Urinary tract infection & Sepsis - prevention & detection

Judi Shaw-Rice MD

UnitedHealthcare – Community Plan of Texas

July 8, 2020

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Disclosure

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I have no actual or potential conflict of interest in relation to any product or service mentioned in this program or presentation.

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Learning Objectives

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At the end of this presentation you should:-

- 1. Understand the significance & difference between Uncomplicated and complicated UTI.
- 2. Understand when to collect a culture.
- 3. Understand the importance of recurring UTI in women, & when to use prophylactic Anbx.
- 4. Understand risk factors for developing a UTI – in men, women, and kids
- 5. Learn how to identify and prevent sepsis
- 6. Understand how life threatening and serious sepsis is and the avoidable cost

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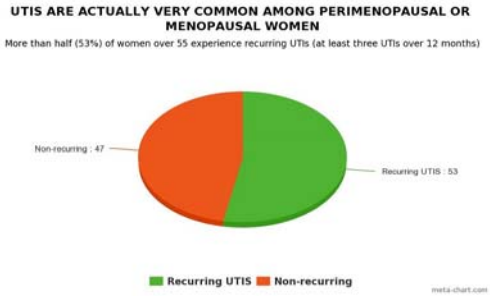
Urinary tract infection (UTI) - STATS

- Community-acquired UTIs account for @ 8M ambulatory visits & 1M hospitalizations each year in the USA
- 1M nosocomial UTIs are dx annually, primarily indwelling catheters associated UTIs
- Catheter- associated UTIs account for @ 40% of all healthcare –associated infections
- @ 50% of all women experience a UTI by 30yo, primarily due to sexual activity.
- @ 5% of otherwise healthy women who experience a UTI are at greater risk of developing future infections
- *Uropathogenic E.coli accounts for 75%-95% of all UTIs in women*



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Urinary tract infection – Risk Factors

- 1. **sexual activity** – mostly young women
- 2. **structural abnormalities** - Kidney stone, cyst
- 3. **functional abnormalities**
- 4. **Topical agents** – spermicides
- 5. **Foreign objects** – diaphragms, urethral catheterizations
- 6. **Disease states/conditions** :- Diabetes, pregnancy, Obesity, genetic factors Immunosuppression,

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Question #1

Uncomplicated means- infections in non-pregnant women without structural or neurologic abnormalities or comorbidities.

Is this statement
A. True
B. False

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Urinary tract infection – pathogenesis

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- **Classification :**
  - **By anatomic location**
    - lower : cystitis
    - upper: pyelonephritis, perinephric abscess
    - prostatitis
  - **By intensity** of possible illness, consequences and level of anticipated treatment (influences choice and duration of treatment)
    - **Uncomplicated**: infections in non-pregnant women without structural or neurologic abnormalities or comorbidities. Can still develop into severe ds/sepsis.
    - **Complicated**: men, pregnant women, persons w foreign bodies (indwelling catheters, Kidney stones ie calculi), kidney disease, immunocompromise, obstructions, urinary retention from neurologic ds, , healthcare assoc. infections, recent antibiotics use, age WITH comorbid conditions (not age alone)

Kids – common and important problem in childhood, challenging to dx

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Urinary tract infection – pathogenesis

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Asymptomatic bacteriuria:- lack of systemic signs or Sx of active infection

plus - 100K CFU/mL of a uropathogen from 2 consecutive voided specimens in women or one in men

or - 100 CFU/mL of one catheterizd specimen

*** NOT an indication of need for antibiotics **** (except in pregnant women or if GU procedure planned)

Recurrent UTI in women :- *require repeat culture*

1. **Relapse**(5-10% of cases):- infections that recur within 2 weeks of completing Anbx course w the same organism
   - suggested infection w a resistant strain of bacteria, incomplete treatment or a structural abnormality eg renal stone
2. **Reinfection**(most common):-presents >2 weeks after completion of anbx course
   - usual cause is a bacteria strain different from the initial infection

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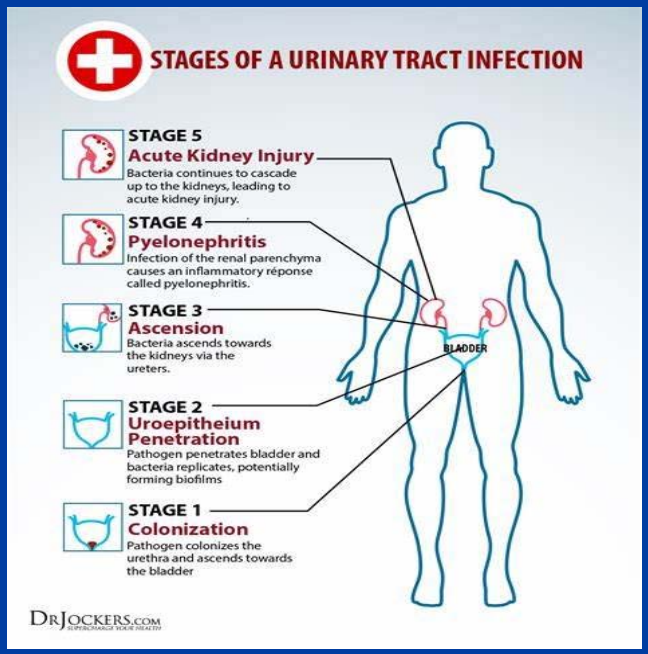

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Question #2

You must collect a urine culture on all people who have urine Sx?

