

Module 10: Antimicrobial Stewardship in the Management of Bloodstream Infections (BSI)



Objectives

By the end of this session, you should be able to:

1. Describe the causes, risk factors, and clinical signs of bloodstream infections (BSI)
2. Demonstrate correct blood culture collection
3. Interpret blood culture results accurately
4. Apply diagnostic and antimicrobial stewardship to guide treatment
5. Reassess and adjust antibiotics based on clinical response and lab results



Introduction

- A bloodstream infection (BSI) occurs when bacteria, viruses, or fungi enter the bloodstream, potentially leading to a systemic infection.
- Causes can be infections at other sites in the body, surgical procedures, or the use of medical devices like catheters or intravenous lines.
- Ports of entry include breaks in the skin, lung infections, gastrointestinal infections and urinary tract infections
- Bloodstream infections cause significant morbidity and mortality



Introduction...

- Characteristics of BSI that render them ideal targets for stewardship interventions include:
 - High mortality and morbidity rates
 - Long hospital stay and significant healthcare costs
 - Frequent misdiagnosis and overuse of antibiotics
 - High risk of antibiotic resistance



Stewardship Opportunities for BSI

1. Diagnostic stewardship involves;

- Ensuring the right test is done at the right time with proper sample collection.
- Providing timely and accurate test results to guide appropriate treatment.
- Promoting correct specimen collection and pathogen identification.
- Supporting clinicians with accurate, timely reporting for better treatment decisions.
- Educating and collaborating with healthcare workers (HCWs) on proper diagnostic procedures and result interpretation.



Stewardship Opportunities for BSI...

2. Antimicrobial stewardship involves;

- Ensuring appropriate use of antibiotics to improve patient outcomes and reduce resistance.
- Involves seven rights (patient, indication, drug, dose, route, time and duration).
- Beyond the seven rights we have:
 - Timely review (Escalation, de-escalation or discontinuation)
 - Monitoring and feedback e.g. monitoring of resistance rates and reporting as an antibiogram to guide in empiric treatment.
 - Infection, Prevention and Control (IPC)
 - Collaboration and educating HCW on AMS.
 - Research



Blood Culture Collection Technique

Preparation for performing blood collection for culture are

- Verify that you have the correct patient
- Appropriate indication for blood cultures
- Note the date and time of the specimen collection.
- Adhere to any special instructions

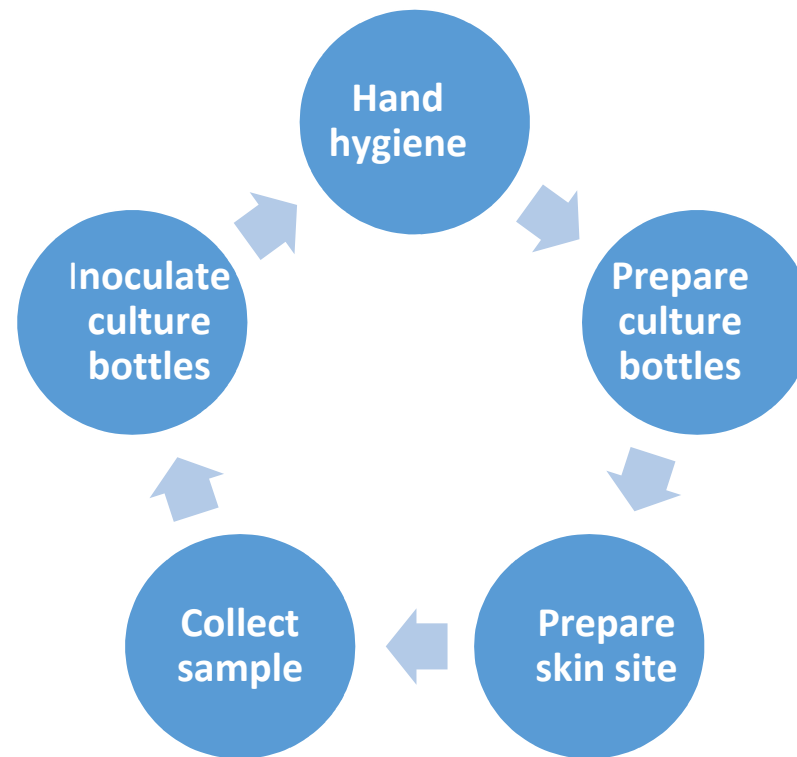


Blood Culture Collection Technique...

- Perform hand hygiene and use appropriate PPE prior to touching the patient environment or any equipment that will be used to obtain the cultures.
- Prepare culture bottles in accordance with local recommendations Blood cultures are always taken as a set - this is 2 bottles; one aerobic and one anaerobic specimen bottle or, in some settings, two aerobic collection bottles.
- Prepare the skin site - identify the side for venipuncture and clean with an appropriate skin preparative agent such as chlorhexidine or povidone-iodine.
- Collect the sample without contaminating the patient's skin.



Blood Culture Collection Technique...



Blood Culture Inoculation Volume

- Optimal blood fill volumes determine the diagnostic yield of blood cultures. Each ml of blood, up to 10 ml, can increase the sensitivity of the blood culture
- The volume of blood obtained from infants and children is relatively less based on age and depends on the specific culture bottle manufacturers instructions
- Laboratories should routinely monitor the volume of blood cultured as a quality assurance activity and provide feedback to clinical staff



Blood Culture Inoculation Volume...

