Republic of Kenya

COUNTY GOVERNMENT OF KAKAMEGA

MINISTRY OF HEALTH

KAKAMEGA COUNTY GENERAL HOSPITAL

ANTIMICROBIAL TREATMENT GUIDELINES AND PROTOCOLS

4th Edition 2024

FOREWORD

Antimicrobial resistance (AMR) threatens the very core of modern medicine and the sustainability of an effective, global public health response to the enduring threat of infectious diseases. Effective antimicrobial drugs are prerequisites for both preventive and curative measures, protecting patients from potentially fatal diseases and ensuring that complex procedures, such as surgery and chemotherapy, can be provided at low risk. Yet systematic misuse and overuse of these drugs in human medicine puts patients at risk due to the development of resistance. Without harmonized and immediate action on both local and global scale, the world is heading towards a post-antibiotic era in which common infections could once again kill. Healthcare workers have a vital role in preserving the power of antimicrobial medicines. Inappropriate prescribing and dispensing can lead to misuse and overuse if medical staff lack up-to-date information, cannot identify the type of infection, yield to patient pressure to prescribe antibiotics or benefit financially from supplying the medicines.

Better hygiene and infection prevention measures are essential to limit the development and spread of antimicrobial-resistant infections and multidrug-resistant bacteria.
This Guideline use seeks to promote appropriate and effective antimicrobial prescribing to enhance the quality of patient care and improve clinical outcomes. We encourage all healthcare workers to adhere to these guidelines.

Dr. Babra Murila
Medical Superintendent

EDITORIAL NOTE

This guideline has been developed by a multidisciplinary team comprising medical specialists, microbiologists, clinical pharmacists, infection prevention and control specialists, ASP sub-committee members, and the medicine and therapeutics committee.

The hospital antibiogram has been used to identify the most common pathogens and profile their antimicrobial susceptibility patterns. This guide aims to rationalize antibiotic use and optimize patient outcomes in various in-patient and out-patient units.

The guide does not apply to all patients uniformly. Patient care must be individualized, and the choice of antimicrobials may need to be modified in special groups such as pregnant and lactating mothers, renal and hepatic dysfunction, recent antimicrobial therapy, history of hypersensitivity, and the presence of significant drug interactions.

The periodic revision of this guide will be informed by changes in the local antibiogram, availability of new antimicrobials, and new recommendations on antibiotic use.

This guideline should be implemented by all the relevant healthcare providers and where there is a need for significant variation in antimicrobial choice, the antimicrobial stewardship team at the hospital should be consulted.

Dr. Sharon Oginda
Chairperson AMS Committee

Dr. Linet Elamenya
Secretary AMS Committee

List of Abbreviations

ASP	**Antimicrobial Stewardship Program**
AMR	Antimicrobial resistance
IV	Intravenous
MRSA	Methicillin-Resistant *Staphylococcus aureus*
PO	Per Oral
SPP	Species
HAI	Hospital Acquired Infections
TB	Tuberculosis
CRP	C -reactive protein
BNF	British National Formulary
ESR	Erythrocyte Sedimentation Rate
CSF	Cerebrospinal Fluid
TMP-SMX	Trimethoprim/ Sulfamethoxazole
HACEK	Heamophilus, Actinobacillus, Cardiobacterium, Eikinella, Kingella *spp*
VAP	Ventilator-associated pneumonia
ICU	Intensive care unit
PCP	Pneumocystis Carinii Pneumonia
MTC	Medicines and Therapeutics Committee

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Key Antimicrobial Stewardship Principles:

