Sepsis

RECOGNIZING “SICK”

Objectives

Be able to define Sepsis

Define SIRS

Name at least one scoring tool for Sepsis

SEPSIS

-
- About 1.7 million adults develop sepsis each year.
- Nearly 270,000 die each year from sepsis
- 1 in 3 who dies in a hospital has sepis
  - CDC:2020 https://www.cdc.gov/sepsis/clinicaltools/index.html

SEPSIS

-

BETWEEN 28 AND 50 PERCENT OF PEOPLE WHO GET SEPSIS DIE!

AND WHY?

Old and young

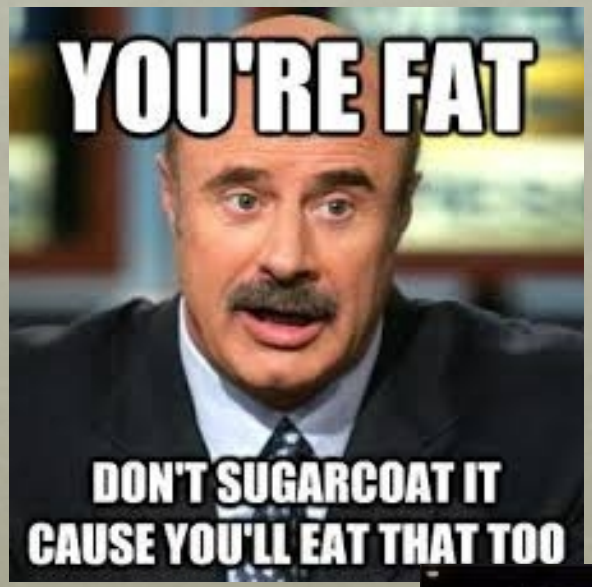
AGE: Very young and old have weak immune systems.



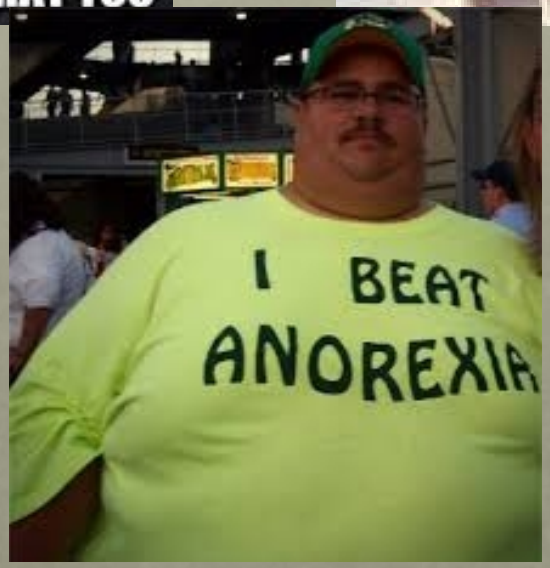




WE'RE GETTING FAT









Living conditions

LIVING CONDITIONS: Lack of heat, crowded quarters, squalor







IMMUNE STATE:
Cancer, Diabetes, Lupus, Drug Use, Alcohol, Homeless
…….. etc



MEDICATIONS:
Prednisone, Methotrexate, Chemotherapy.....







But there is more to sepsis

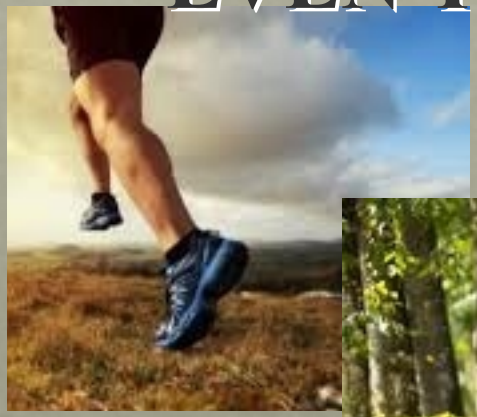
sepsis





E GROUPS

EVEN THE HEALTHY!





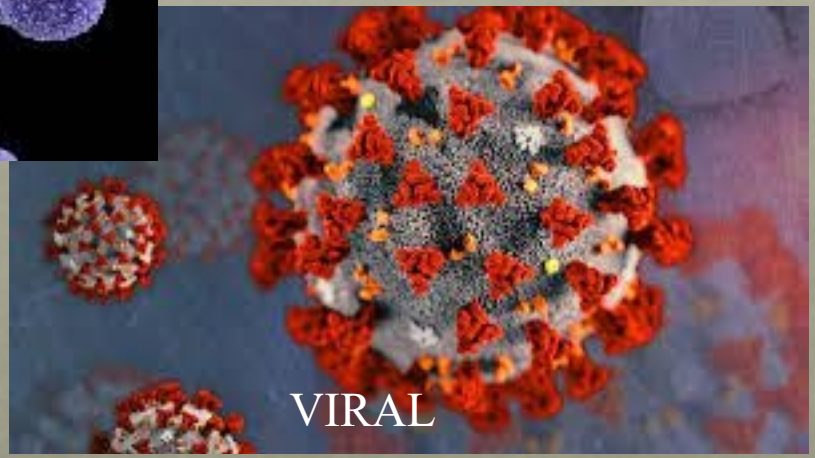


sepsis

CAUSES OF SEPSIS: ALWAYS AN INFECTION







sepsis

- Flu Pandemic of 1918
  - Infected 500 million worldwide
  - 20 – 50 million died
  - 675,000 Deaths in US
- Influenza deaths 1976-2006
  - Low: 961
  - High: 14,715
  - Average: 6309 CDC



