS

SOFA Score

SOFA ≥ 2
= 10% mortality risk

Infection

+

Sepsis-related Organ Failure Assessment

Altered mental status

Hypoxemia

Platelets

Oliguria
AKI

Bilirubin

Hypotension

Singer et. al JAMA 2016

qSOFA Score

QUICK

Sepsis-related Organ Failure Assessment

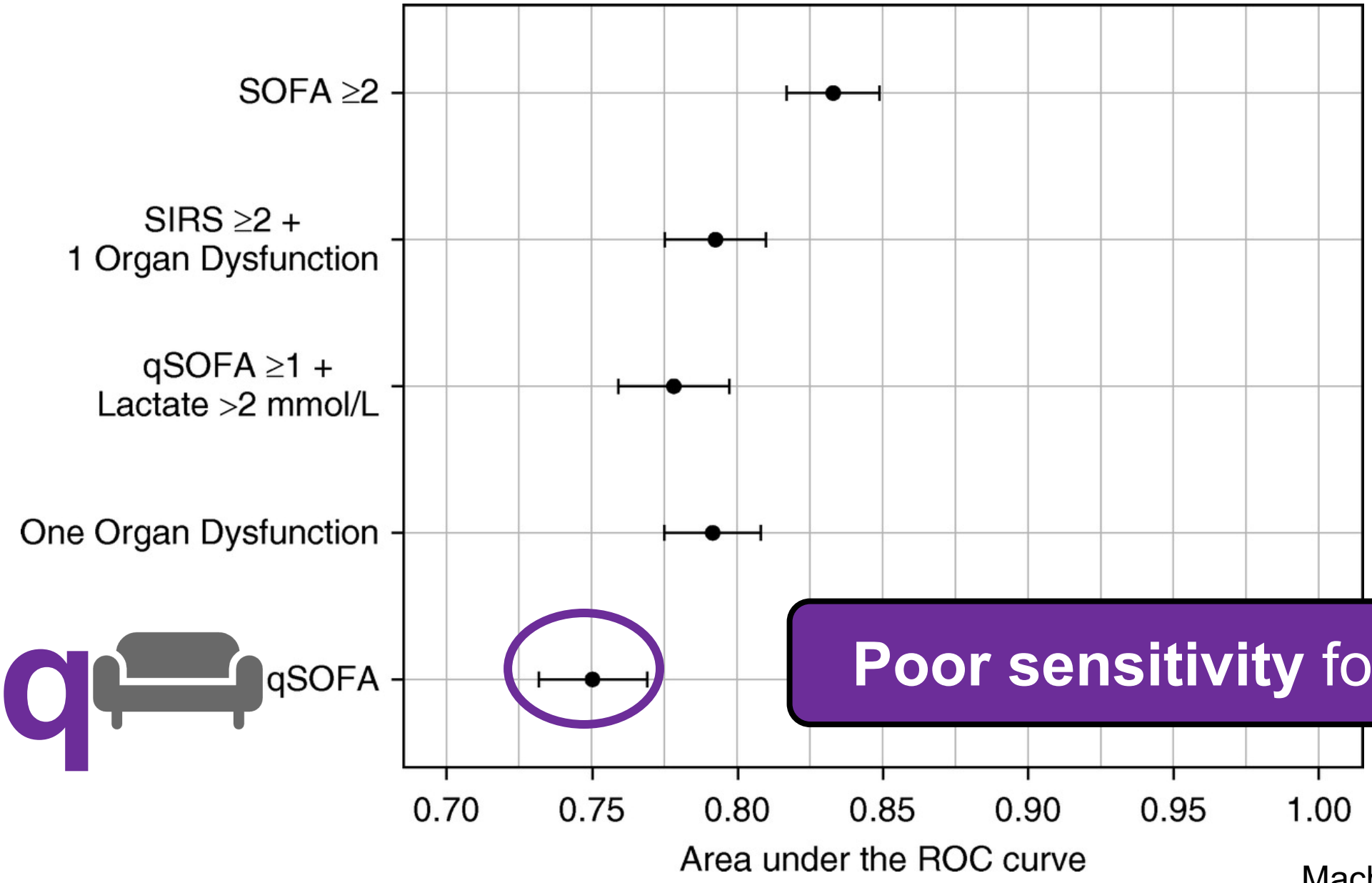
Altered Mental Status

Tachypnea
RR>22

Hypotension
SBP <100 mmHg

Singer et. al JAMA 2016

qSOFA Score



Poor sensitivity for sepsis

Machado et al. AJRCCM 2020

Now What?

Predictive for **in-hospital mortality**

Acute-Care

q  **≥ 2**

ICU

 **≥ 2**

Machado et al. AJRCCM 2020

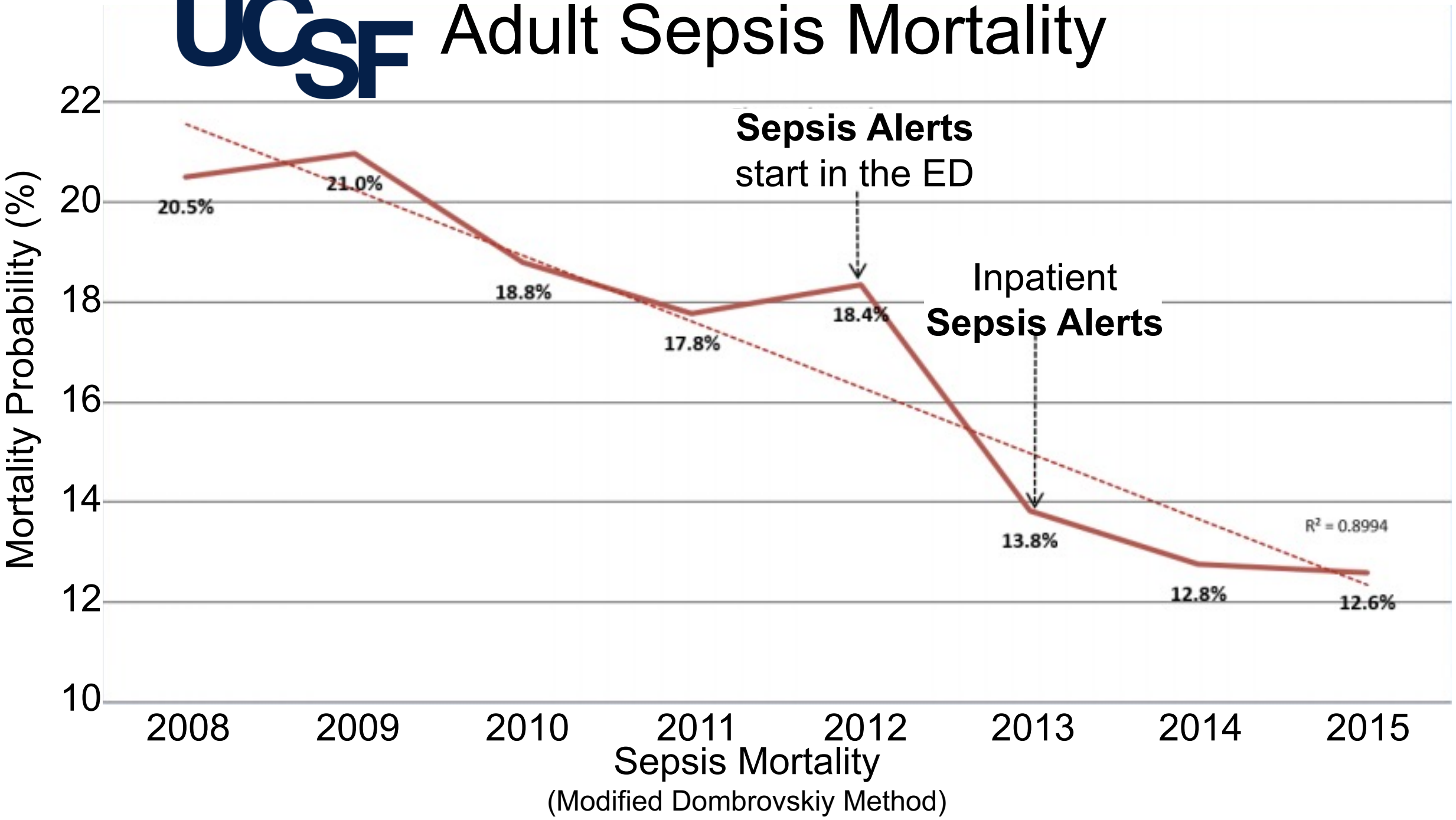
Now What?