A. true
B. False

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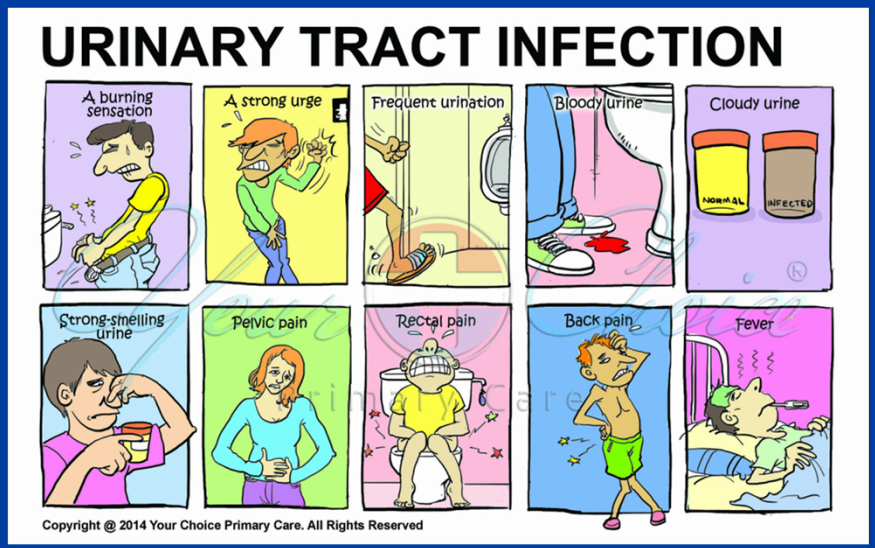
Symptoms



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UTI diagnosis – Symptoms/signs

- In outpatient setting:- need to distinguish lower from upper

Children:-

- children with Pyelonephritis tend to present with fever, *it can be difficult on clinical grounds to distinguish cystitis from pyelonephritis,* particularly in young children <2yrs old

- **Management**: - most >2 months old can safely be managed as outpatient with close follow up (* some studies suggest that outpt management may be considered for well-appearing infants 29-60days old, additional supporting evidence is needed)

- **Indications for hospitalization** :- age <2yo, clinical sx urosepsis (toxic, hypotension, poor capillary refill) immunocompromised, Vomiting or inability to tolerate oral medication lack of adequate outpt follow up (no telephone, distance) , failure to respond to outpt Rx.

- **Risk factors for recurrence** in kids <6yo: white race, age 3-5yrs, Grade IV toV Vesicoureteral reflux.

- **Long-term sequelae** - long term consequences of HTN, renal scarring, impaired renal growth and function; predicting remains difficult, the large majority of children have no long term sequelae

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Question #3

Cystitis and Pyelonephritis affects the same part of the urinary tract?

A. True
B. False

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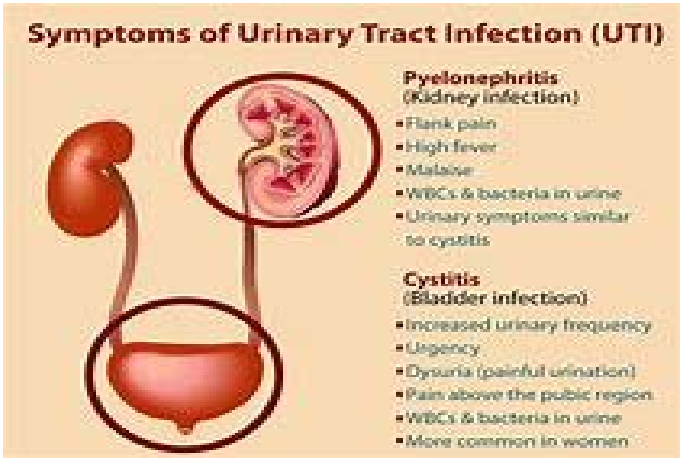
UTI diagnosis – Symptoms/signs



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How to diagnose UTI

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Culture - Mid stream clean-void urine culture

- Presence of pyuria, WBC in urine (>/10 leukocytes/uL)
  - can be detected on dipstick(leukocyte esterase) S/S 75-85%
  - pyuria can be caused by other non-infectious conditions
  - leukocyte casts indicate Pyelonephritis
- Bacteriuria, bacteria in the urine (100K colony-forming units CFU)
  - lower CFU can support dx in the presence of UTI Sx
  - Positive nitrite indicates presence of most Gm Negative bacteria
- Hematuria (blood in the urine)- microscopic or gross
  - can also be seen in non-infectious conditions eg kidney stones and tumors.