Covid-19

CASES

WORLDWIDE:

- CASES:136,780,926
- DEATHS:2,951,945

Covid-19

CASES

UNITED STATES:

- CASES: 31,922,097
- DEATHS: 575,851

MASSACHUSETTS:

- CASES: 660,000
- DEATHS: 17,387

sepsis



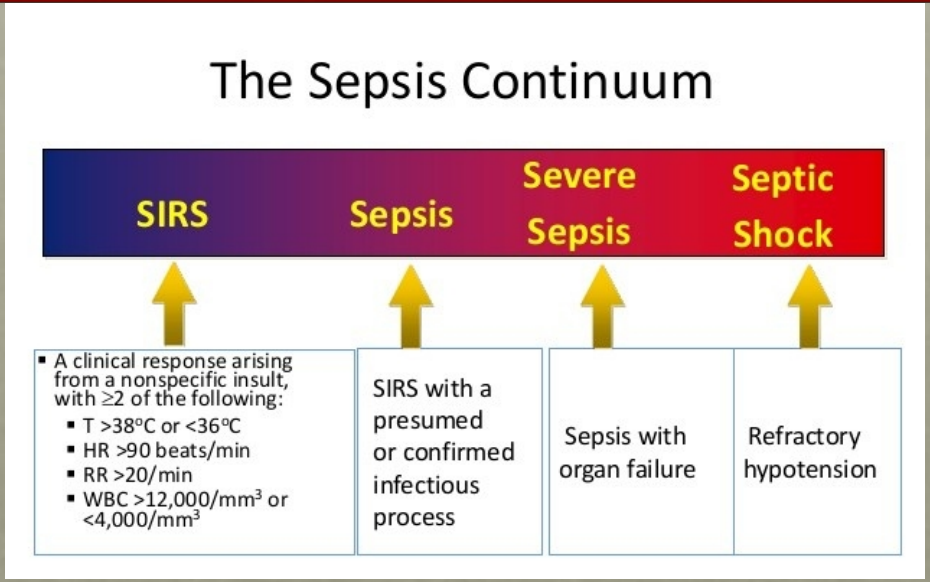
sepsis







WHAT IS SEPSIS?



sepsis

SEPSIS: “life-threatening organ dysfunction due to a deregulated host response to infection.” (*the third international consensus definitions task force)*

sepsis

INFECTION: a microbial invasion of normally sterile tissue with an inflammatory response to the invasion.

•MICROBIAL: Bacteria, Virus, Fungi.

•INFLAMMATORY RESPONSE: Body's response to the "microbial invasion".

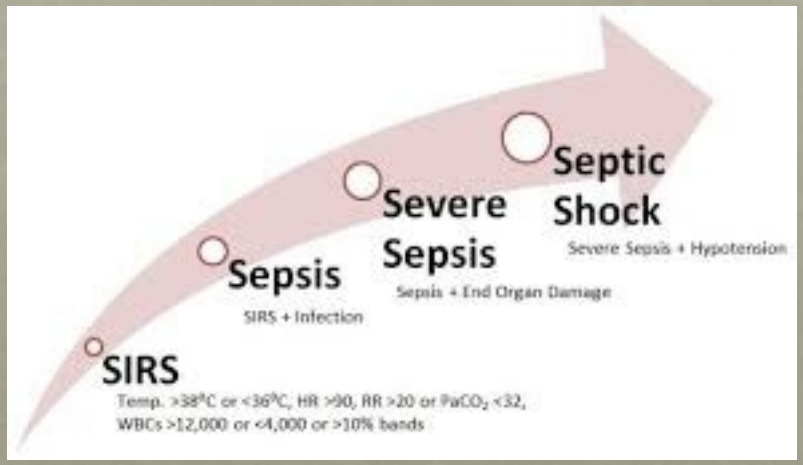
SEPSIS

- BACTEREMIA: Presence of bacteria within the bloodstream.
- Bacteria in the bloodstream (bacteremia) does not always lead to sepsis.



Severe sepsis

- SEVERE SEPSIS: Sepsis plus organ dysfunction, hypoperfusion or hypotension.