Critical Care Societies & Medicare **still not using SOFA**

Newer data casting doubt on their clinical validity

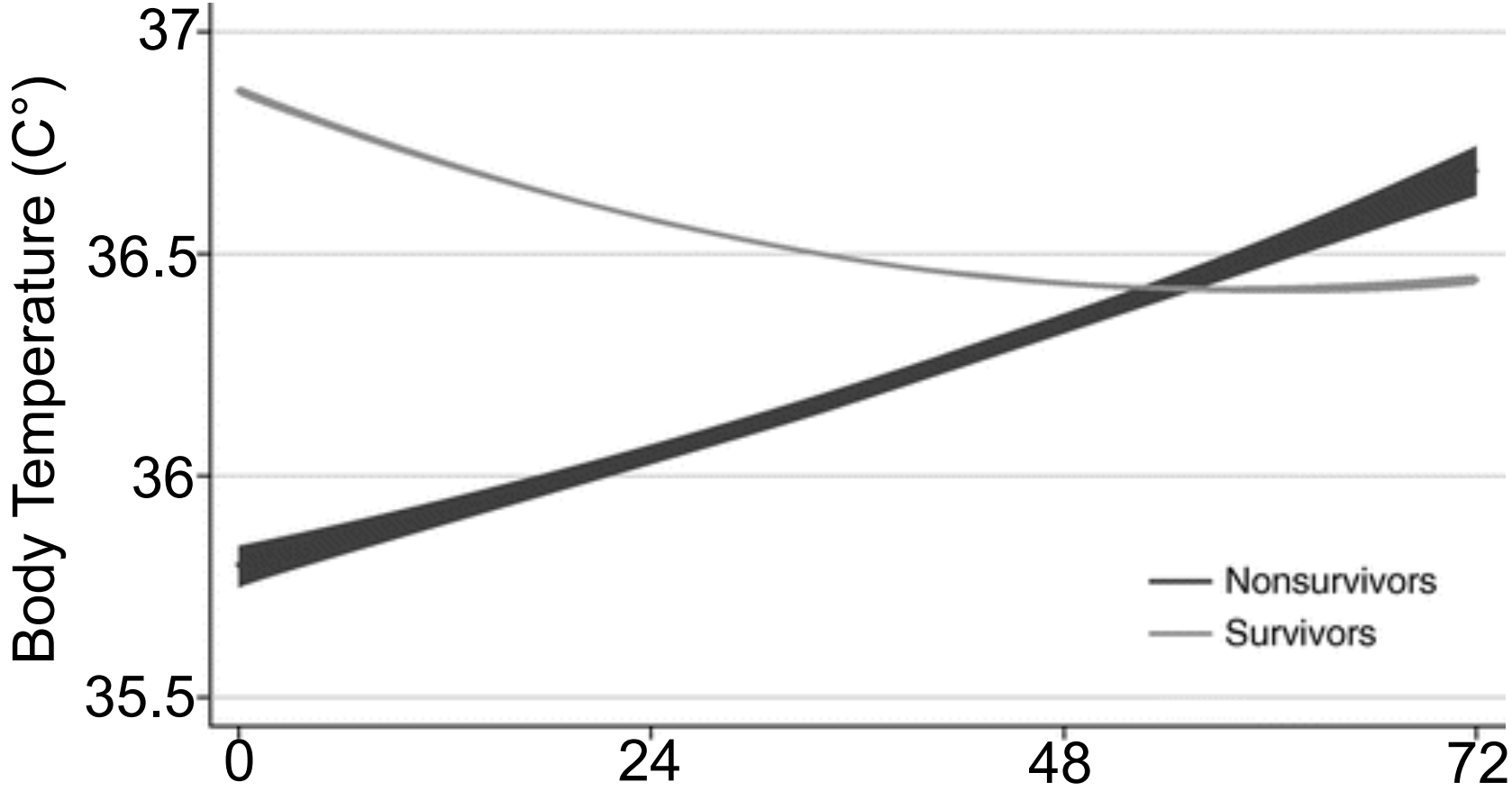
IN PRACTICE: Back to SIRS (+ **q**SOFA?)

Adult Sepsis Mortality



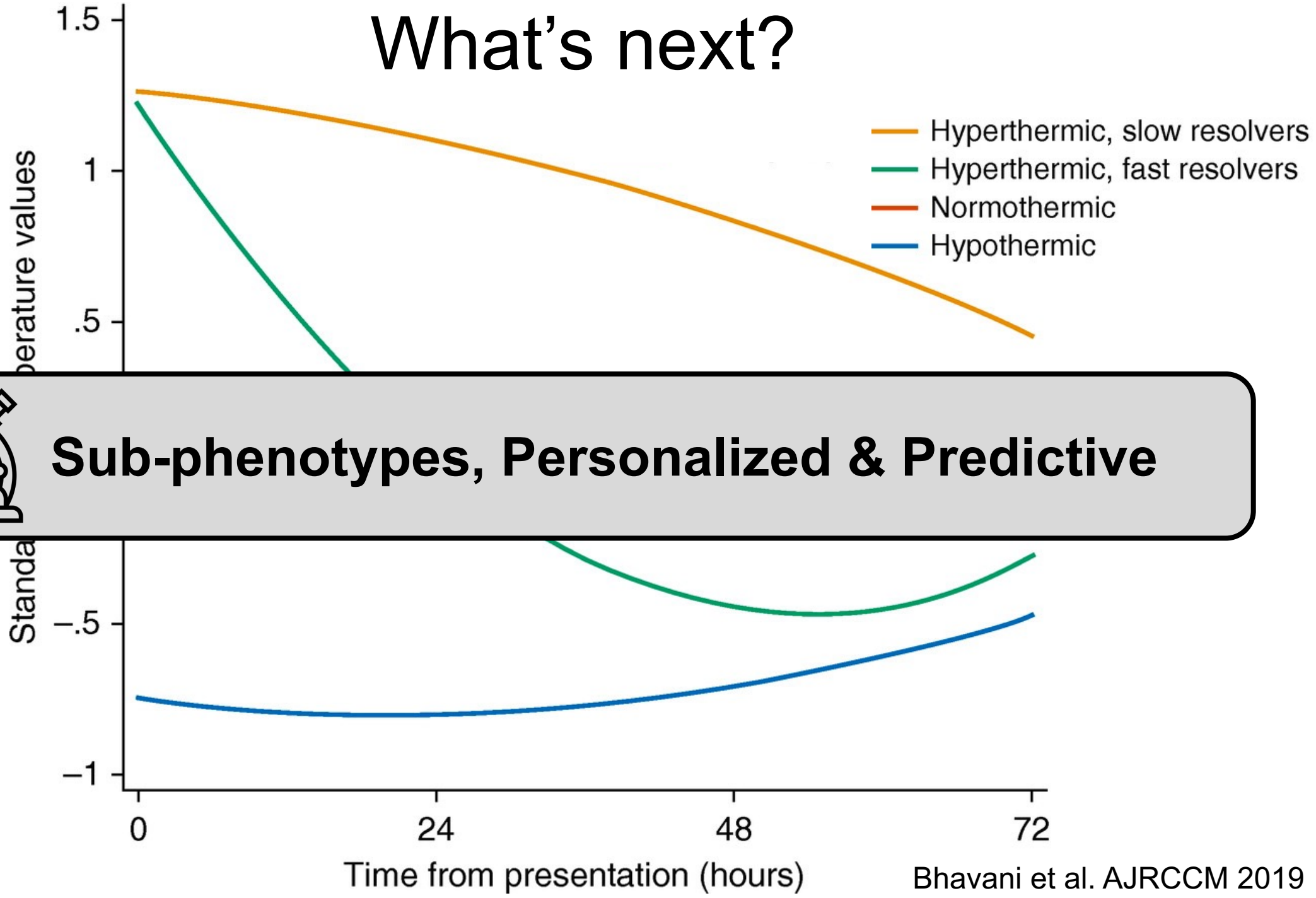
What's next?

Sub-phenotypes, Personalized & Predictive



Bhavani et al. AJRCCM 2019

What's next?



Sub-phenotypes, Personalized & Predictive

Bhavani et al. AJRCCM 2019

Objectives

Discuss the **diagnosis** & **diagnostic pitfalls** of sepsis

Develop a **framework for the management** of septic shock

Review post-sepsis care and **outcomes after the ICU**

Phase 1 (0-6hrs): **Early Dx & Stabilization**

EARLY recognition!