1. An Antimicrobial Stewardship Programme (ASP) aims to improve the safety and quality of patient care and contribute significantly to reductions in the emergence and spread of Antimicrobial Resistance (AMR) and is a key component in the reduction of Healthcare-Associated Infections (HAIs).
2. Antibiotics do not merely treat infections but affect the microbial environment within and beyond the patient, therefore, must be used appropriately and with care.
3. Do not start antimicrobial therapy unless there is clear evidence of infection. Antimicrobial resistance is a threat to the effective treatment of infections. To lower the risk of developing antibiotic resistance, antibiotics that are likely to be bactericidal to the pathogen at the site of infection should be chosen.
4. Use adequate antibiotic doses and for an adequate duration.
5. Inappropriate use of broad-spectrum antibiotics must be avoided because it promotes the overgrowth of *Clostridium difficile*. Always choose the narrowest spectrum antibiotic if possible.
6. Antibiotics must be prescribed for the shortest duration necessary. All antibiotic prescriptions must therefore be for a defined duration.
7. For all infections, document in the medical notes the diagnosis and the indicators for making the diagnosis (↑WBC count, ↑Procalcitonin, temp >38°C, evidence of inflammation, fluid collection, ↑CRP, etc.)
8. If possible, review all sensitivity results daily and always change to the sensitive antibiotic with the narrowest spectrum and most cost-effective option.
9. Antibiotic doses should not be missed unless unavoidable. Missed doses are everyone's responsibility and should be investigated and the treatment route, formulation or dose reviewed as necessary to ensure administration and compliance.

Recommended Good Practice on Antimicrobial Use

1. Not all admitted patients require antibiotics; fever does not necessarily mean the presence of a bacterial infection
2. Appropriate investigations are recommended for all infections- for diagnosis, treatment, and follow-up. (Employ rapid diagnostic tests such as CRP, ESR as well as differential WBC count where applicable)
3. Microbiological specimens should be collected before initiating antimicrobial therapy.
4. Prescribe antimicrobials contained in the Pharmacy drug availability list.
5. Check for factors that will affect drug choice and dosage such as age, renal and hepatic impairment, pregnancy, lactation, infection severity, and hypersensitivity and drug interactions.
6. Ensure that an appropriate dose is prescribed; if uncertain consult a pharmacist or check in the BNF or latest Drug index or hospital formulary.
7. For the under-five children, use the basic pediatric protocol 2022.
8. The need for antimicrobial therapy should be reviewed at 48 hours and regularly thereafter. If investigations do not suggest an infection, antibiotics should be stopped and other appropriate management instituted
9. For most infections 5 days of antimicrobial therapy is sufficient. Exceptions include: Meningitis, deep-seated abscesses, infective endocarditis, osteomyelitis, pyelonephritis, blood and stream infections