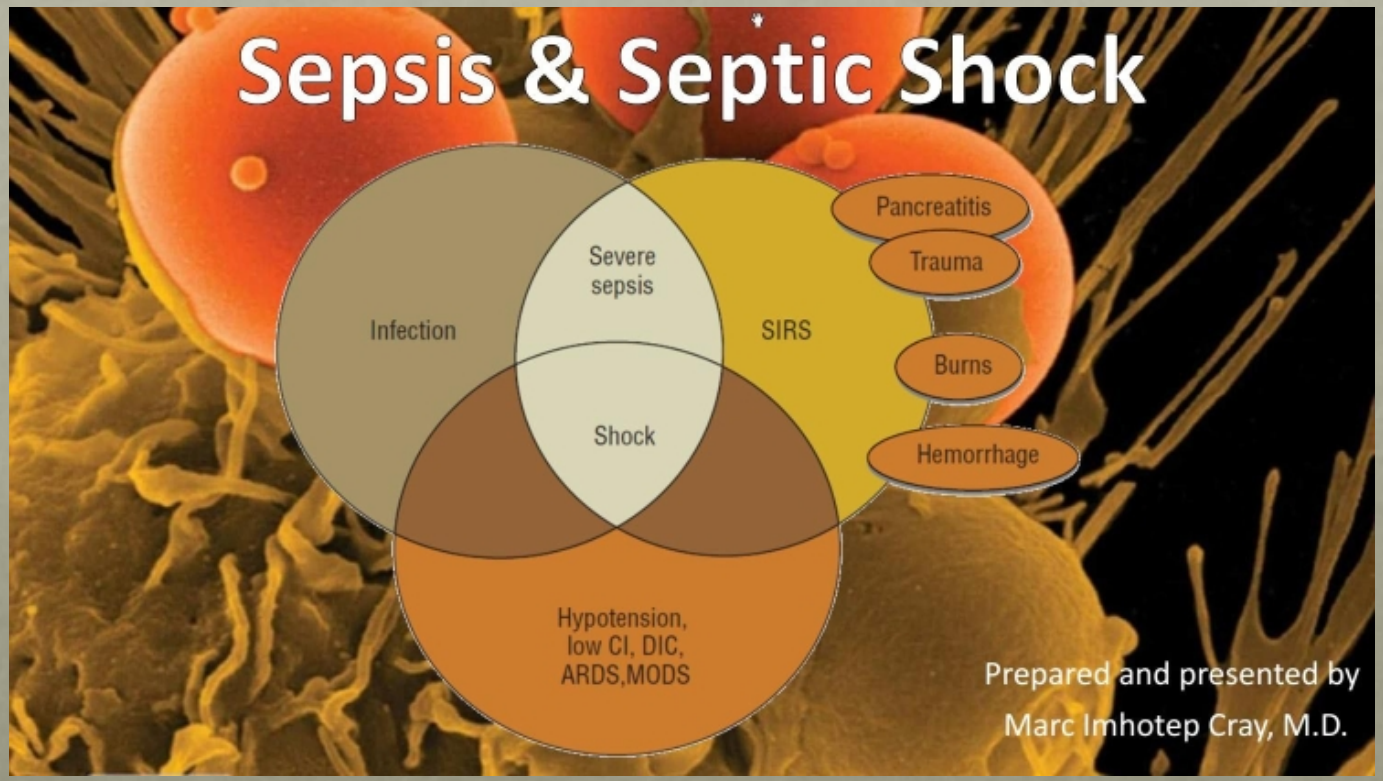


Severe sepsis

- ORGAN DYSFUNCTION: The body organs can't perform their normal function due to the spread of the bacteria.
  - Brain: mental status
  - Lungs: oxygen, carbon dioxide exchange
  - Heart: pumps blood
  - Vessels: regulates vessel size to maintain pressure and perfusion
  - Kidneys: Filtration and fluid regulation.
  - Liver: Mounts an immune response and filtration.

Septic shock

SEVERE SEPSIS WITH HYPOTENSION



DEFINING SESPIS

WARNING: All the terminology is changing.

SIRS

Systemic Inflammatory Response Syndrome

SIRS

DEFINED AS HAVING 2 OR MORE OF THE FOLLOWING:

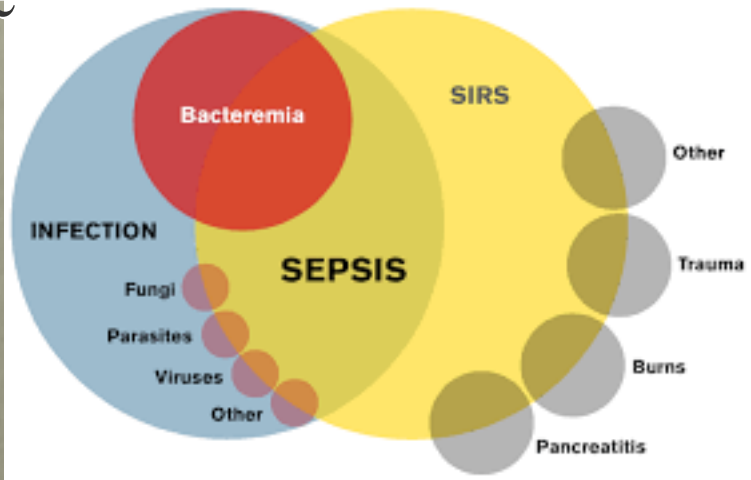
- Fever greater than 100.4 F
- Pulse greater than 90 ppm
- Respiratory rate greater than 20 per minute
- **$PaCO_2$ less than 32 mm Hg**
- Abnormal WBC count (greater than 12k or less than 4k or greater than 10% bands)