+Adjunct diagnostics (ex. Lactate)

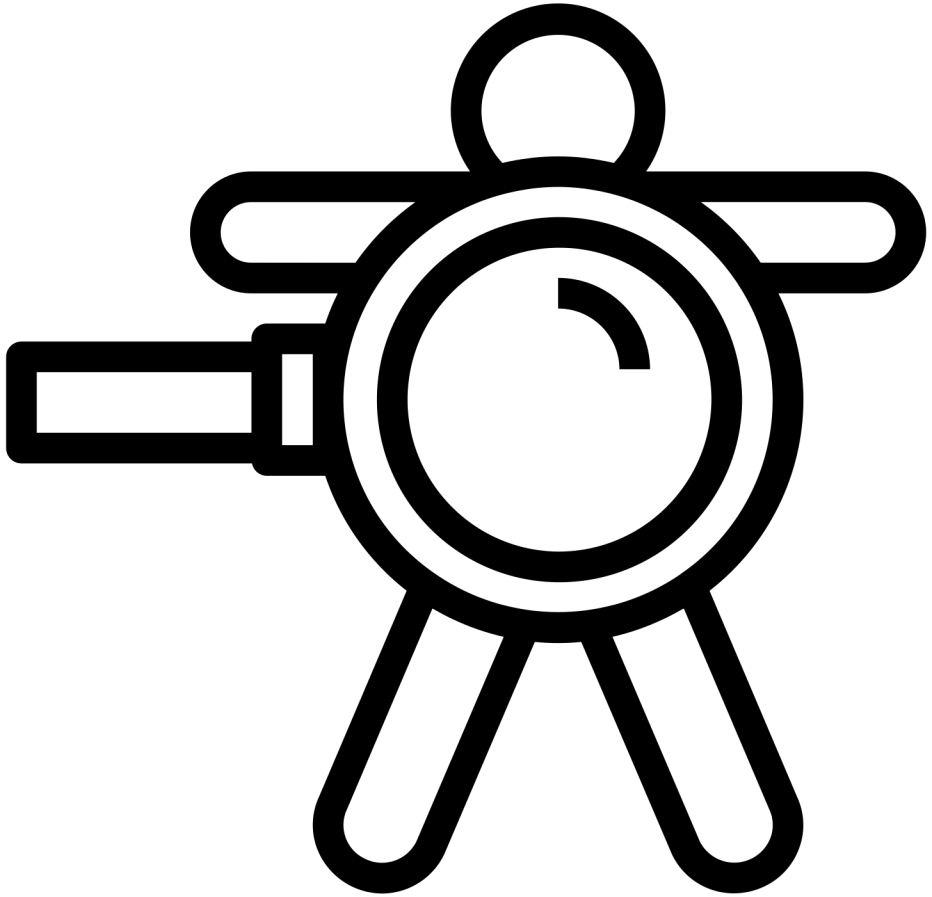
EARLY ANTIBIOTICS are key! (**<u>after cultures!!</u>**)

<u>Thoughtful</u> volume resuscitation + pressor use

Think about adequate access

(Short term **good** peripheral access is OK!)

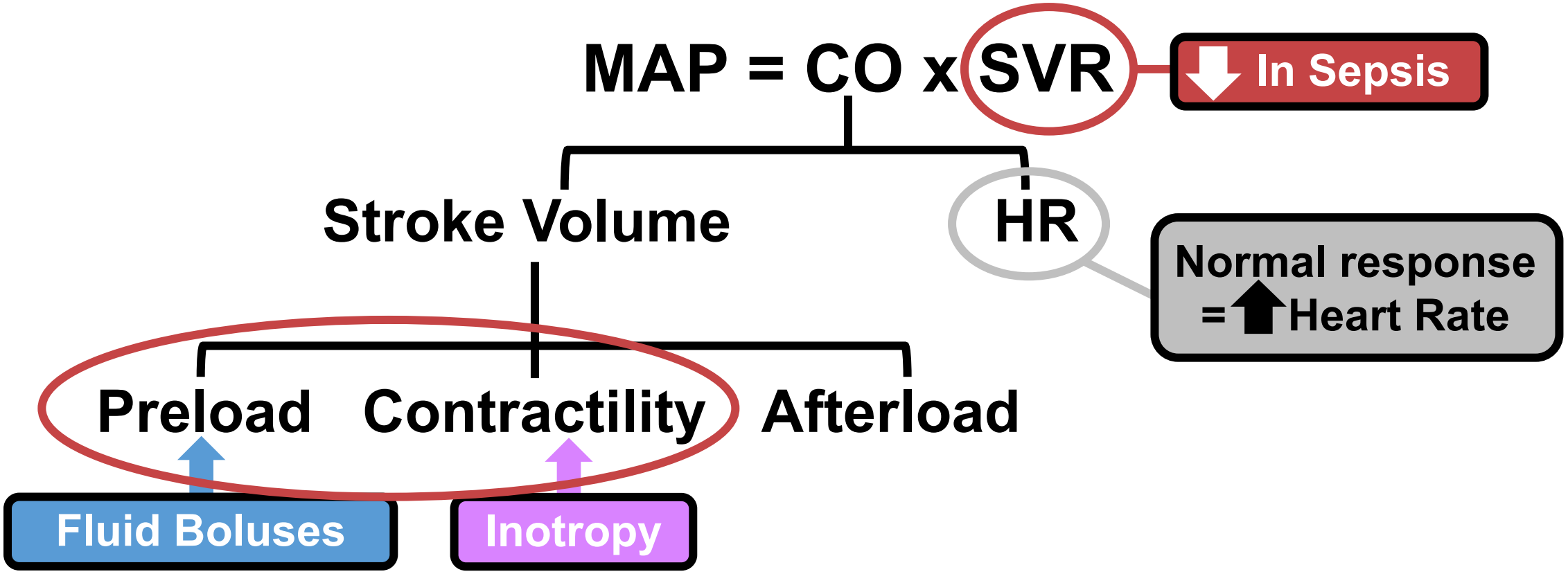
Caution!



Immunocompromised Patients!

HIV
Transplant patients
Rheumatologic conditions
Elderly
ESRD on HD

Resuscitation in Sepsis



Resuscitation – Fluid Responsiveness

Lung Ultrasound → **Fluid Tolerance**

Fluid administration **DOESN'T cause harm**

Fluid Responsiveness

Passive Leg Raise
Pulse Pressure
IVC
LVOT VTI
And MORE!