Patient	Total volume	Aerobic	Anaerobic
Adult	20 ml	10 ml	10 ml
Paediatric	5-20 ml	2.5-10 ml	2.5-10 ml
Infant	1-2 ml	0.5-1 ml	0.5-1.0 ml



Strategies to Improve Blood Collection and Cultures

- Avoid 'routine' surveillance cultures without indication
- Wipe the tops of the blood culture devices with disinfectant before collection
- Inject the blood into the aerobic device first then into the anaerobic bottle
- Avoid collection from intravascular lines
- Collect two sets of samples from different sites to rule out contamination
- Dedicated or trained staff should collect blood for cultures
- The sample should be transferred to the laboratory at room temperature as soon as possible and processed immediately



Case Study

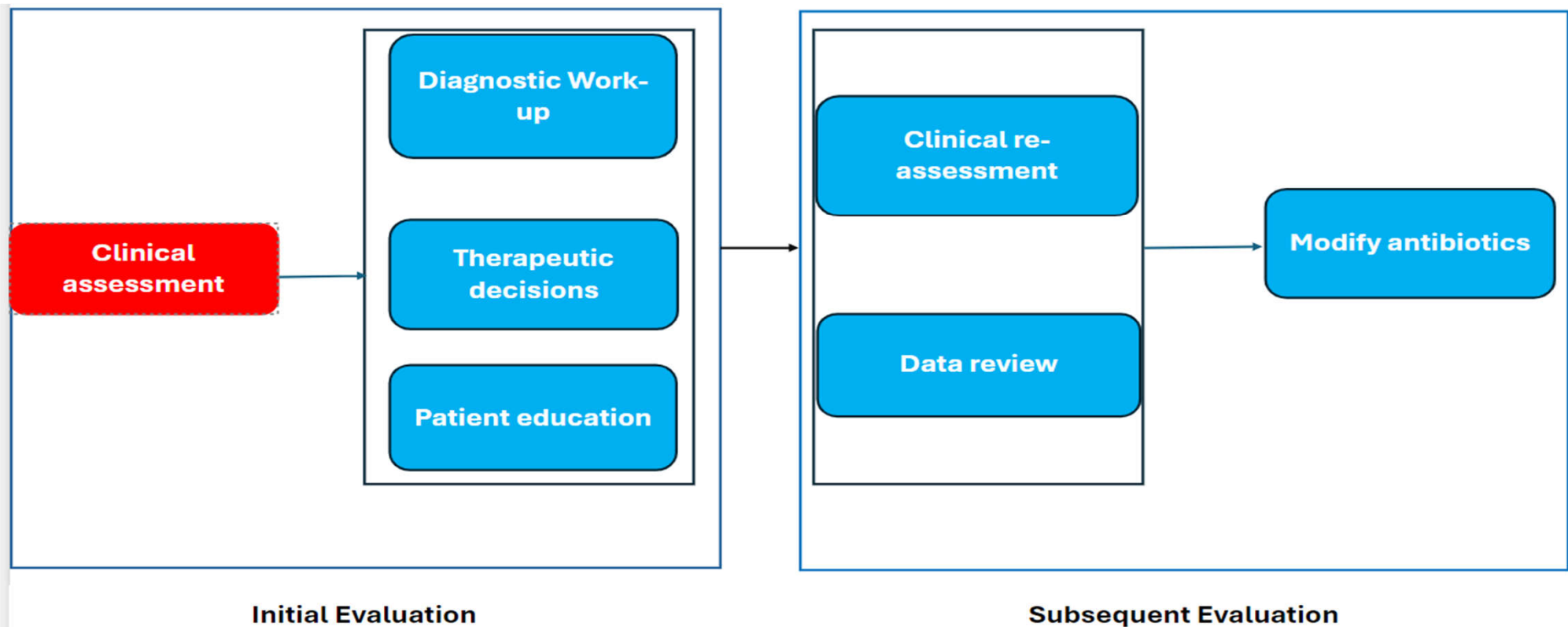
B.M a 25 year old female accompanied by her friend, presented with 48 hours of fever, chills and sudden onset of pleuritic chest pain. Her friend reported that she had a worsening cough for the last several days. The two women live in a flat with a third roommate and they recently had a party with several friends, some of whom were coughing. Both women are significant smokers.

Her past medical history indicates she had a Splenectomy 2 years ago. On examination her blood pressure was 90/60 mmHg, Heart rate-112 bpm, Temperature-39.0° and a respiratory rate of 28 breaths per minute. She was also found to be Disoriented

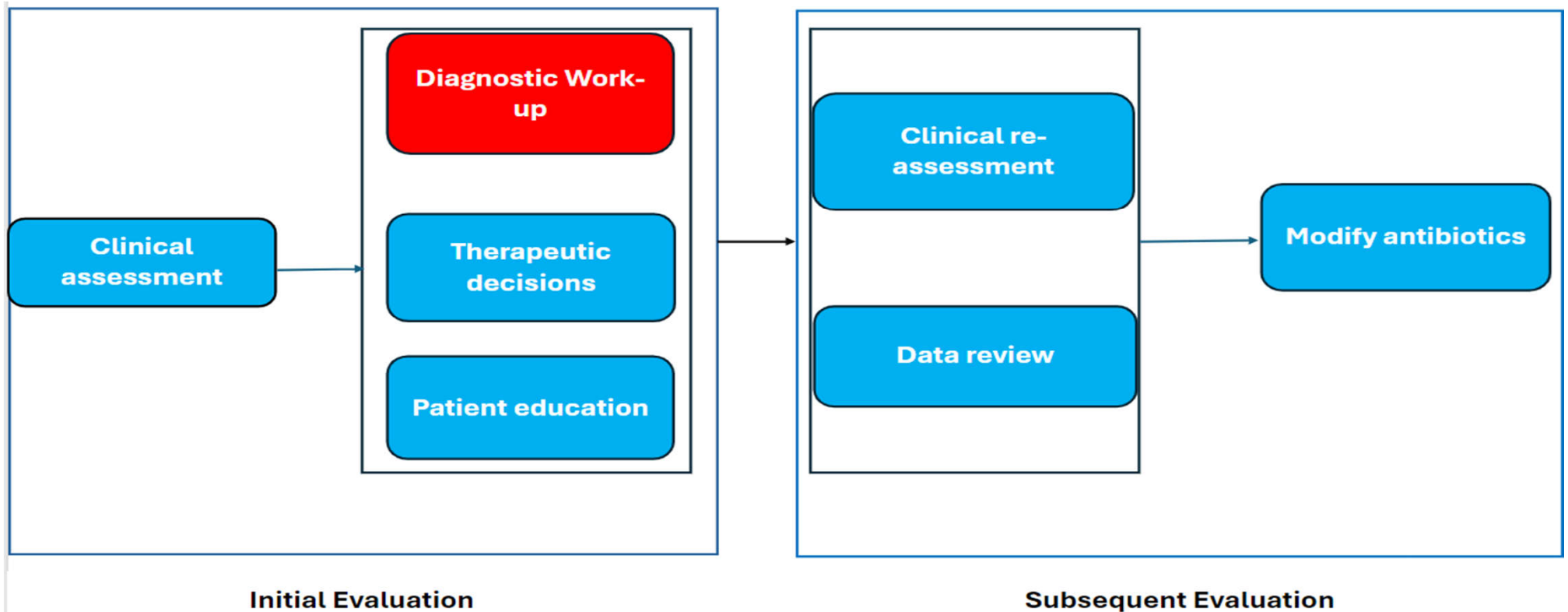
What are the immediate next steps in managing her suspected bloodstream infection?