SIRS

NON-SPECIFIC AND NOT NECESSARLY SEPSIS

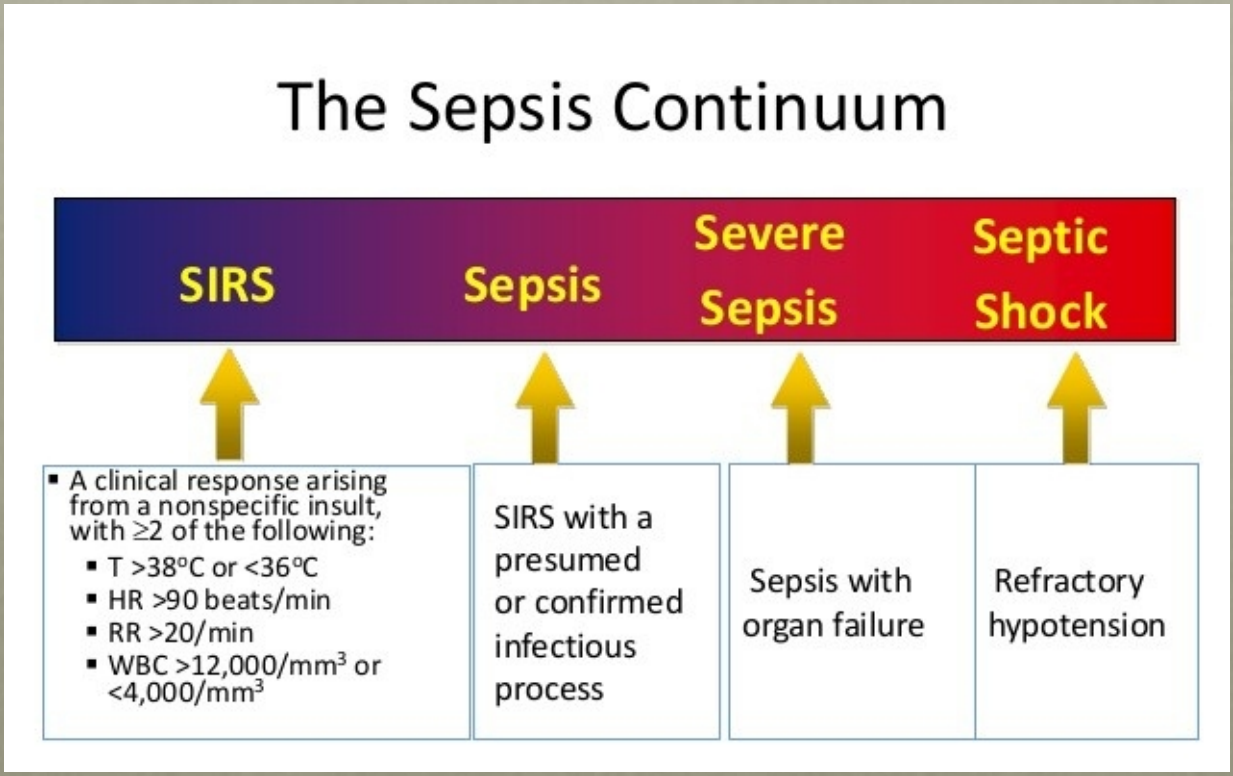
CAUSES:

- Ischemia: MI's, vascular occlusion
- Infection: Localized; UTI, pneumonia
- Inflammation: Auto-immune response
- Trauma



SEPSIS

- SEPSIS is the systemic response to infection.
- Sepsis = SIRS + a documented or presumed infection



sepsis

SEPSIS = SIRS (2 of the following) plus an infection.

- Fever greater than 100.4 F
- Pulse greater than 90 ppm
- Respiratory rate greater than 20 per minute
- **$PaCO_2$ less than 32 mm Hg**
- Abnormal WBC count (greater than 12k or less than 4k or greater than 10% bands)

Severe sepsis

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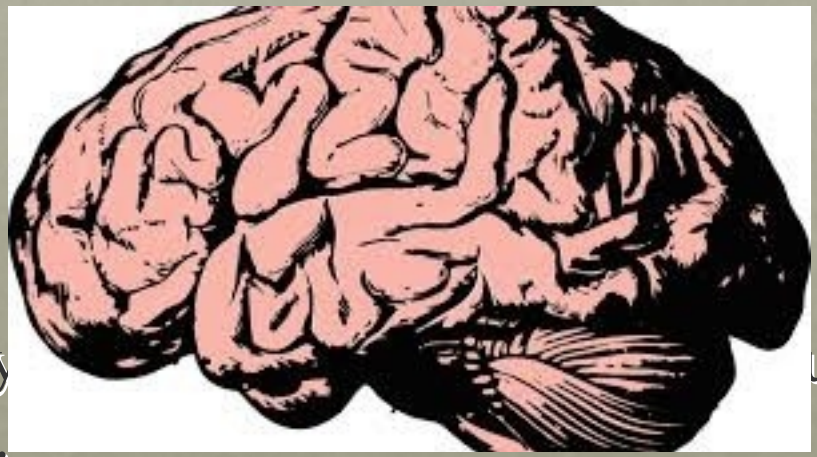
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THE BRAIN: Typically, there is a change in mental statu
(encephalopathy).