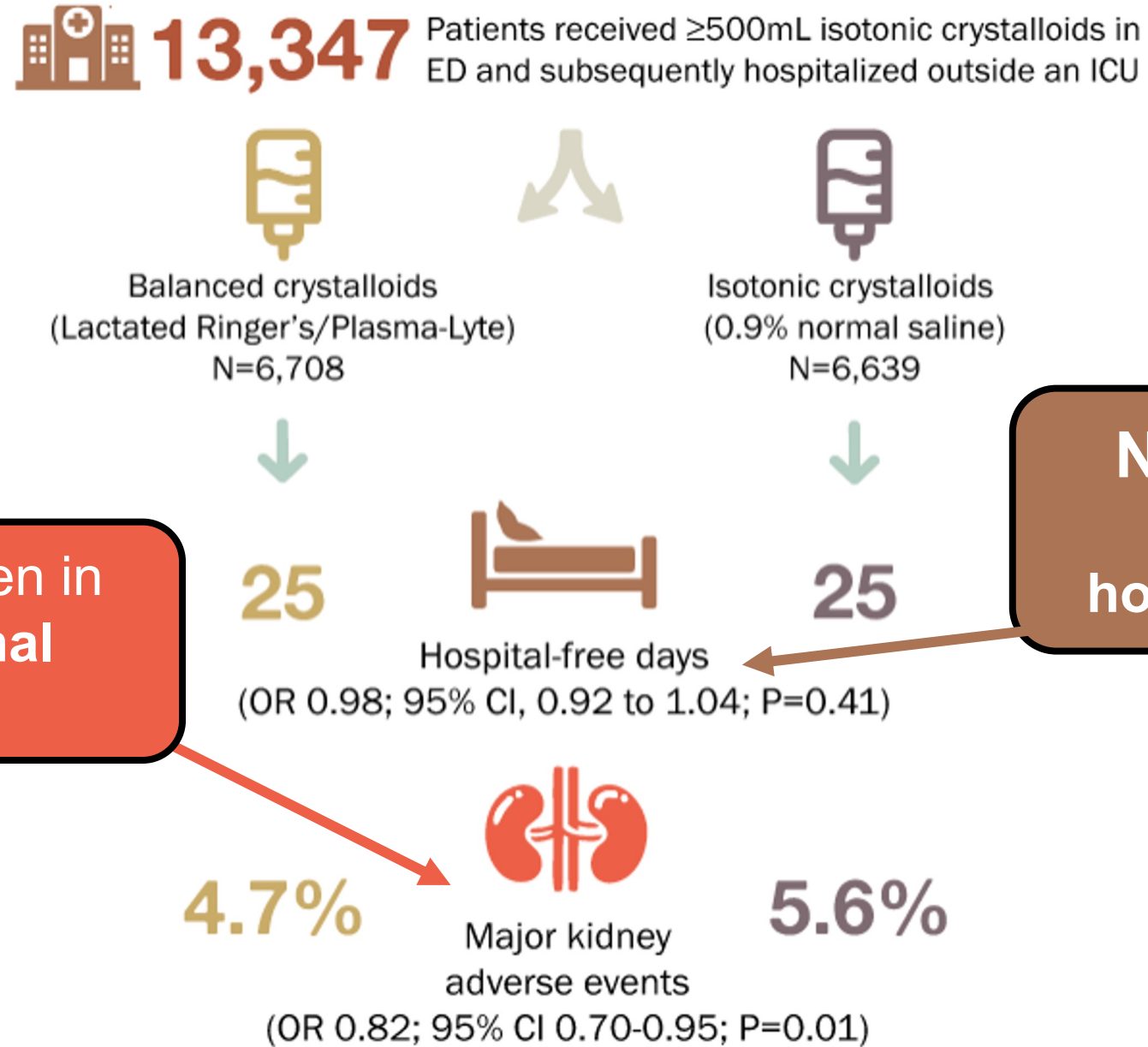
↑ **Cardiac Output ~10-15%**

Only ~50% of septic patients are fluid responsive after initial resuscitation

Fluid Responsive ≠ ↑ Sustained MAP

None are perfect. ALL have limitations!!

SALT-ED Trial



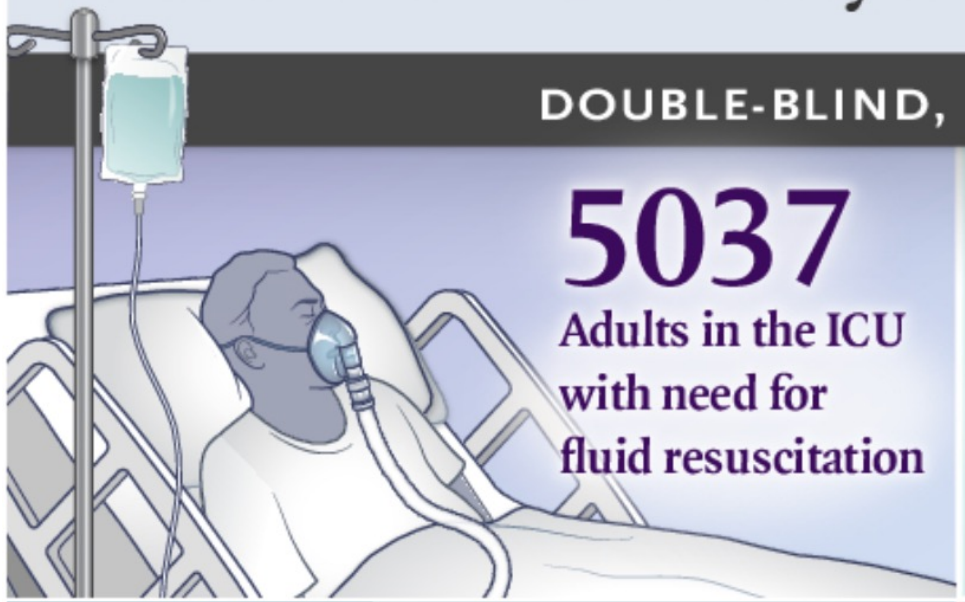
Largest benefit seen in **pre-existing renal dysfunction**

No difference in mortality or **hospital free days**

Self et al. NEJM 2018

Balanced Multielectrolyte Solution vs. Saline in Critically Ill Adults

DOUBLE-BLIND, RANDOMIZED, CONTROLLED TRIAL



5037
Adults in the ICU with need for fluid resuscitation

	Balanced multielectrolyte solution	Saline
	N=2515	N=2522
Death from any cause		
Renal replacement therapy	Difference, −0.20 percentage points; 95% CI, −2.96 to 2.56	
Mean maximum increase in serum creatinine	0.41 mg/dl	0.41 mg/dl
	Difference, 0.01 mg/dl; 95% CI, −0.05 to 0.06	

Secondary analysis showed mortality benefit!
More to come on the LR vs Saline debate

Use of balanced multielectrolyte solution in critically ill adults did not result in a lower risk of death or acute kidney injury than use of saline.

LaMontagne et al. JAMA 2020

New 65 Trial

POPULATION

1388 Men
1067 Women

Patients aged ≥65 years with vasodilatory hypotension, as assessed by treating clinician

Mean age: 75 years

LOCATIONS

65 Adult ICUs in the UK

INTERVENTION

2463 Patients analyzed

1221
Permissive hypotension
Vasopressor use guided by mean arterial pressure, target of 60-65 mm Hg

1242
Usual care
Vasopressor use at discretion of treating clinicians

PRIMARY OUTCOME

All-cause mortality at 90 days

FINDINGS

All-cause mortality at 90 days

Permissive hypotension
500 of 1221 patients

Usual care
542 of 1242 patients

There was no statistically significant difference.

Absolute risk difference, **−2.85%**
(95% CI, −6.75% to 1.05%); *P* =.15

No difference: mortality, renal function, respiratory function, ICU length of stay or 90-day cognitive outcomes

Accelerated liberation from vasopressors by ~5 hours

LaMontagne et al. JAMA 2020

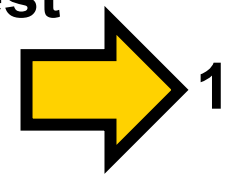
Resuscitation – Practical Tips!

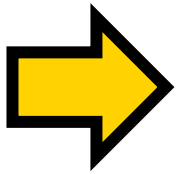
Consider Access!

Central line ≠ Fastest

Flow ∝ r^4/L

Each additional extension tubing can **reduce flow by 30%**





mL/min	
30	22 GA PIV
60	20 GA PIV
105	**18 GA PIV**
85	18 GA LONG PIV
205	16 GA PIV
330	14 GA PIV
15	**PICC Single Lumen (16 GA)**
10	**PICC Double Lumen (18 & 22 GA)**
105	**Triple Lumen Catheter(18 GA)**

Resuscitation – Practical Tips!

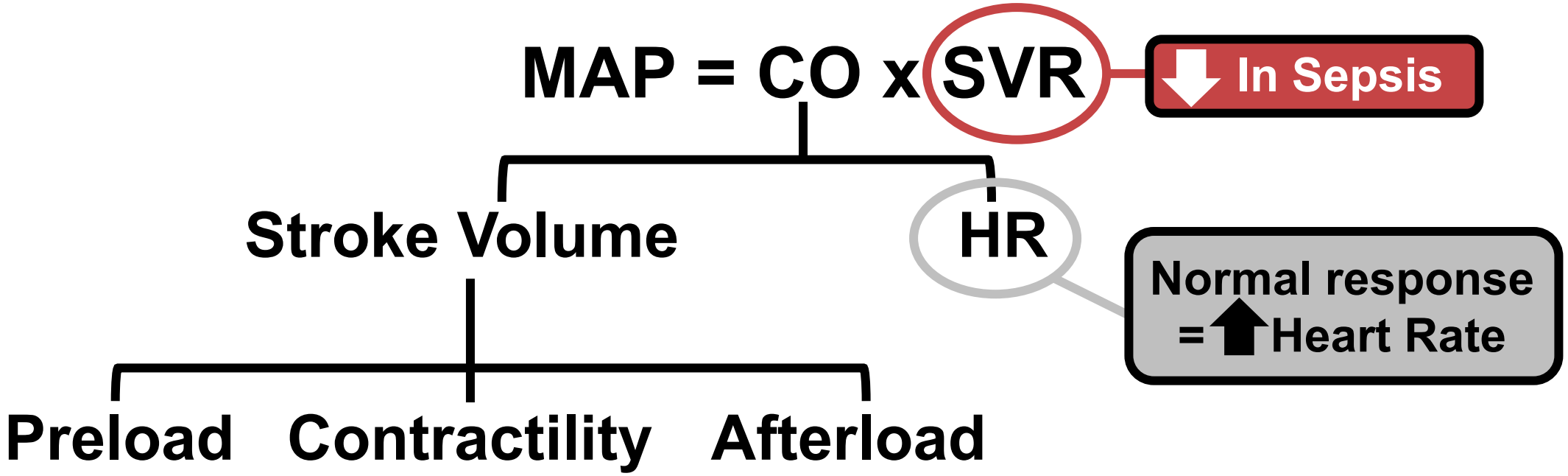
Cautious boluses in ESRD, CHF, pulm hypertension or peri-intubation patients (250cc → reassess!)