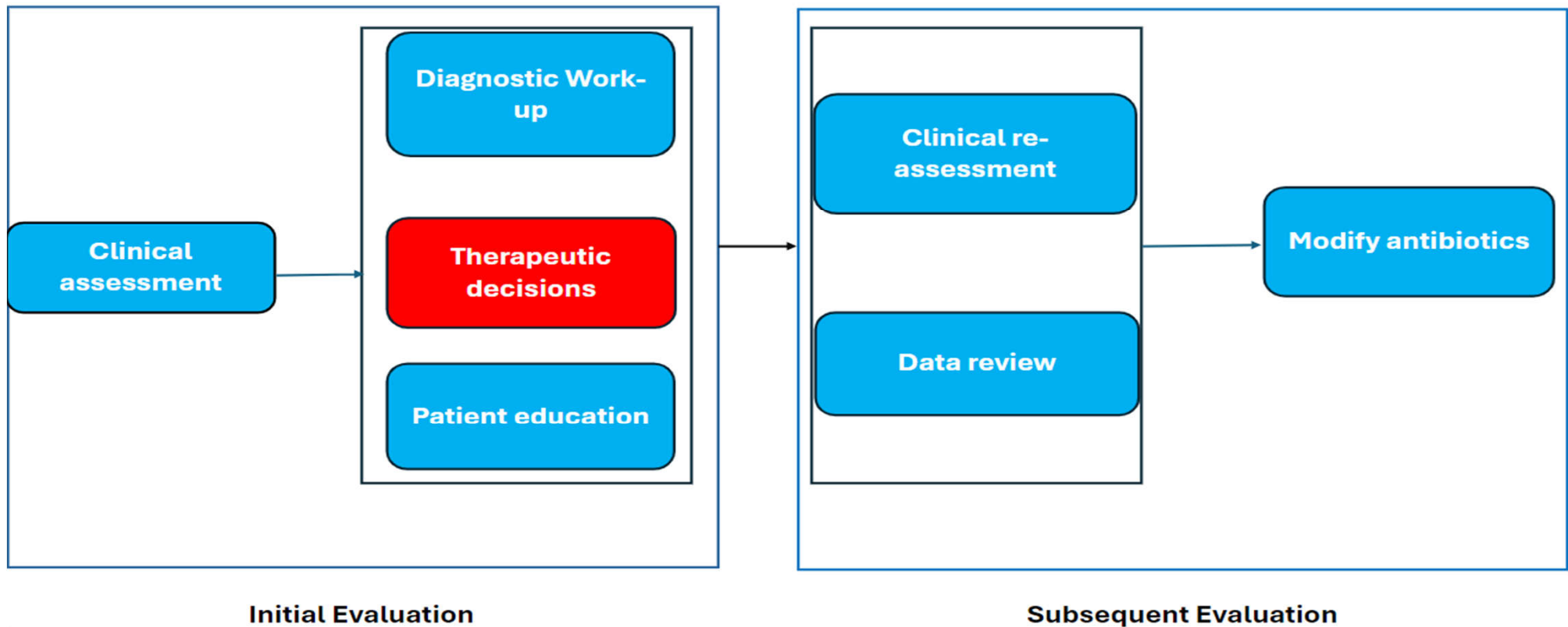
Step 1: Assess for Signs and Symptoms of BSI