•Confusion

•Somnolence

•Lethargy



•Thought to be due to hy ular
dysfunction in the brain.

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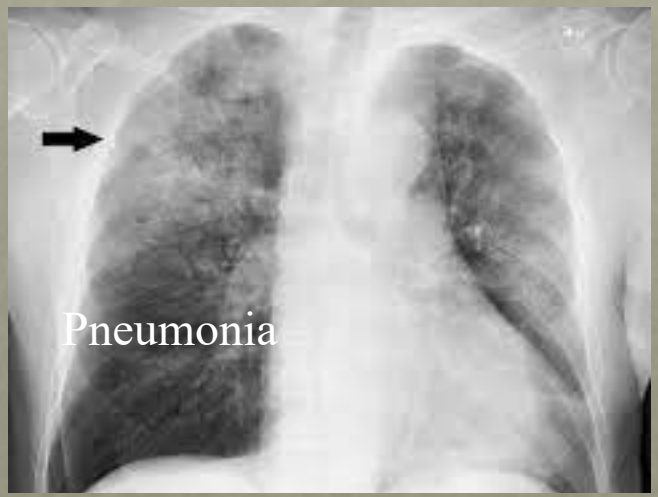
THE LUNGS:

•May be the source of the original infection

•Vessels in the lungs get injured allowing for “leaking” of fluid from the vessels into the lungs.

•ARDS; Acute Respiratory Distress Syndrome: when the lungs fill up with fluid.



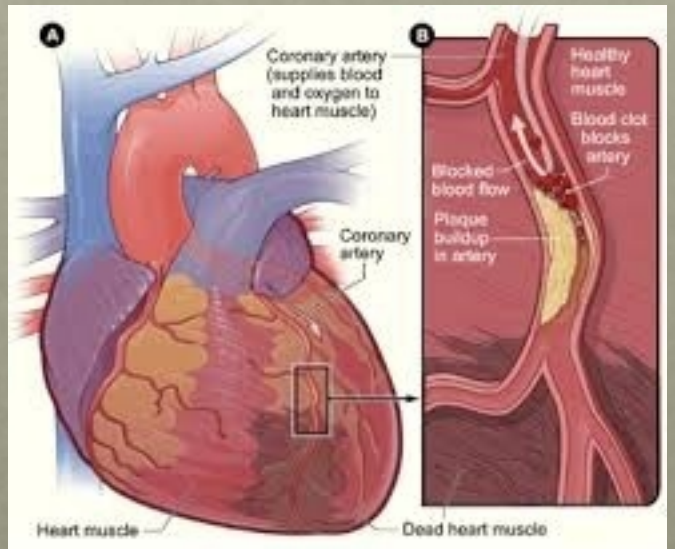


sepsis

THE HEART: The heart tries to compensate for the vessels dilating.

•Have early high output compensation

•Heart muscle gets to “stretched out” and decompensates resulting in in ability to contract.

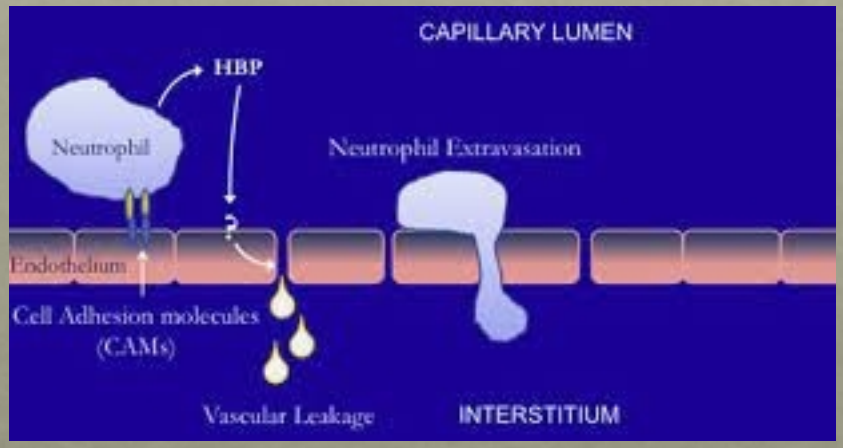


sepsis

THE VESSELS:

•Vessels dilate and result in hypotension

•Micro-vascular changes result in tissue and organs from getting oxygen and completing energy exchange so that the end organs can function.



sepsis

THE KIDNEYS: Diminished flow and disruption to the kidney's filtration system results in diminished output and lack of filtration of impurities…AND RENAL FAILURE