*** Cultures are not recommended in women w uncomplicated cystitis*

*** Cultures are indicated in pyelonephritis, complicated cystitis and recurrent UTIs*

Imaging – most cases do not require, however US can detect obstructions, Helical CT can detect kidney stones

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Question #4

Every time you find WBCs in the urine, you need to treat w Anbx?

A. True
B. False

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Prevention & Treatment for UTI

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Treatment

- 1. **Antibiotics** oral (for uncomplicated): Nitrofurantoin(5days); Bactrim(3days) ; Fosfomycin (1day);

  ** fluoroquinolones should not be used as 1st-line Tx due to increased resistance

  Prophylactic daily anbx - reduce the risk of recurrence by 95%, in women with >3 UTIs in prior 12 months, or >2 in the prior 6 months; 50% revert to prior recurrence within 6 months of d/c Anbx. Indicated for pregnant women previously treated for cystitis and asymptomatic bacteriuria to prevent recurrence
- 2. **fluids** :- oral and/or IV

Prevention

- 1. Symptomatic relief
- 2. Showers preferred not baths
- 3. Perineal cleansing : front to back
- 4. Voiding after intercourse
- 5. *Cranberry juice – has not been shown to work*
- 6. No perfumes etc in perineal area
- 7. avoidance of spermicide contraceptives
- 8 topical vaginal estrogens (due to menopausal effect)
- 9. Vitamins C (Ascorbic acid)

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What is sepsis?

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Question #5

No one dies from sepsis in 3 days?

A. True
B. False

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Which one of these can lead to sepsis?

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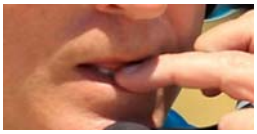
- A. 

B 

- C. 

D. 

- E. 

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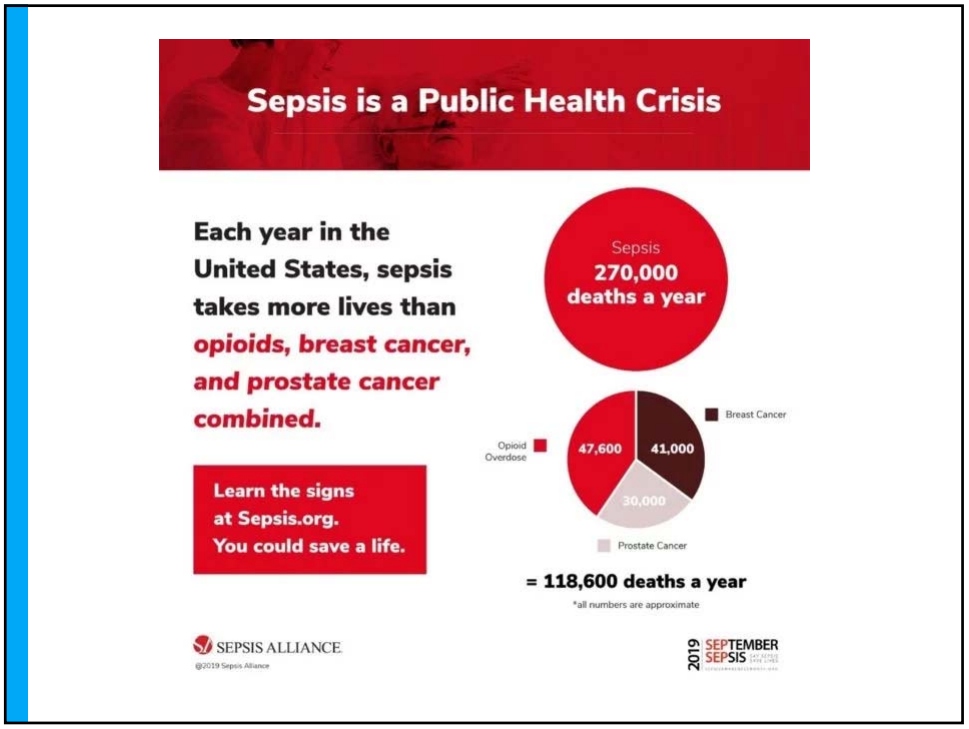