Step 2: Collect Blood Samples for Lab Diagnostics



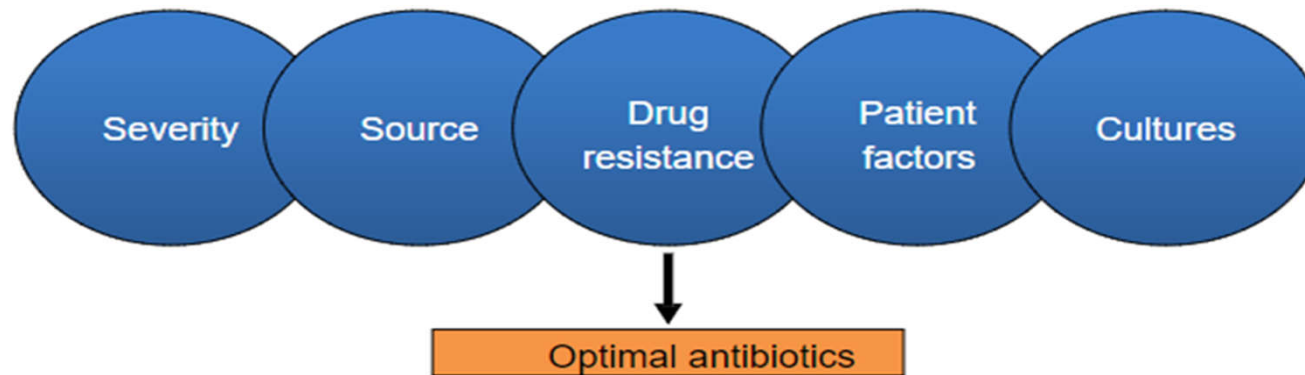
Step 3: Therapeutic Decisions



Principles of Rational Antibiotic Prescribing

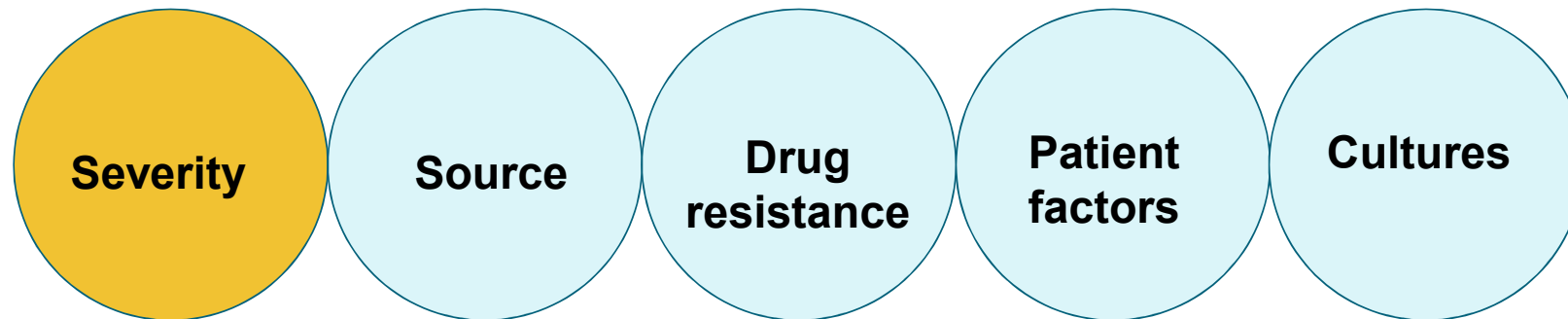
When determining the most effective empiric therapy you must consider:

- Severity of illness
- Source of infection
- Drug Resistance
- Patient Factors like history of drug allergies, comorbidities etc.
- Cultures



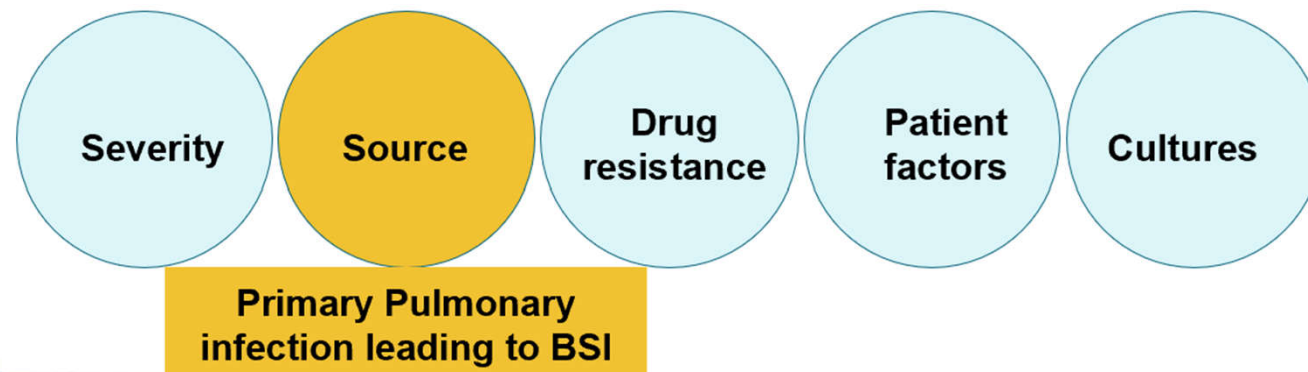
Principles of Rational Antibiotic Prescribing: Severity

- Antimicrobials are used empirically when infection is suspected before microbiologic data to support the diagnosis.
- Ensure a blood sample is collected before initiating antibiotic treatment.
- Administration of antimicrobials should not be delayed, as early administration is critical for proper treatment
- The severity of symptoms, such as fever, hypotension, and altered mental status, can help determine the urgency of treatment including supporting the Airway, Breathing and Circulatory systems.