sepsis

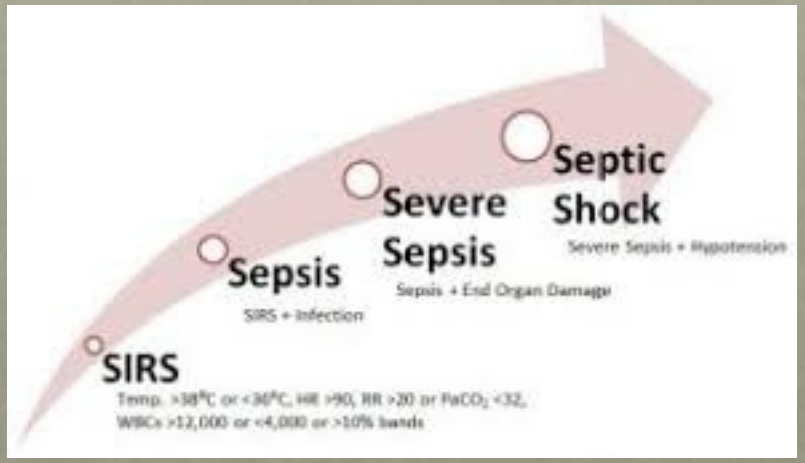
THE LIVER: Liver assists in the defense against infect and clearing bacteria. "Shock Liver" prevents this process and results in an elevated ammonia and worsening encephalopathy.



sepsis

SEPTIC SHOCK:

- Hypotension needing vasopressors to maintain a Mean Arterial Pressure of 65 mm Hg along with
- MAP Systolic + 2 Times Diastolic/3
  - Pressure needed to perfuse the brain
- A lactate of greater than two after adequate fluid resuscitation.



Pediatric sepsis

Pediatric sepsis

FACTS ABOUT SICK KIDS:

1.Kids are not little adults

2.Treating kids can be similar to being a veterinarian.

3.When sick, they go into overdrive and then go south quickly.

Pediatric sepsis

HISTORY Assessment

- Typically comes from the adults
- Medical conditions
- Find out about immunizations
- Sick contact
- Daycare?

Pediatric sepsis

OBSERVATION What is your PAT

- Kid look sick?
- Quiet?
- Weak? Floppy?
- Rash?

Pediatric sepsis

INITIAL ASSESSMENT

- Decreased mental status?
- Cold/cool extremities?
- Delayed capillary refill?
- Weak pulses? Are the central and peripheral different?
- Kid peeing?
- Hypotensive?

Pediatric sepsis

PEDIATRIC HYPOTENSION

- Less than one month: Systolic less than 60 mm Hg
- 1 month to 10 years: Systolic less than 70 + (2 x age in years).
- Greater than 10 years: Systolic less than 90 mm Hg

Ems Recognition of sepsis

Why all the fuss?

Recognizing sepsis



Recognizing sepsis

- 

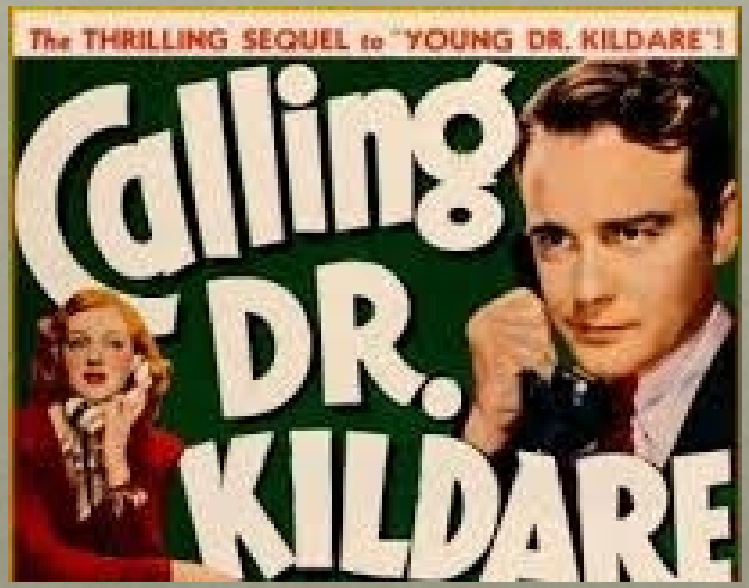
- Majority ambulance.





Recognizing sepsis

Early recognition means early intervention.



Recognizing sepsis



PRE-HOSPITAL RECOGNITION AND TRIAGE MEANS THE PATIENT GETS EARLY ATTENTION.

Early recognition prevents this



And assures a happy ending!



EMS RECOGNITION



“The secret is in the vitals”

Early warning score

- Use vitals and common physical findings and give them a score.
- This collates information so it can be critically analyzed.
- Used throughout the world as an “alert” to possible sepsis.

Early warning score

Chart 1: The NEWS scoring system

Physiological parameter	Score 3	2	1	0	1	2	3
Respiration rate (per minute)	≤8		9–11	12–20		21–24	≥25
SpO_2 Scale 1 (%)	≤91	92–93	94–95	≥96			
SpO_2 Scale 2 (%)	≤83	84–85	86–87	88–92 ≥93 on air	93–94 on oxygen	95–96 on oxygen	≥97 on oxygen
Air or oxygen?		Oxygen		Air			
Systolic blood pressure (mmHg)	≤90	91–100	101–110	111–219			≥220
Pulse (per minute)	≤40		41–50	51–90	91–110	111–130	≥131
Consciousness				Alert			CVPU
Temperature (°C)	≤35.0		35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	

Early warning score

Chart 2: NEWS thresholds and triggers

NEW score	Clinical risk	Response
Aggregate score 0–4	Low	Ward-based response
Red score Score of 3 in any individual parameter	Low–medium	Urgent ward-based response*
Aggregate score 5–6	Medium	Key threshold for urgent response*
Aggregate score 7 or more	High	Urgent or emergency response**

* Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care to a critical care team is appropriate.