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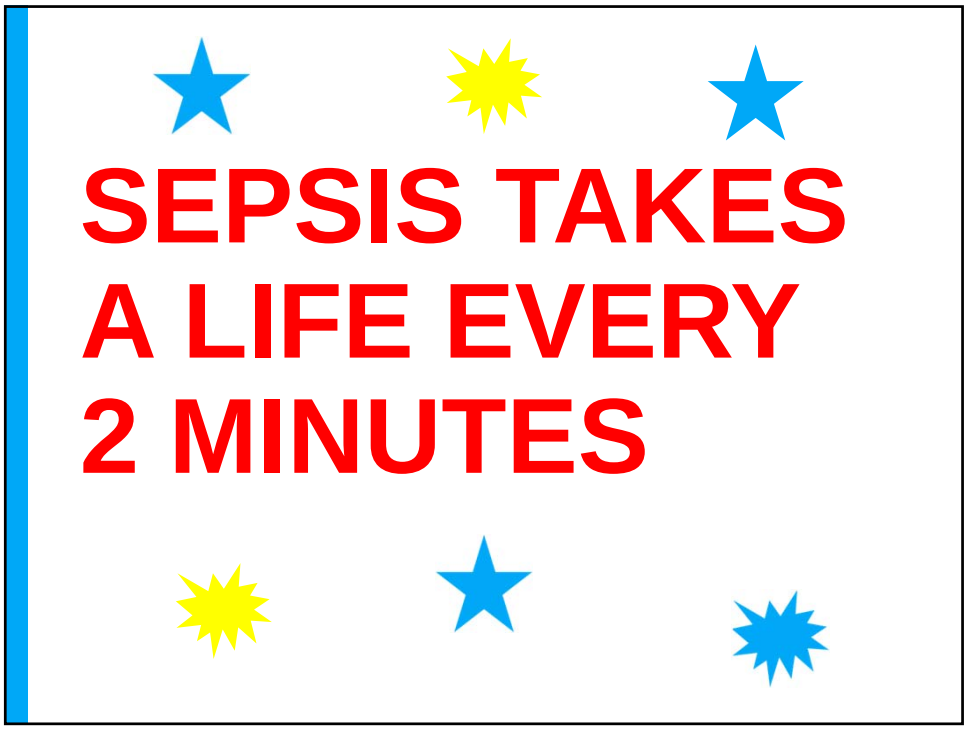

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Sepsis vs SIRS

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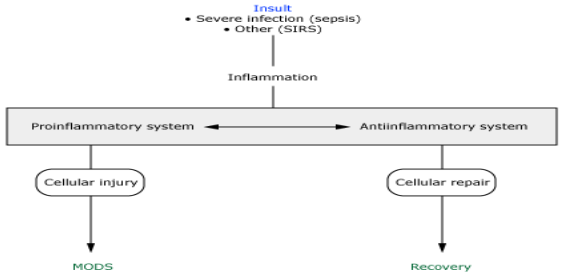
- **Sepsis** occurs when the release of proinflammatory mediators in response ***to an infection*** exceeds the boundaries of the local environment, leading to a more generalized response



- When a similar process occurs in response to a ***noninfectious condition*** (eg, pancreatitis, trauma), the process is referred to as **systemic inflammatory response syndrome (SIRS)**

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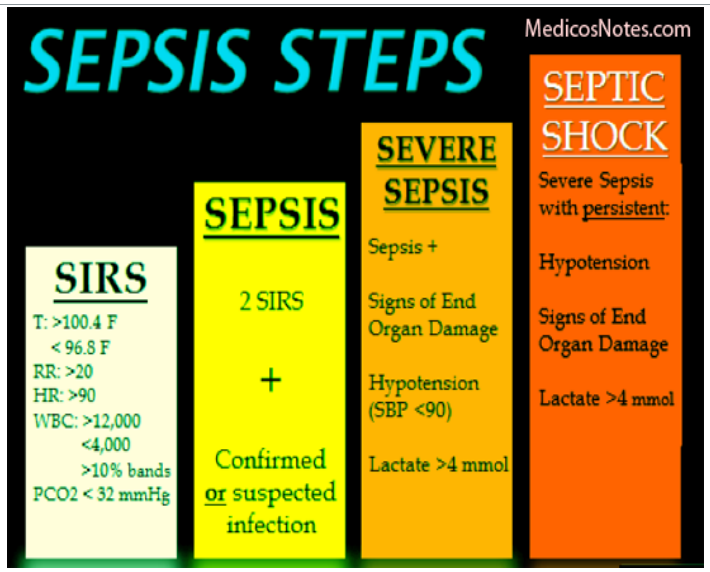

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Sepsis

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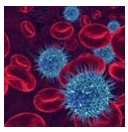

- **Sepsis can be conceptualized as malignant intravascular inflammation**
  - **Malignant** because it is uncontrolled, unregulated, and self-sustaining
  - **Intravascular** because the blood spreads mediators that are usually confined to cell-to-cell interactions within the interstitial space
  - **Inflammatory** because all characteristics of the septic response are exaggerations of the normal inflammatory response.