”Normal EF” in sepsis may actually be low
(Pressors augment cardiac output)

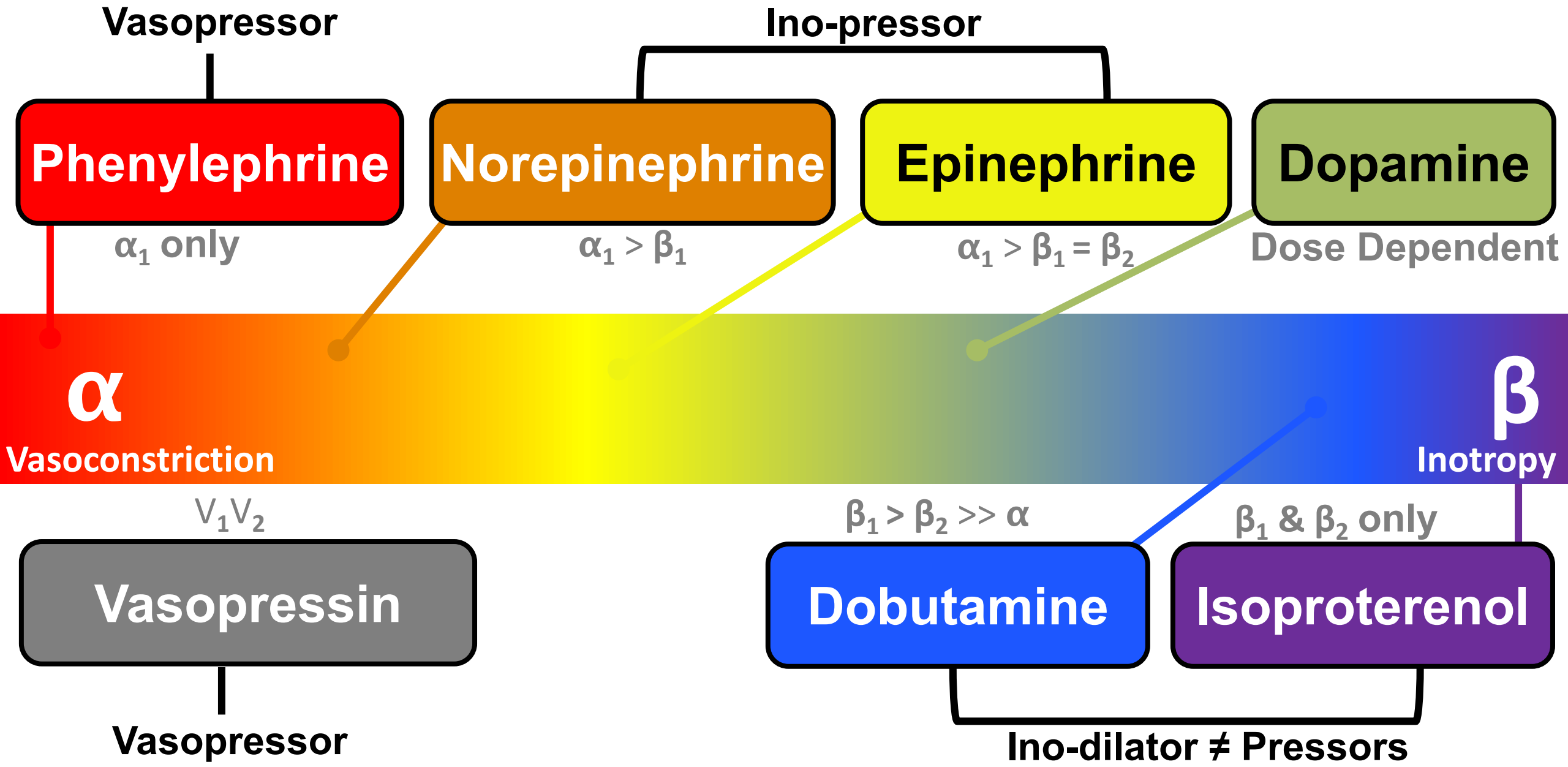
If not responding to pressors/fluid boluses → consider the “septic heart” (get a TTE)

Not all hypotension needs fluid!!
“Dry lungs are happy lungs”

Resuscitation in Sepsis



Vasopressors – Which one?



Vasopressors – Which one in **SEPIS**?

Norepinephrine

Ino-pressor

1

↑SVR ↑CO

Side effect: arrhythmogenic

Vasopressin

Vasopressor

2

↑SVR

Mortality benefit in septic shock

Epinephrine

Ino-pressor

3

↑SVR ↑CO

Side effect: arrhythmogenic

Dopamine

Inoconstrictor

OR

Phenylephrine

Vasopressor

4

Neither are great options ☹

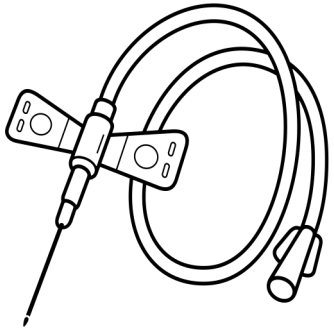
Vasopressors – Is Peripheral OK?