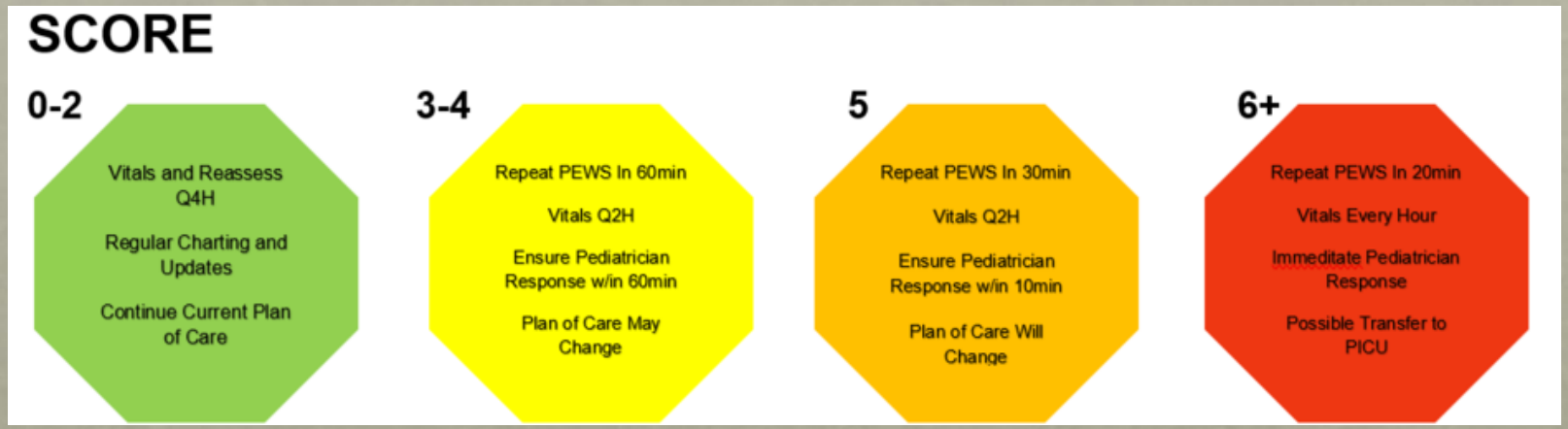
**The response team must also include staff with critical care skills, including airway management.

Pediatric early warning score (pews)

Table 1.1	0	1	2	3	Score
Cardiovascular	Pink **or** capillary refill 1-2 seconds.	Pale **or** capillary refill 3 seconds.	Grey **or** capillary refill 4 seconds. Tachycardia of 20 above normal rate.	Grey and mottled **or** capillary refill ≥5 seconds. Tachycardia of 30 above normal rate **or** bradycardia.	
Respiratory	Within established baseline. No retractions Room Air	≥10 above established baseline. Mild Contractions Up to 2L/min **or** 30%	≥20 above established baseline. Moderate Contractions Up to 4L/min **or** 40%	≥30 above established baseline. Severe Contractions Grunting Up to 5L/min **or** 50%	
Behavior	Playing/Appropriate or Sleeping	Irritable, but Consolable	Irritable and Inconsolable Restless **or** Pain	Lethargic or Confused Reduced Response to Voice or Pain	
Score an additional 2pts for nebulizer use, suctioning, or persistent vomiting after surgery.					
				Total	

Table 1.2	Retraction Severity	
Mild	**Moderate**	**Severe**
Subcostal or Substernal	Intercostal or Supraclavicular	Suprasternal or Sternal

Pediatric early warning score (pews)



Quick sofa

sequential organ failure assessment

- Uses 3 criteria to predict potential sepsis.
  1. Change in mental status from baseline.
  2. Systolic blood pressure less than or equal to 100
  3. Respiratory rate greater than or equal to 22.

  SCORE OF 2 OR GREATER HIGH RISK FOR SEPSIS AND ICU ADMISSION.



lactate

- A measure of perfusion.
- Increases with decrease in tissue perfusion
- Multiple other causes and does not equate with sepsis.
- Inversely related to survival; lower the number, the higher the chance of living.

Lactate & Co2

- Lactate results in acidosis.
- The early response to tissue or metabolic acidosis is to breath fast (blow down the CO2 to neutralize the acidosis)
- A CO2 OF 24 HAS CORRELATED WITH A LACTATE OF 4.

MEAN ARTERIAL PRESSURE

- MEAN ARTERIAL PRESSURE (MAP): A measure of the average pressure during one cardiac cycle.
- Better reflects organ perfusion.
- MAP of 65 mm Hg to 70 mm Hg goal to perfuse tissue in sepsis.