- It is uncertain why immune responses that usually remain localized sometimes spread beyond the local environment causing sepsis. The cause is likely multifactorial and may include the direct effects of the invading microorganisms or their toxic products, release of large quantities of proinflammatory mediators, and complement activation. In addition, some individuals may be genetically susceptible to developing sepsis.

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EFFECTS OF SEPSIS

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- Despite a clear understanding of the inflammatory and coagulation mechanisms triggered during the early stage of severe sepsis, *not much is known about the cellular aspects underlying the mechanisms that ultimately lead to organ dysfunction and death.*

- **SYSTEMIC** - ***Widespread cellular injury*** may occur when the immune response becomes generalized; cellular injury is the precursor to organ dysfunction. *The precise mechanism of cellular injury is not understood*, but its occurrence is indisputable as autopsy studies have shown widespread endothelial and parenchymal cell injury.

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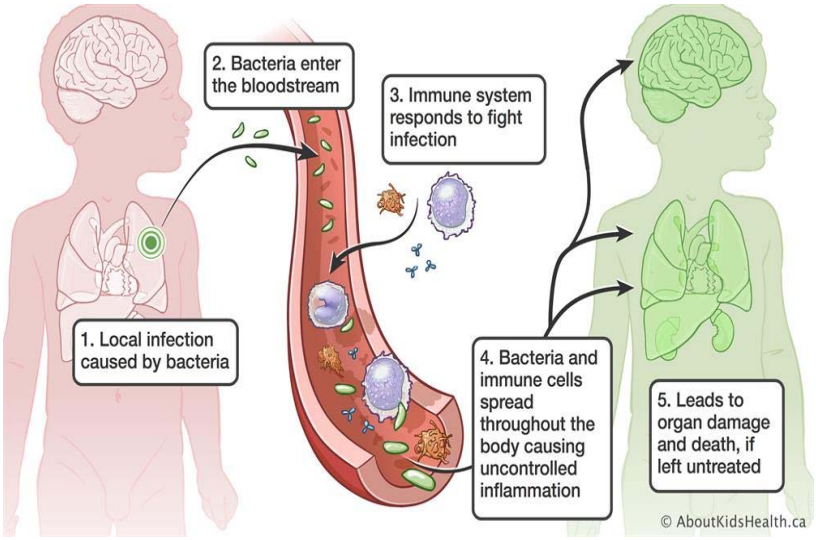

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Effects of sepsis

ORGAN – SPECIFIC - The cellular injury described above, accompanied by the release of proinflammatory and anti-inflammatory mediators, often progresses to organ dysfunction. Cellular injury is the precursor to organ dysfunction. The precise mechanism of cellular injury is not understood, No organ system is protected from the consequences of sepsis.

- **- Circulation** — Hypotension due to diffuse vasodilation is the most severe
- **- Lung** — Endothelial injury in the pulmonary vasculature, the result is pulmonary edema, which creates ventilation-perfusion mismatch and leads to hypoxemia.
- **- Gastrointestinal tract** — The circulatory abnormalities typical of sepsis may depress the gut's normal barrier function, allowing translocation of bacteria and endotoxin into the systemic circulation
- **- Liver** — The reticuloendothelial system of the liver normally acts as the first line of defense in clearing bacteria and bacteria-derived products that have entered the portal system from the gut. Liver dysfunction can prevent the elimination of enteric-derived endotoxin and bacteria-derived products,
- **- Kidney** — Sepsis is often accompanied by acute renal failure. The mechanisms by which sepsis and endotoxemia lead to acute renal failure are incompletely understood. Acute tubular necrosis due to hypoperfusion and/or hypoxemia is one mechanism
- **-Nervous system** — Central nervous system (CNS) complications occur frequently in septic patients, often before the failure of other organs. The most common CNS complications are an altered sensorium (encephalopathy). The pathogenesis of the encephalopathy is poorly defined.

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SEPSIS IS PREVENTABLE!!

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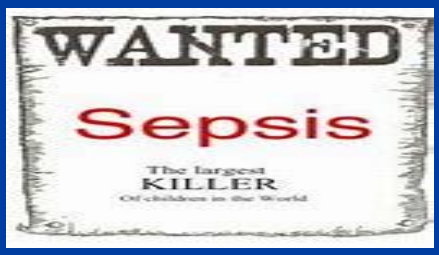

What are the sources of sepsis?