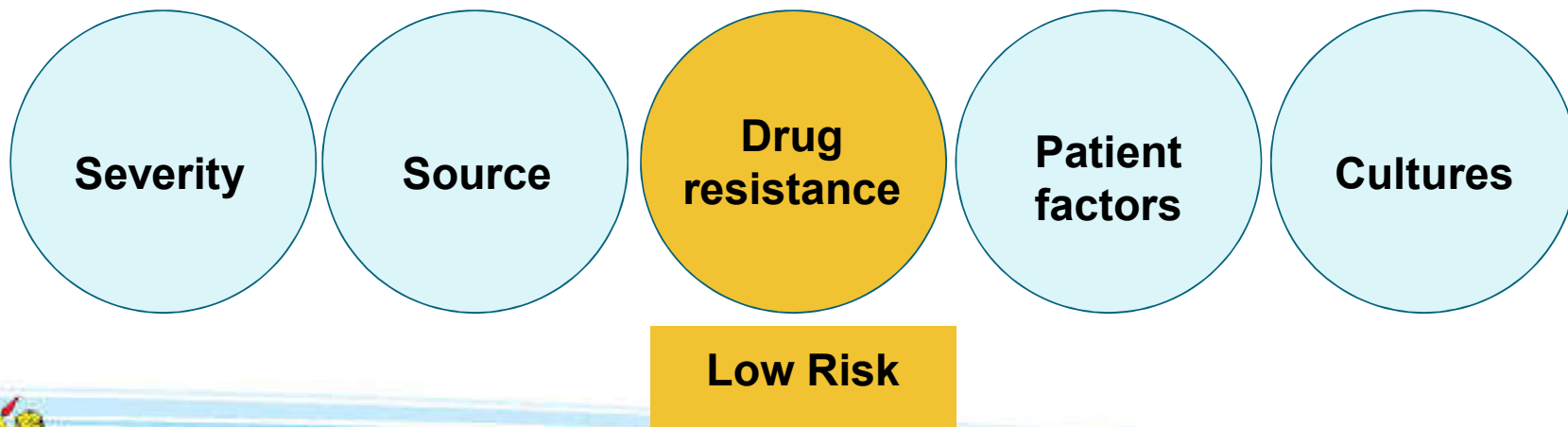
Principles of Rational Antibiotic Prescribing: Source

- Primary **infections** such as pneumonia, urinary tract, and intra-abdominal **infections** are often the **source** of BSIs
- Identifying the potential source of the infection can guide antibiotic selection as different sites of infection are associated with specific pathogens
- Empiric coverage in this case should include coverage for suspected respiratory pathogens given the likely diagnosis of septicemia from a pulmonary source



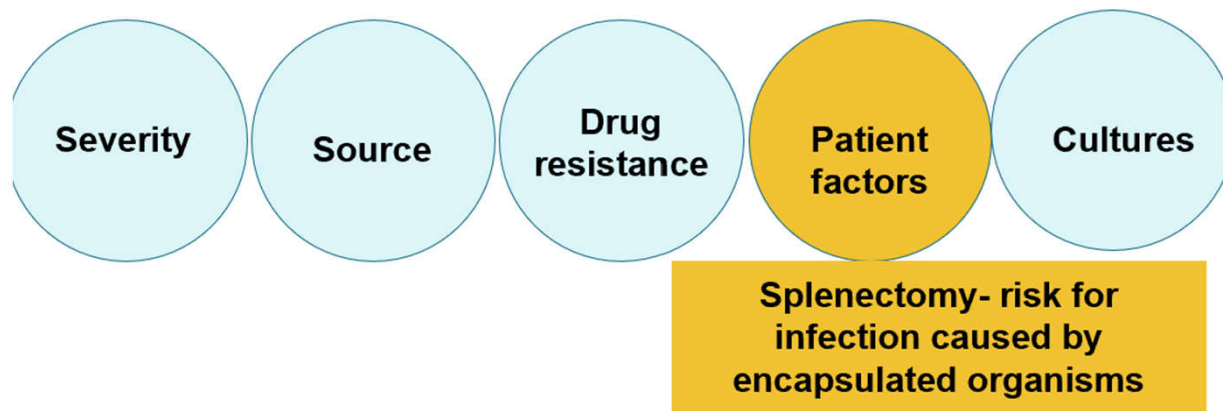
Principles of Rational Antibiotic Prescribing: Drug resistance

- Where the risk of resistance is low use of narrow spectrum antibiotics that specifically target known or suspected pathogens lower risk of promoting resistance whereas if the risk of resistance is suspected, broader spectrum antibiotics are selected to cover possible MDR bacteria
- Local resistance patterns enable selection of antibiotics that are more likely to be effective



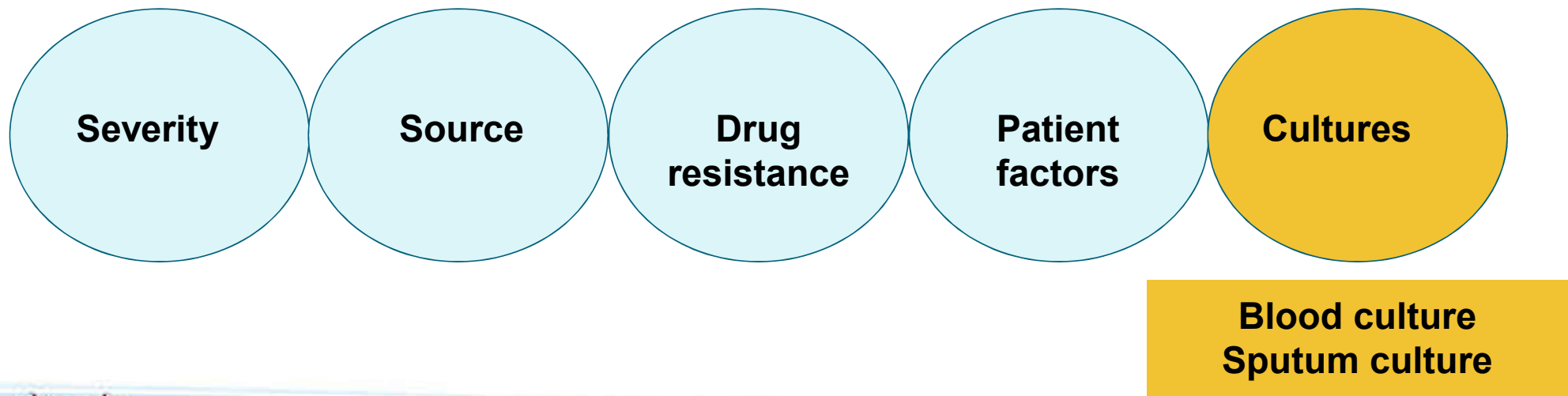
Principles of Rational Antibiotic Prescribing: Patient Factors

- Consider Patient factors such as: Age, comorbidities, immune status, allergies
- In this case the history of splenectomy puts the patient at risk for serious infections caused by encapsulated organism such as *Streptococcus pneumoniae*.