MEAN ARTERIAL PRESSURE

- MEAN ARTERIAL PRESSURE (MAP) of 65 mm Hg to 70 mm Hg goal to perfuse tissue in sepsis.
- MAP is measured by weighing the BP in thirds giving extra weight to the diastolic
- Done because the pressure is in diastole twice as long as systole.
- 2(diastolic) + systolic / 3

MEAN ARTERIAL PRESSURE

- MEAN ARTERIAL PRESSURE (MAP)
- MAP = 2(diastolic) + systolic / 3
- PATIENT BP = 80/56

MAP = (56 x 2) + 80 / 3

MAP = 112 + 80 / 3

MAP = 192 /3

MAP = 64

SUMMARY

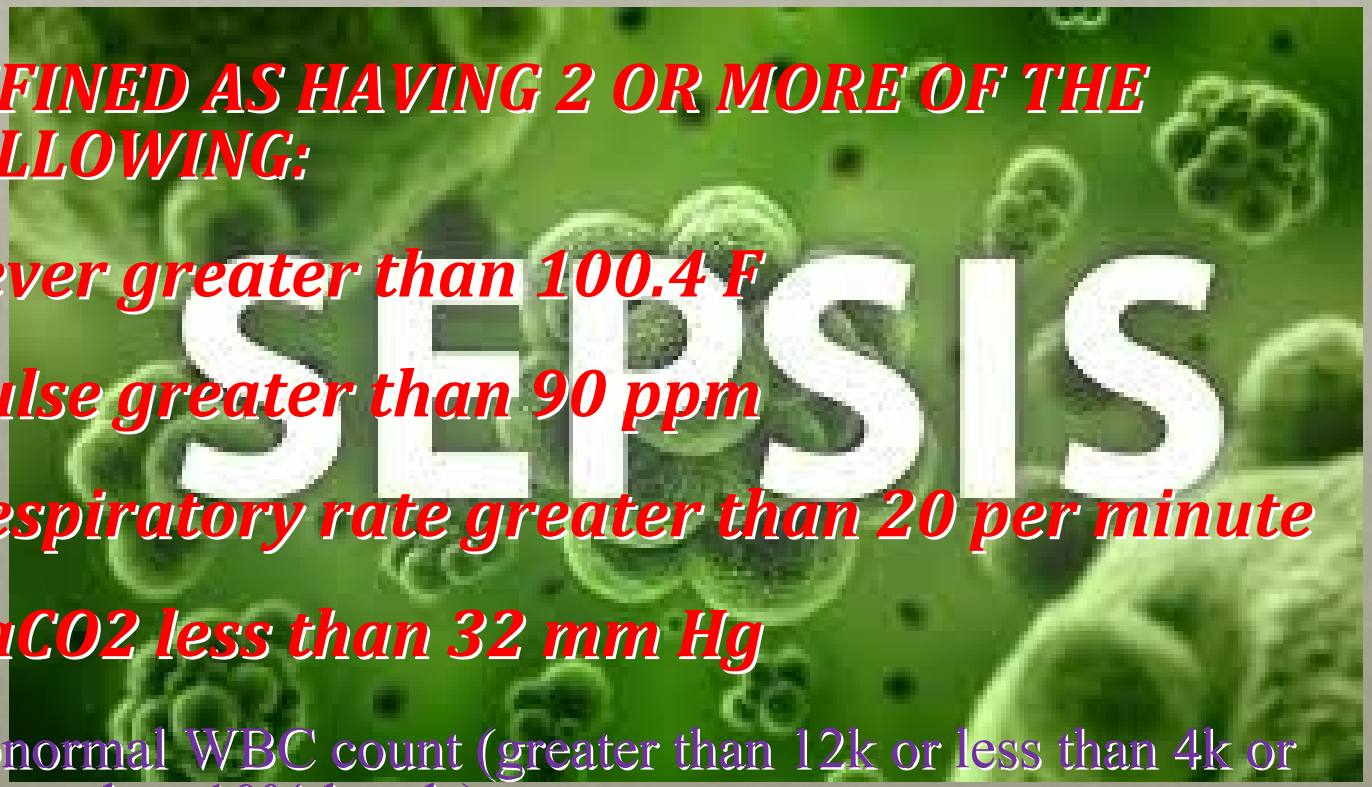
RECOGNIZE 'SICK'

Not all sick is sepsis, but this is the first step to treating those in the most need of our care.

RECOGNIZE 'SICK'

SIRS: Systemic Inflamatory Response Syndrome

SIRS



DEFINED AS HAVING 2 OR MORE OF THE FOLLOWING:

- ***Fever greater than 100.4 F***
- ***Pulse greater than 90 ppm***
- ***Respiratory rate greater than 20 per minute***
- ***PaCO2 less than 32 mm Hg***
- Abnormal WBC count (greater than 12k or less than 4k or greater than 10% bands)

NEWS 2

NEWS OF 5 OR ABOVE



QSOFA



- Change in mental status from baseline.
- Systolic blood pressure less than or equal to 100
- Respiratory rate greater than or equal to 22.

SCORE OF 2 OR GREATER HIGH RISK FOR SEPSIS AND ICU ADMISSION.

react

Begin to treat the patient and notify the hospital



respond

BE AGGRESSIVE!

- AIRWAY: O2, CPAP, ETT, END-TIDAL CO2
- IV: Aggressive Fluid Challenge
- PRESSORS: Dopamine, Levophed

MAP = 65 mm Hg or better