Phenylephrine

Norepinephrine

Epinephrine

OK Peripherally



20 GA PIV

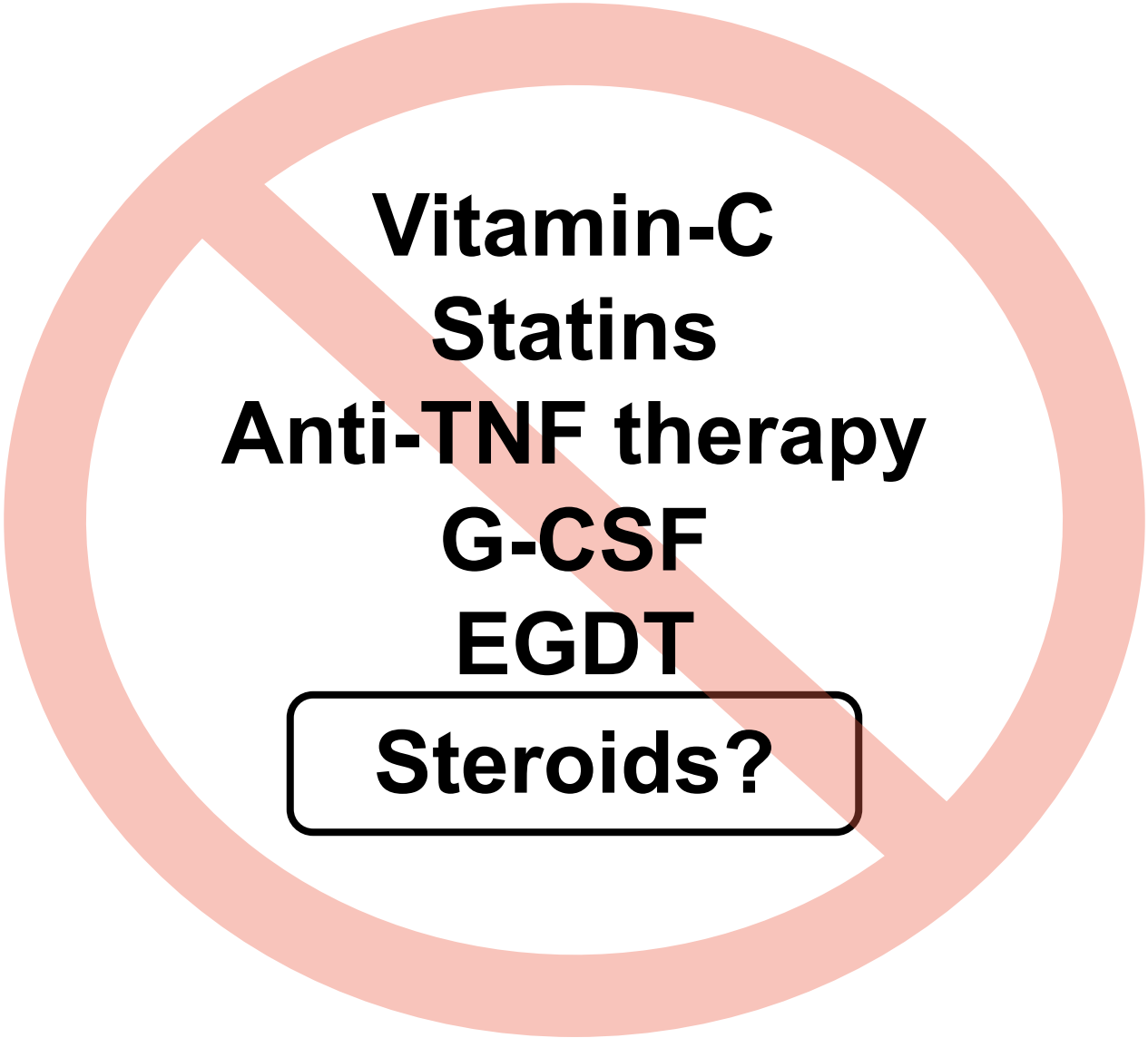
18 GA PIV

NOT in hand or wrist

Low dose for ~24hrs (or more?)

Emerg Med Austr 2020

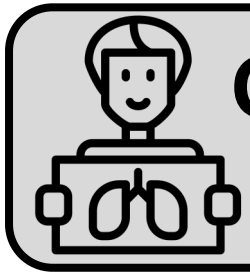
What Doesn’t Work?



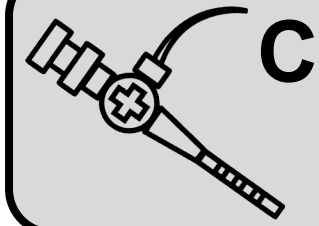
Phase 2 (6-24hrs): **Finding the Source**

START with careful history & physical

Obtain Blood/Urine/Sputum cultures
(*Try to get before ABX* BUT don't delay ABX)

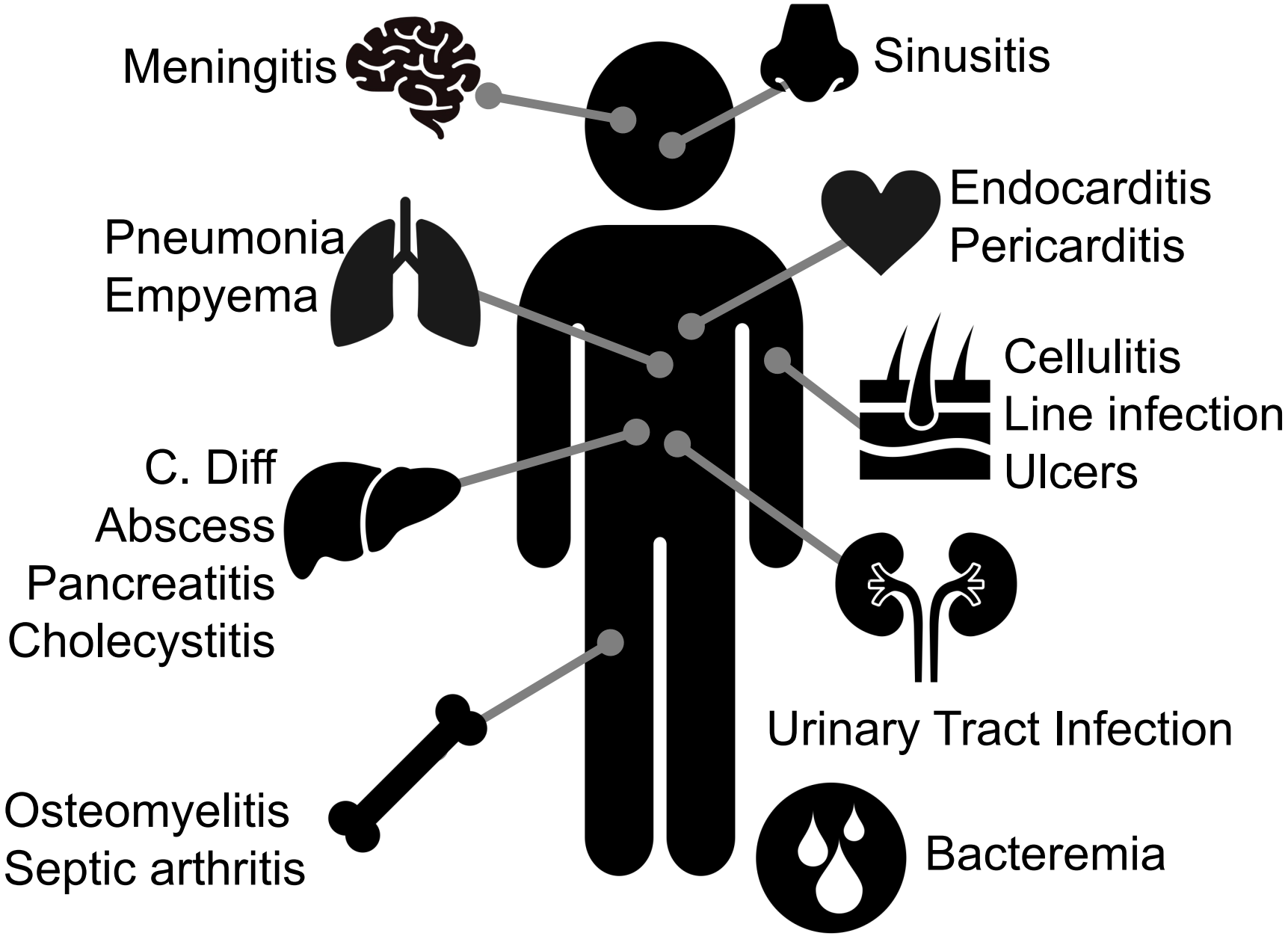


Obtain Basic Imaging (CXR/POCUS)
Consider advanced imaging (CT scan)



Consider advanced diagnostics
(Lumbar puncture, bronchoscopy, etc.)

Phase 2 (6-24hrs): **Finding the Source**



NON-infectious

Drug fever
Central fever
Malignancy
DVT/PE
Rheumatologic
Post-operative
Transfusion reaction
Transplant rejection
Adrenal Insufficiency