Principles of Rational Antibiotic Prescribing: Cultures

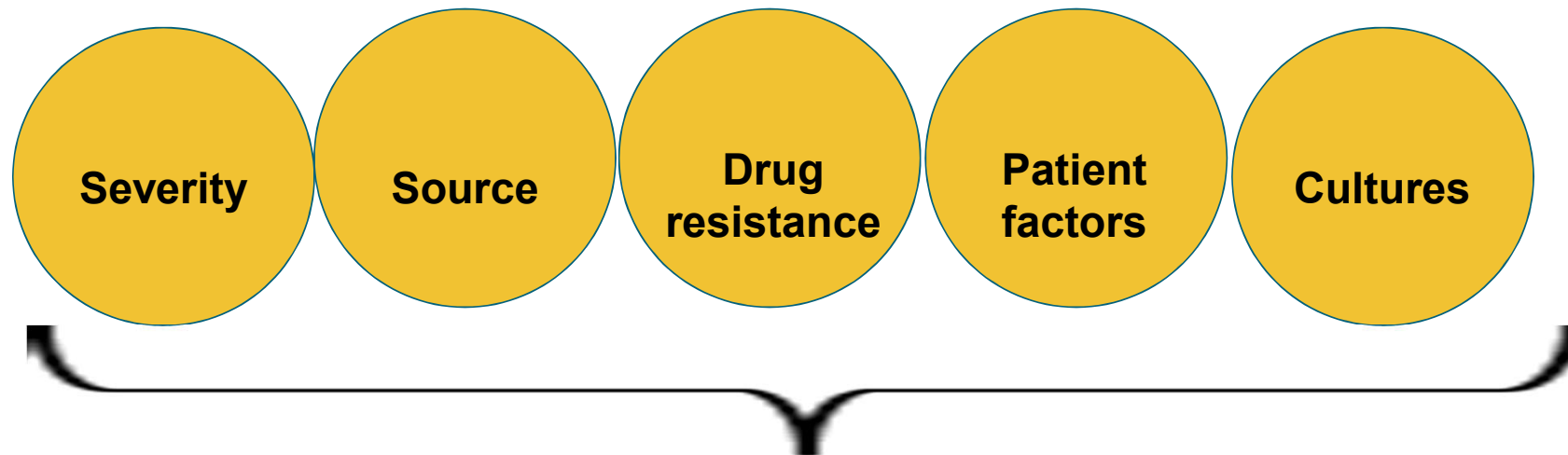
- Obtain specimen for cultures prior to initiation of antimicrobial therapy
- Blood cultures and susceptibility testing aid in identifying the specific pathogen and guiding targeted treatment and alternative options if the patient doesn't respond



An Informed Antibiotic Choice

Empirical treatment: Follow the

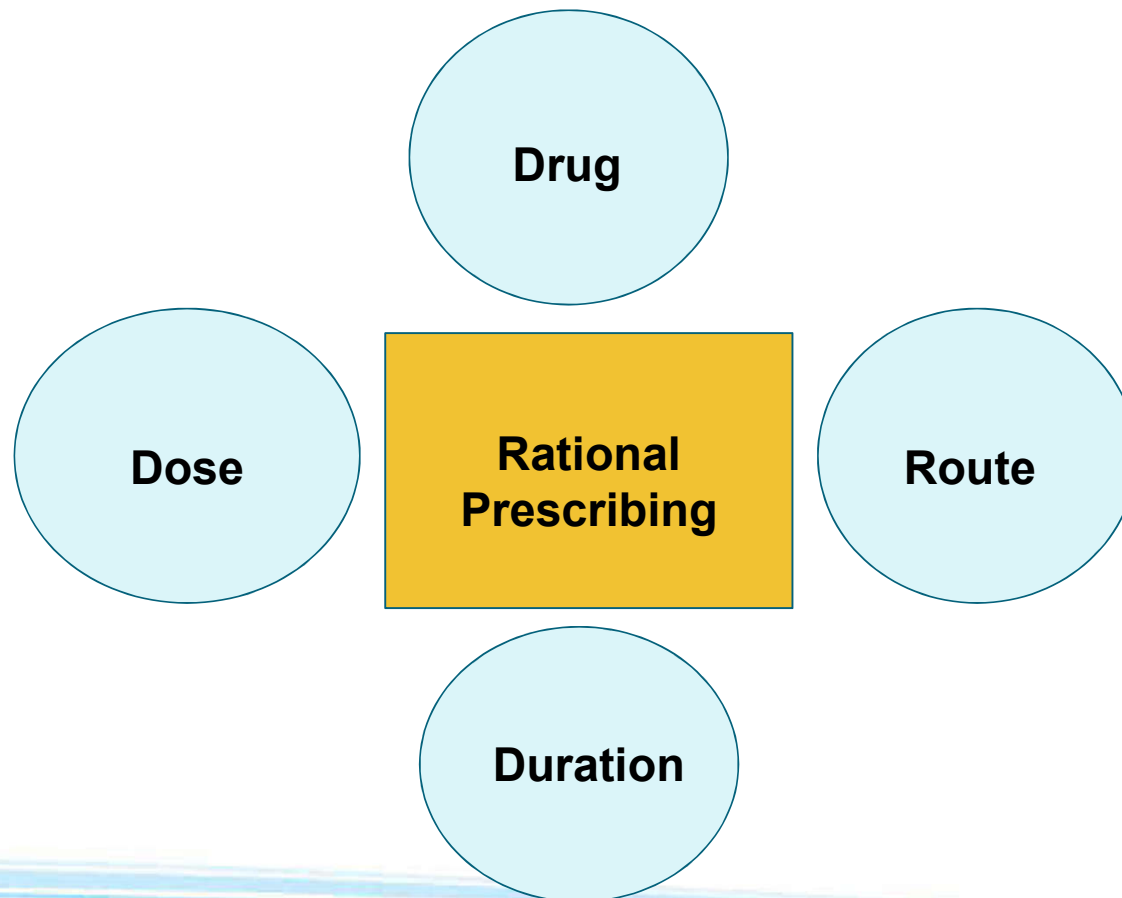
- local treatment recommendations and national guidelines e.g. AWaRe categorization included in the STGs.
- Local resistance and susceptibility patterns