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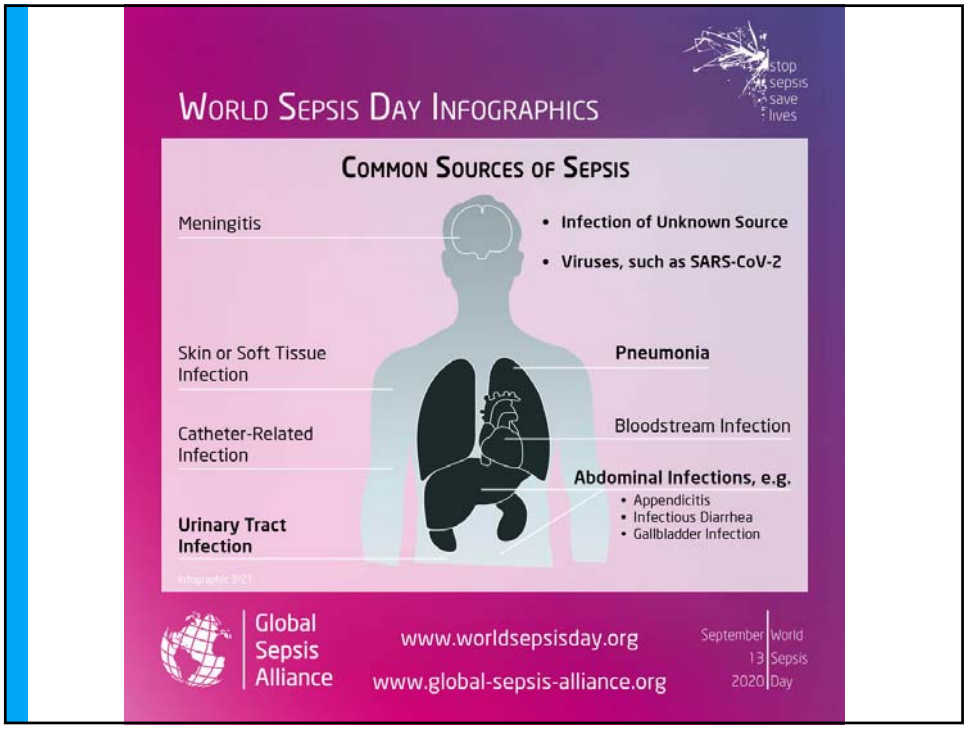

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Question #6

UTIs can be caused by all kinds of bacteria, there's really no predominant one?

A. True
B. False

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What is the primary source of sepsis?

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- ***Determining the source of infection is critical to therapeutic decisions, as the most likely pathogen involved, and thus appropriate empiric therapy, depends on the site of the primary infection, and varies depending on the patient population.***

- ***Gram-negative bacilli*** **are the cause of approximately a 25% to 50% of all bloodstream infections**, depending on geographic region, whether the onset of the infection is in the hospital or community, and other patient risk factors.

- Since the 1980s, gram-positive aerobes (eg, coagulase-negative staphylococci, Staphylococcus aureus, and enterococci), and Candida species have increased in relative importance.

(Gram-negative bacillary bacteremia in adults - Authors:Rebekah Moehring, MD, MPHDeverick J Anderson, MD, MPH)

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What is the source of sepsis?

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- **Hospital setting** –
  - Most hospitalized patients with gram-negative bacteremia have at least one comorbid condition
  - Other important procedure-related risk factors for gram-negative bacteremia include prostate biopsy and endoscopic retrograde cholangiopancreatography

- In a study of 179 cases of hospital-onset gram-negative bacillary bacteremia identified from a large database of acute care hospitals in the United States, reflects the observation that the urinary tract, in which E. coli is the most common pathogen, is the most common source for community-onset gram-negative bacteremia, whereas infections of the urinary, respiratory, and gastrointestinal tracts contribute more equally to hospital-onset bacteremia

  - (Gram-negative bacillary bacteremia in adults - Authors:Rebekah Moehring, MD, MPHDeverick J Anderson, MD, MPH)

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What is the source of sepsis?

- **Community-onset infections –**

In a study from two tertiary care centers in the United States, 45 % of community-onset bloodstream infections were due to gram-negative bacilli in contrast to 31 % of hospital-onset infections

- Gram-negative bacilli cause a higher proportion of community-onset than hospital-onset bacteremias, since community-onset bacteremias are more likely related to primary infections of the urinary tract, abdomen, and respiratory tract as opposed to device-related infections.
- frequently occurs in the elderly
- natural disasters involving trauma in water are also at increased risk for infections caused by gram-negative bacilli
- Urinary retention and recent urogenital surgery as host factors independently associated with the risk of bacteremia
- Several studies of elderly patients in the community, in nursing homes, or admitted to hospitals, have identified the *urinary tract as the most frequent source of gram-negative bacteremia*. Infections of the gastrointestinal tract, biliary tract, and skin or soft tissues are less frequent sources of bloodstream infections.