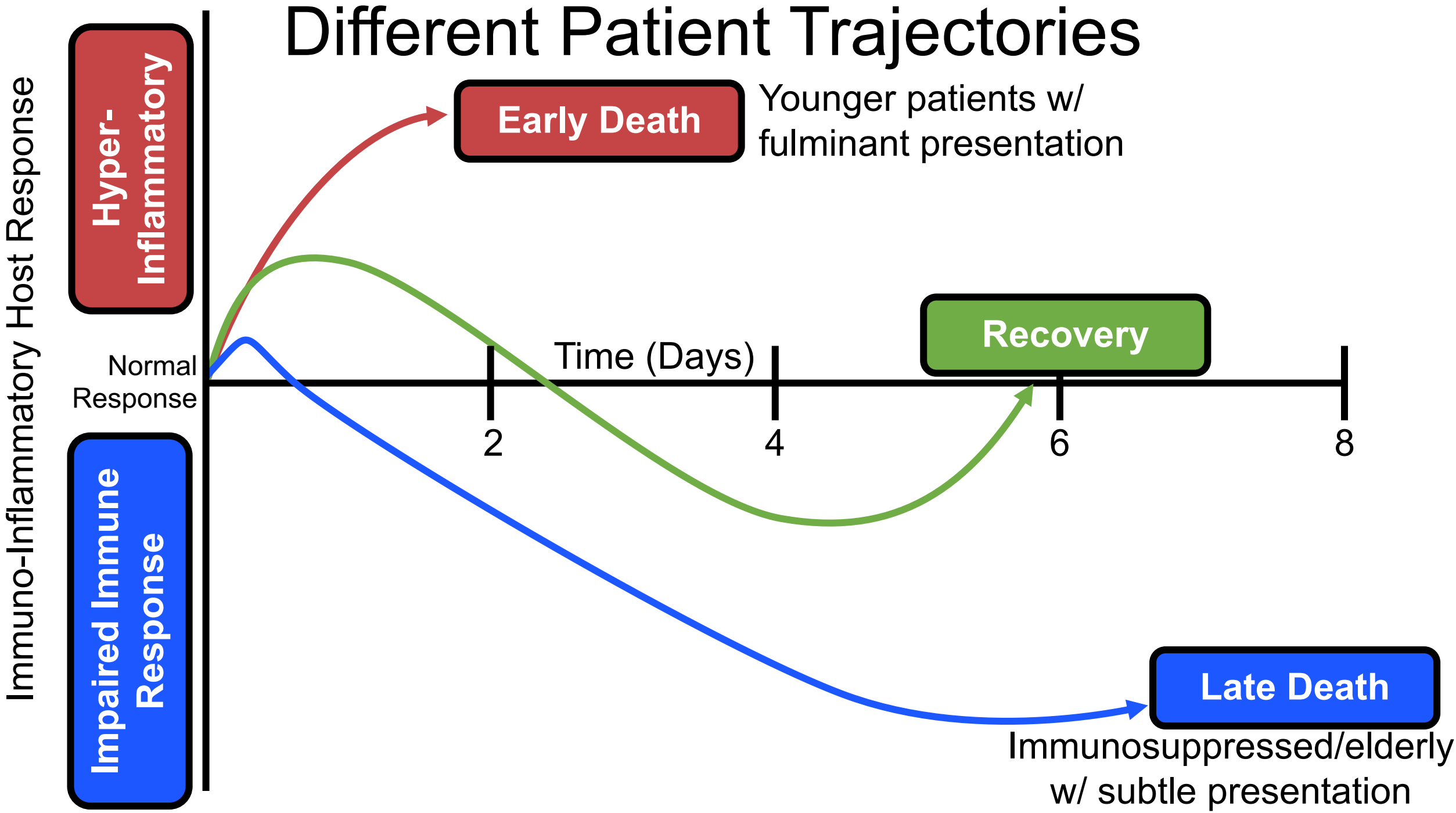
Phase 3 (1-3 days): **Limit Iatrogenesis**

Narrow antibiotics based on cultures (esp. vanco)

Consider diuresis! (Obligate ICU intake 2 - 4 L/day)

Limit harms! PT/OT, delirium precautions, de-line

Recognize different patient trajectories


Different Patient Trajectories
Immuno-Inflammatory Host Response
Hyper-Inflammatory
Impaired Immune Response
Normal Response
Time (Days)
2
4
6
8
Early Death
Younger patients w/ fulminant presentation
Recovery
Late Death
Immunosuppressed/elderly w/ subtle presentation

What about Covid-19?

Spoiler Alert: It's the same

2020 Surviving Sepsis Guidelines

DO use a **conservative fluid resuscitation strategy** for patients with COVID-19

DO use **balanced crystalloids** like **Lactated Ringer's** when available for **fluid resuscitation** for patients with COVID-19

DO use **norepinephrine** as **first-line vasopressor** for patients with COVID-19

SUGGEST using **epinephrine** or **vasopressin** as **first-line** if **norepinephrine NOT available** for patients with COVID-19

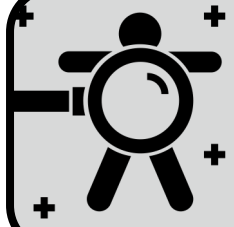
DO NOT use **dopamine** if **norepinephrine** is available for patients with COVID-19

DO add **vasopressin** as **second-line vasopressor** for patients with COVID-19 already on **norepinephrine**

DO target **mean arterial pressure** of **60 – 65 mmHg** for patients with COVID-19

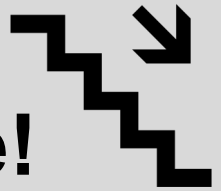
DO add **dobutamine** if there is **persistent hypoperfusion and cardiac dysfunction** after **fluid resuscitation and norepinephrine** for patients with COVID-19

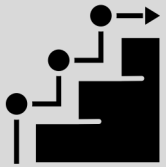
Take Home Points: **Treating Sepsis**



Early diagnostics & resuscitation matter!
Use fluids & vasopressors thoughtfully

Start with broad antibiotic coverage
BUT don't forget to de-escalate!





Search in a STEP-Wise fashion for the source
(Don't forget about those mimics)

Limit iatrogenesis! (*Do no harm!)*
PT/OT, delirium precautions, de-line, diuresis