Cephalosporin and Macrolide

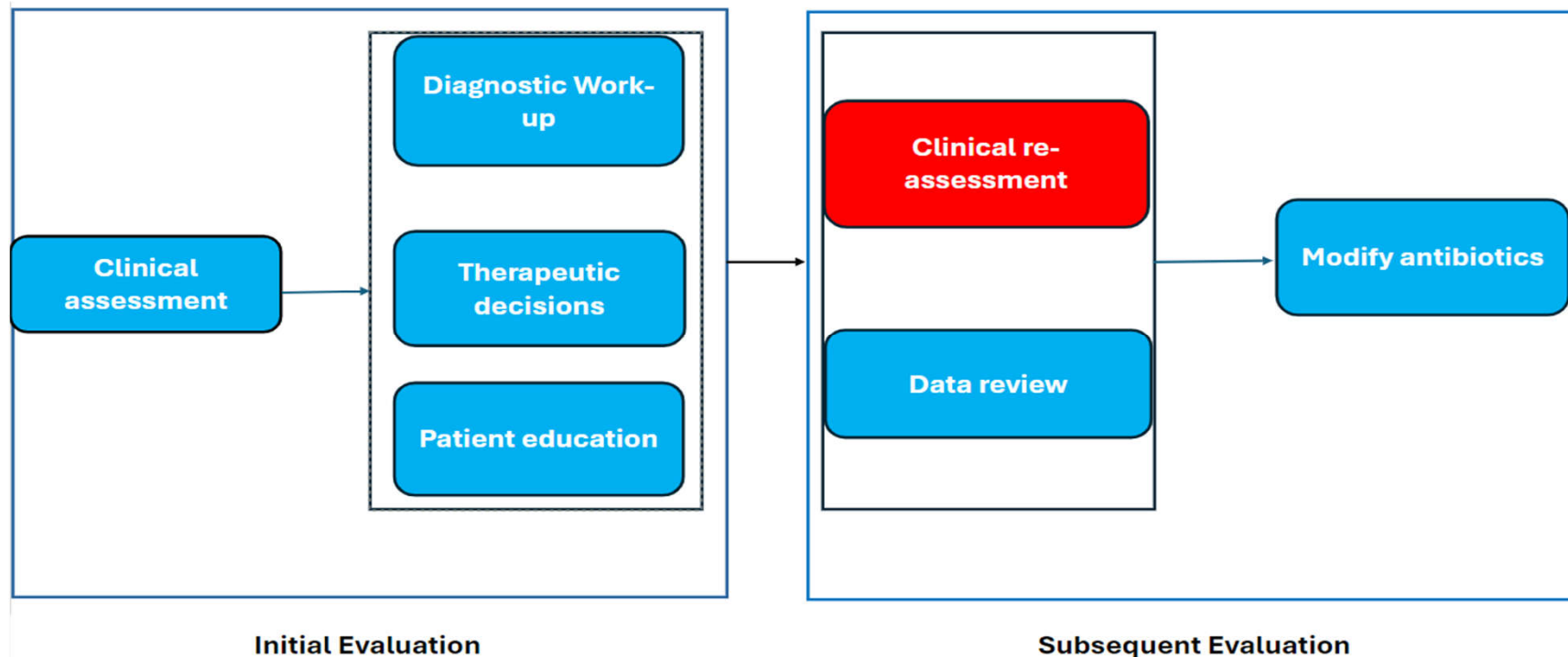


Rational Prescribing



Step 4: Clinical Re-assessment

Re-assess the patient's response to therapy, identify complications, and adjust treatment as needed



Clinical Re-assessment and Data Review

- Reassess the patient:
 - Clinical response
 - Diagnostics
 - Adverse events
- Review antimicrobial therapy at 48 hours and regularly thereafter.
- When examined after 48 hours, the patient
 - Has improved clinically
 - Is afebrile
 - Has oxygen saturation of 98% on room air
 - Preliminary results for both blood and sputum cultures are positive for *Streptococcus pneumoniae*
 - Is it a true pathogen or a contaminant?



An Informed Antibiotic Choice: Interpretation of Blood Culture Results

- In order for a culture result to be considered positive it:
 - must grow a recognized pathogen.
 - *Staphylococcus aureus*, Group A and Group B Streptococci, Enterobacteriaceae and *Candida* species are among the most isolated clinical pathogens.
 - A common example in clinical practice can be illustrated by examining two scenarios.
 - In one, a single blood culture of the two obtained yield *Staphylococcus aureus* while in the other it yields a coagulase-negative *Staphylococcus* such as *Staphylococcus epidermidis*.
 - *Staphylococcus aureus* is managed as a true bloodstream infection whereas coagulase-negative *Staphylococcus* is considered a skin contaminant in the absence of clinical or laboratory evidence to the contrary.