(Gram-negative bacillary bacteremia in adults - Authors:Rebekah Moehring, MD, MPHDeverick J Anderson, MD, MPH)

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SEPSIS IS PREVENTABLE!!

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What are the symptoms of Sepsis?

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Question #7.

List signs/Sx of sepsis?

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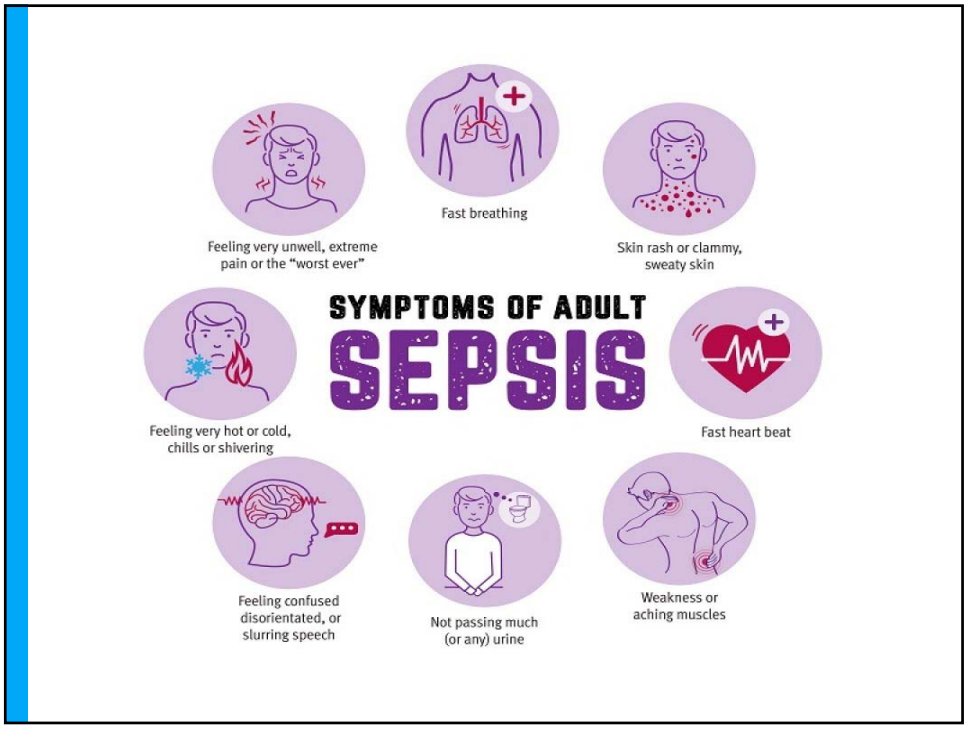

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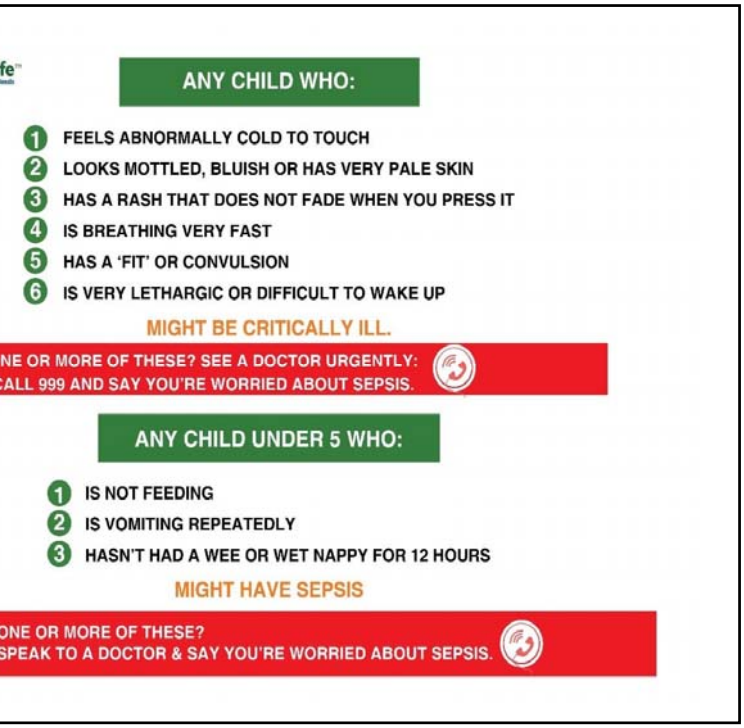