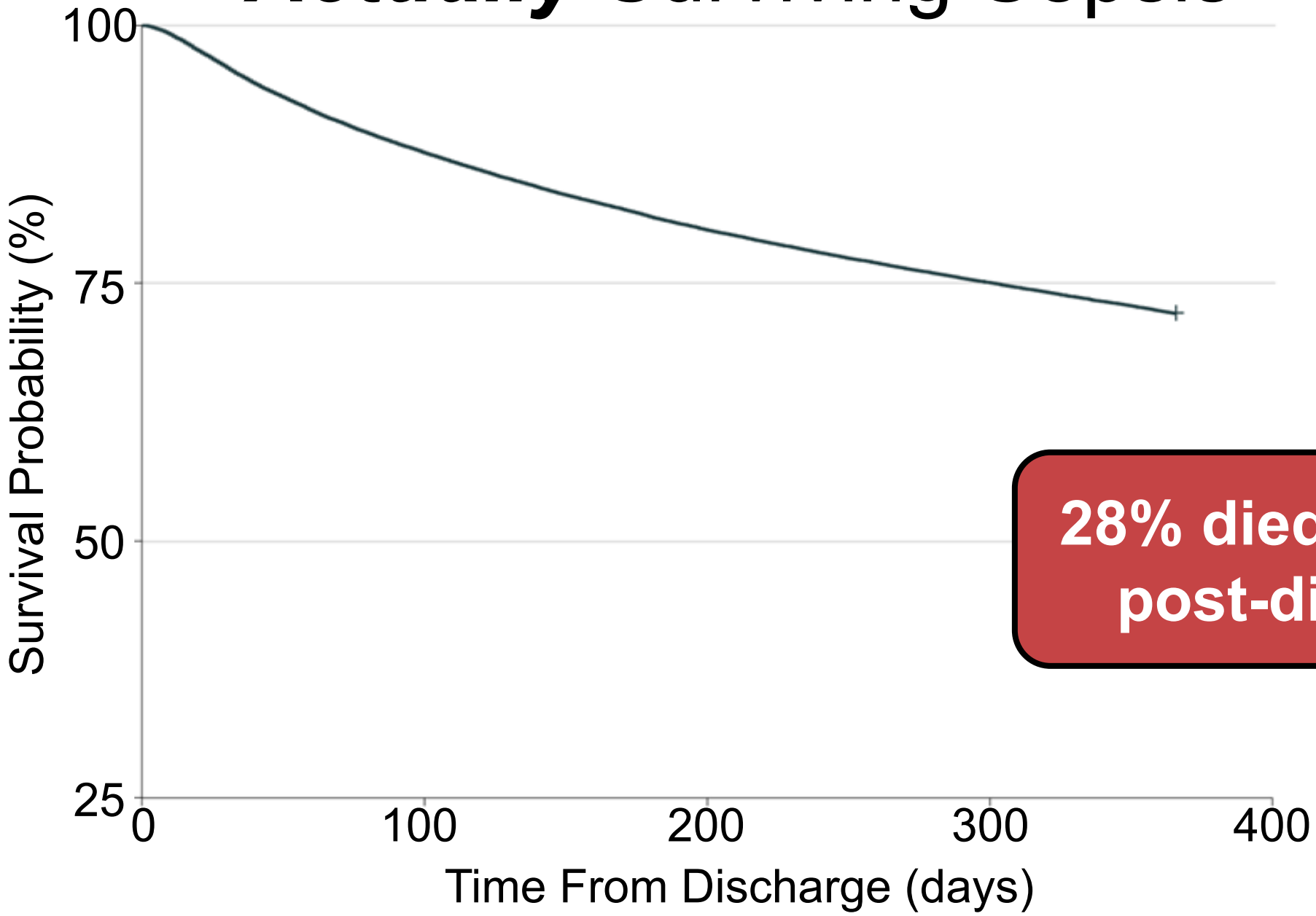
Objectives

Discuss the **diagnosis** & **diagnostic pitfalls** of sepsis

Develop a framework for the **management** of septic shock

Review post-sepsis care and **outcomes after the ICU**

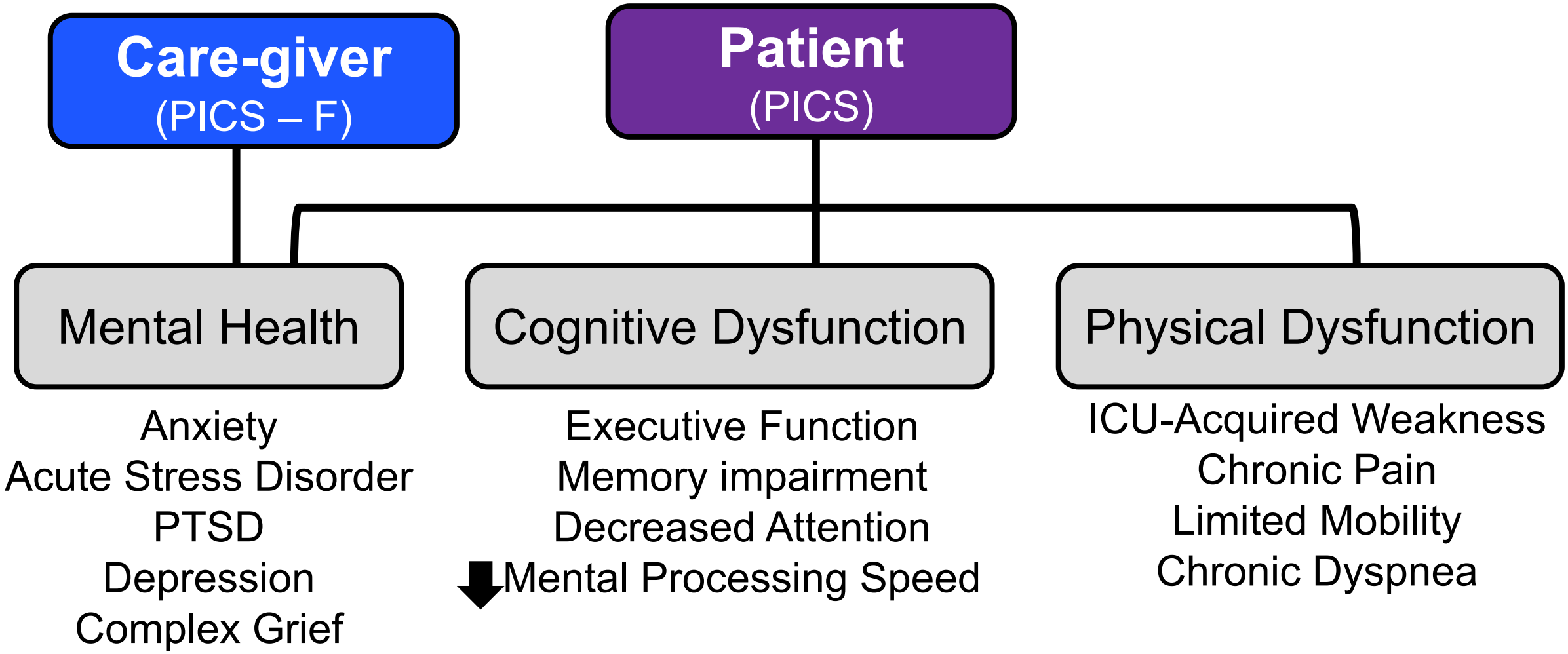
Actually Surviving Sepsis



28% died by 1-year post-discharge

Courtwright et al. JAMA Network Open 2020

Post-Intensive Care Syndrome

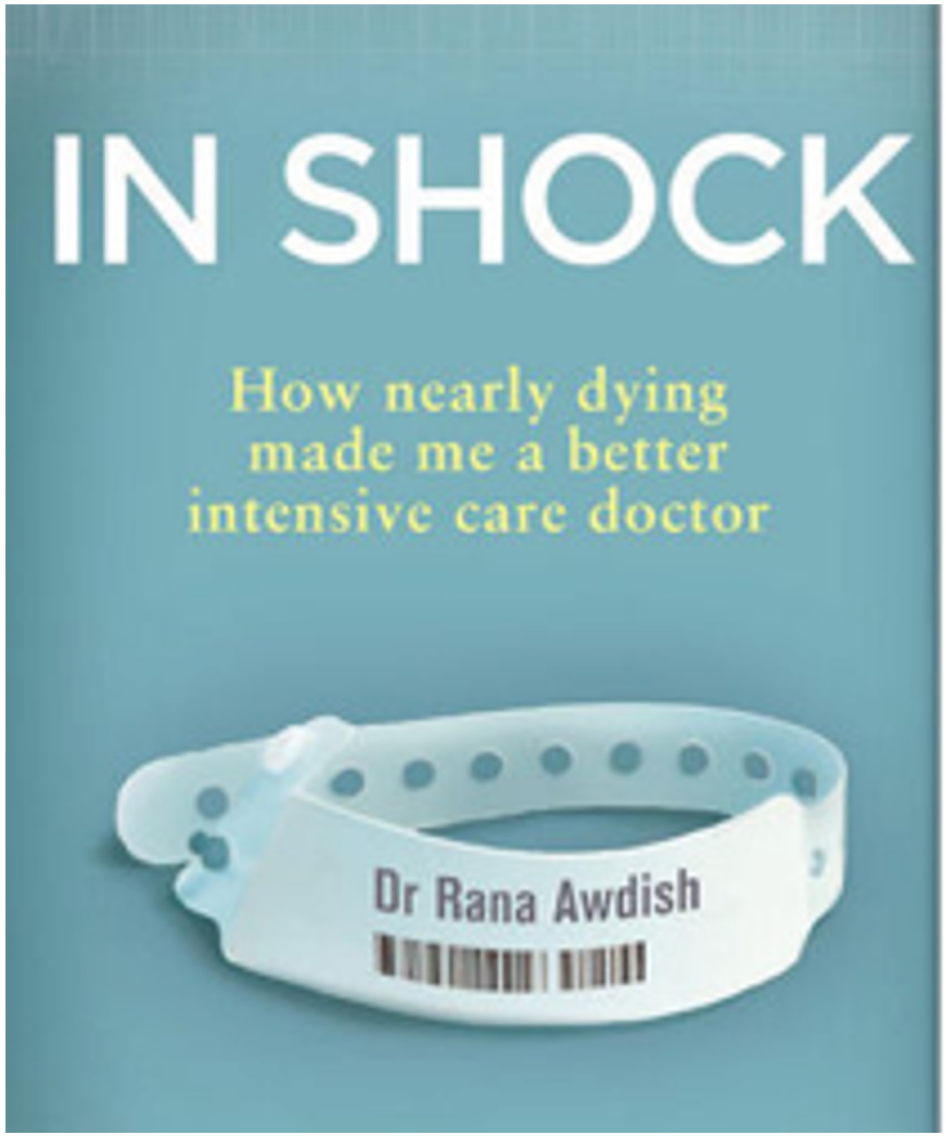


Courtwright et al. JAMA Network Open 2020

The OPTIMAL Clinic: Post-Covid ICU (p**O**st-covid/**P**os**T**-**I**cu **M**ultidisciplin**A**ry c**L**inic)

- Multidisciplinary Clinic with **Pulmonary**, **Geriatrics**, **Psychiatry**, **Integrative Medicine**, & partnerships with **Cardiology**, **Neurology**
- Integrated clinical follow-up and research arms
- Will see patients ~1 month post-discharge (virtual visit), 3 month, 6 month, 9 month, 12 months post-discharge
- **Please refer any patients at risk for Post-ICU Syndrome**

The Most Practice Changing Read on Shock



Awdish. In Shock. 2017

The REAL

Take Home Point

[Video]

Summary

Diagnosis of sepsis is challenging!

qSOFA isn't perfect AND Don't forget the mimics

EARLY ANTIBIOTICS are key!

→BUT Don't forget to de-escalate

Thoughtful volume resuscitation + pressor use

(Large PIVs OK for low dose pressors <24hrs)

At least 50% of those who survive the ICU experience Post-Intensive Care Syndrome

Thank you to **Dr. Lekshmi Santhosh**!
(from whom many of these slides were adapted)

Thank you!
Questions?

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