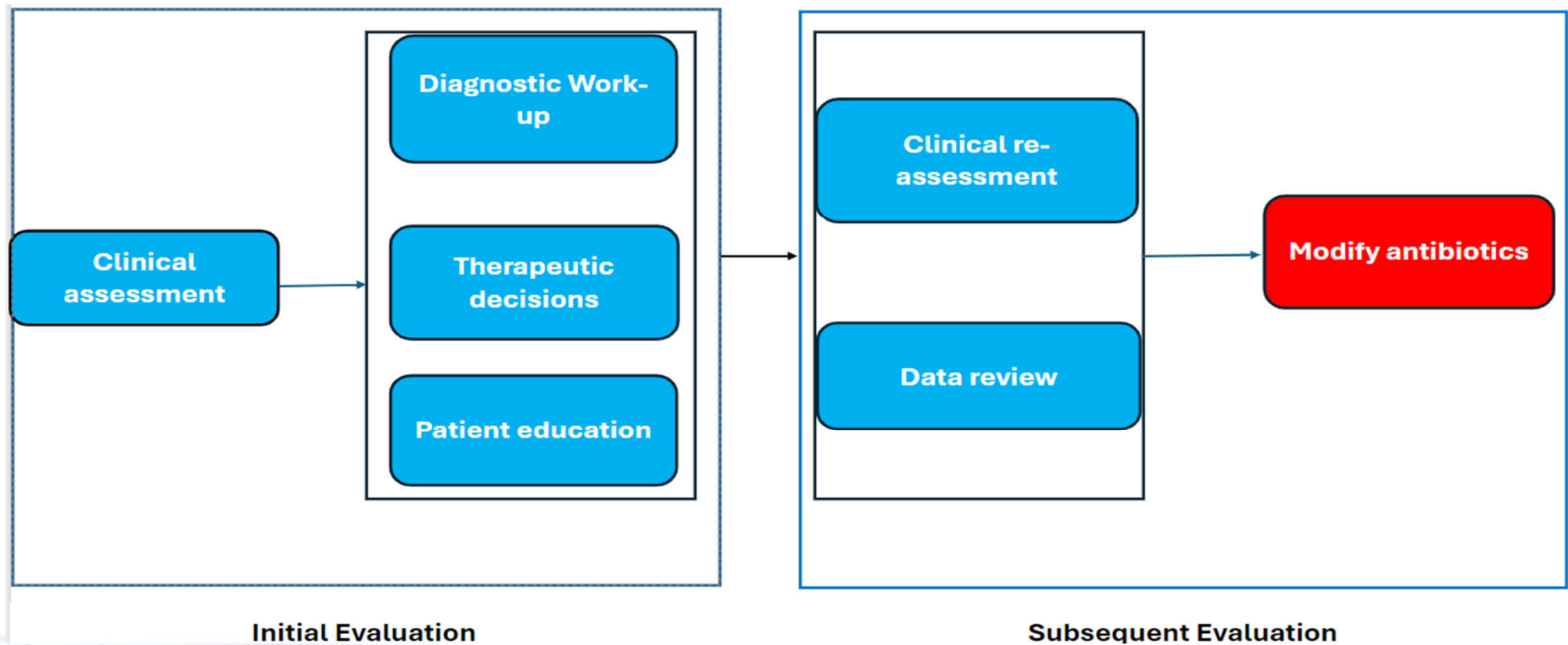


An Informed Antibiotic Choice: Interpretation of Blood Culture Results...

- This situation emphasizes the importance of obtaining at least two sets of blood cultures from two different sites in patients with suspected bloodstream infections.
- This allows differentiation of true infection from positive blood cultures caused by skin contamination.
- Because in some cases an organism traditionally considered a skin contaminant is actually pathogenic, for example, in patients with prosthetic



Step 5: Modify Treatment



Modify Treatment...

- Once Culture and sensitivity results and/or PCR results and other diagnostics are available, a clinical review and decision shall be made to either stop empiric therapy, change to narrow spectrum agent (de-escalate), escalate therapy, or continue therapy.
- By 72 hours, the drug susceptibility results confirm the patient's *Streptococcus pneumoniae* is susceptible to ceftriaxone, penicillin and levofloxacin among other agents
- How do you manage the patient?
- De-escalate your empiric antimicrobial therapy to a definitive treatment course with a high dose amoxicillin which is given orally
- Discharge the patient from the hospital with a follow-up appointment



Central Line Associated BSI

- Definition: Primary bloodstream infection, in a patient with a central line that was in place for >2 calendar days on the date of event, with day of device placement being Day 1 and is not related to infection at another site
- Central Line (CL) use is a major risk factor for BSI
- Central Line Associated BSI are common and associated with
 - increased costs
 - increased hospital stay



Central Line Associated BSI...

- Blood for cultures should be drawn simultaneously from the central venous catheter and a peripheral site according to appropriate blood culture collection protocols, including sterile preparation of the site and withdrawal of appropriate blood volume.
- The blood drawn from the catheter and the peripheral site must grow the same organism on culture.
- A differential time to positivity (dTTP) is considered positive if the central line cultures become positive more than 120 minutes prior to the peripherally drawn cultures.
- This is based on the concept that if the central venous catheter is the source of the infection, it will harbor a high burden of microbial pathogens and thus cultures from the line will become positive faster than those obtained from a peripheral culture.



Key Points

1. BSI causes high morbidity and mortality.
2. Proper blood culture collection is essential.
3. Diagnostic stewardship improves testing and result use.
4. AMS uses the seven Rights to guide proper antibiotic use.
5. Timely reassessment ensures correct treatment adjustments.



The End



***You have come to the end of this module. Kindly attempt module
10 quiz before proceeding to module 11***