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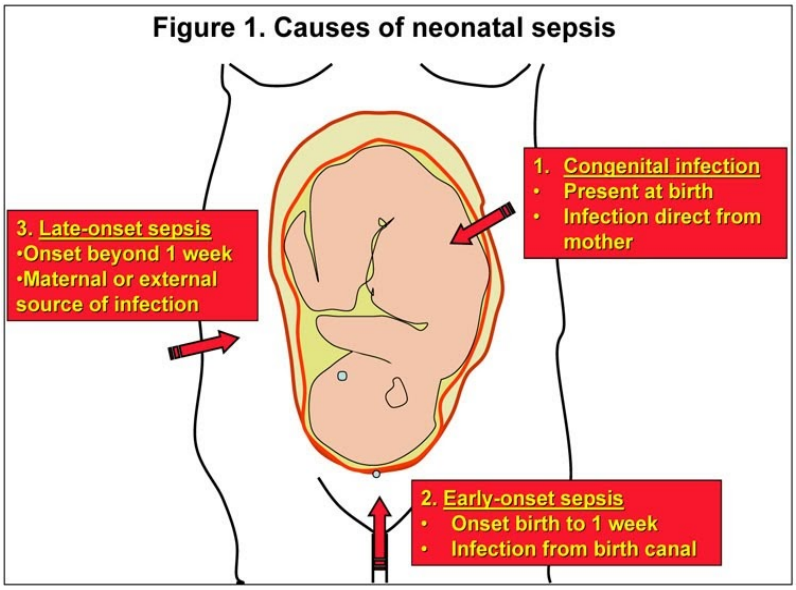

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How bad a problem is sepsis?

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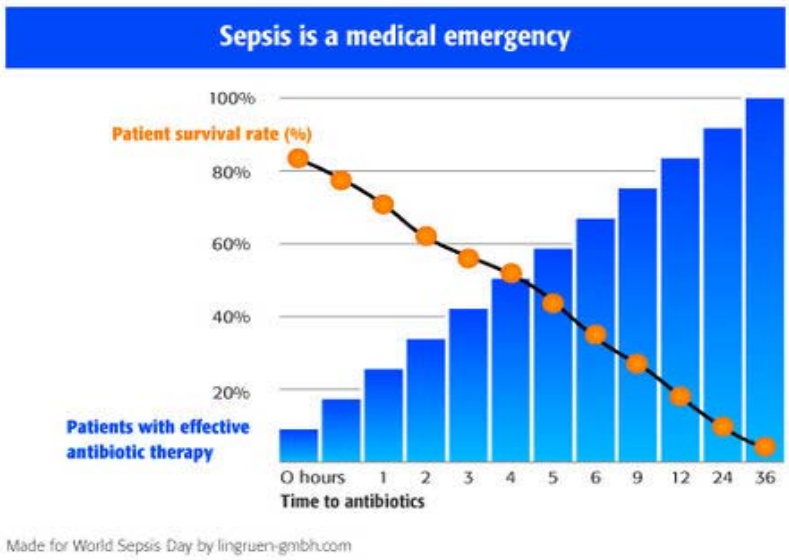

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How much does it cost UHC – TX?

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- **Q3 & Q4 2019** (Dx 1 &2) **- UHC C&S all LOB**

- **Cost of all sepsis Dx admissions - $59 Million**
- - unspecified organism* :- $36 Million
  - E.coli :- $3.1 Million
  - Gm negative (all except E.coli):- $1.6 Million

Cost of Urinary Dx(UTI, pyelo) :- $5.8 Million

Costs of all sepsis Dx 1 only in Star Kids :- $2.6 Million
- Gm Negative (all):- $104 K

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Question #8

Sepsis is preventable?

A. True
B. False

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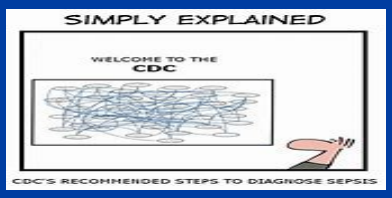
How can sepsis be prevented?



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How can you prevent sepsis?

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1. **Control the environment**
2. **Practice better hygiene** – eg wash hands/skin care, indwelling catheter, PEG site
3. **Control comorbid diseases** - DM; Heart, Renal, Lung disease
4. **Prevent UTIs**
5. **Prevent UTIs**
6. **Prevent UTIs**

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References

- 1. **Pathophysiology of sepsis** - *Author:Remi Neviere, MD*
- *2.* **Evaluation and management of suspected sepsis and septic shock in adults -** *Authors:Gregory A Schmidt, MDJess Mandel, MD*
- *3.* **Gram-negative bacillary bacteremia in adults -** *Authors:Rebekah Moehring, MD, MPHDeverick J Anderson, MD, MPH*
- *4.* ***Urinary tract infections in infants older than 1 month & young children: acute management, imaging and prognosis*** *– Authors: Nadar Shaikh MD, Alejandro Hoberman, MD*

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THANK YOU!!!

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