Figure 1.0 Antibiotic Prescribing Algorithm

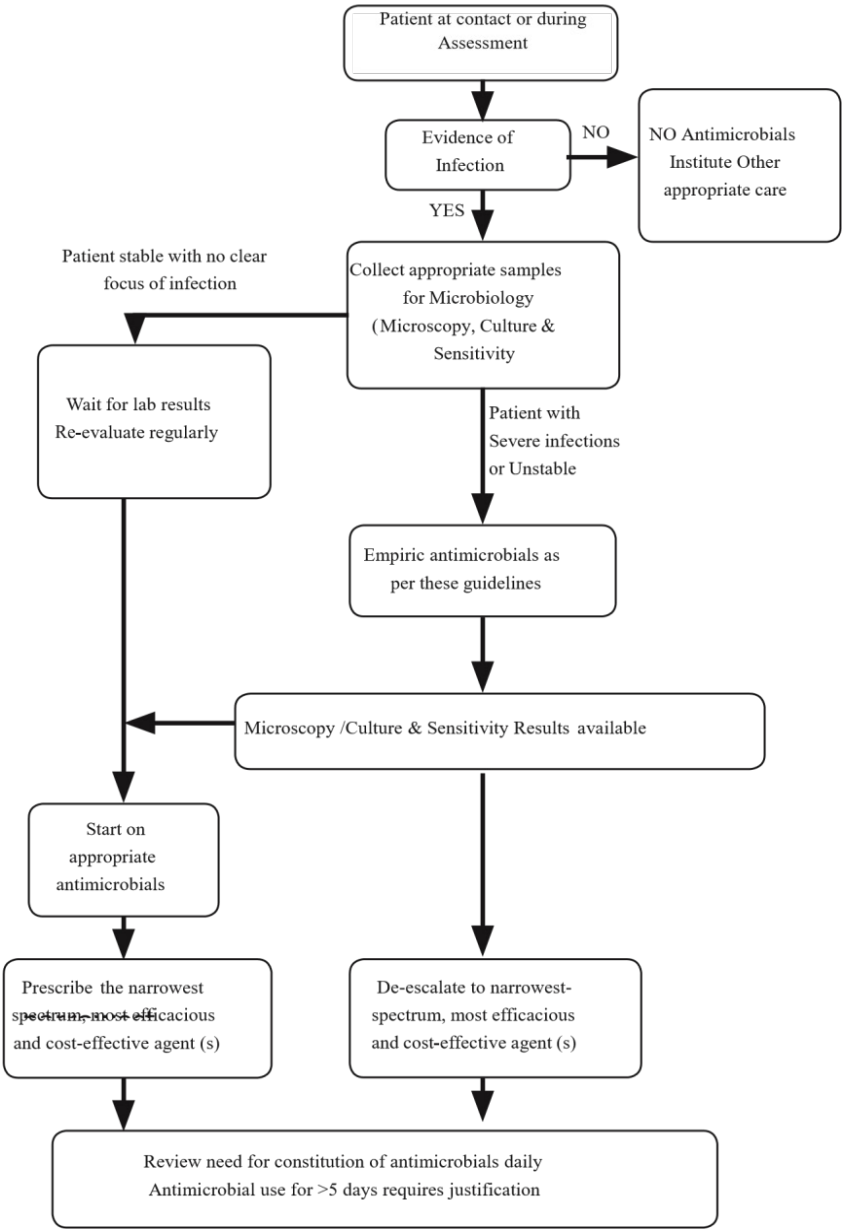


Figure 1: Antibiotic Prescribing Algorithm

Infection Stratification

Community-Acquired infections (CAIs): infections that are contracted outside the hospital or are diagnosed within 48 hours of admission without any previous health care encounter
Healthcare-Associated Infections (HAIs): HAIs are infections acquired by patients while receiving care/hospitalization and manifest 48 hours post admission.
Non-responsive infections: infections not responding to standard antimicrobial therapy. These infections may require further investigations and a multi-disciplinary approach in terms of management

How to use this guideline

1. Identify the site of infection –bloodstream, intraabdominal, lower respiratory tract, urinary tract, skin &soft tissue, etc.
2. Stratify the patient type based on described parameters – Infection stratification. Send specimens for culture before initiating antimicrobial therapy.
4. Choose empiric therapy based on patient category and site of infection.
5. Empiric antibiotic therapy should be de-escalated once the culture and sensitivity report is available. If possible, switch from intravenous to oral medication as soon as possible.

1. ACUTE BACTERIAL MENINGITIS

1.1: ACUTE BACTERIAL MENINGITIS IN CHILDREN >2 MONTHS

DEFINITION	**Acute syndrome characterized by signs of meningeal inflammation**
CLINICAL FEATURES	**Symptoms:** Fever, lethargy, irritability, altered level of consciousness, coma, nausea, vomiting inability to feed, convulsions – generalized or partial. Older children: headache and photophobia. *Can be preceded by symptoms of respiratory tract infection.* **Signs:** **AVPU < A**, stiff neck, bulging fontanelle, sutural diastasis, unequal pupils, focal neurologic signs, hypotonia or hypertonia, maculopapular / hemorrhagic/ purpuric rash. Consider tuberculous meningitis in subacute presentation
LAB INVESTIGATIONS	**Lumbar puncture and CSF Analysis is <u>Gold standard</u> test** *(should be done prior to antibiotic initiation)* CSF analysis is characteristic of bacterial meningitis: • Low CSF glucose <2.2 mmol/L • Elevated WBC >1000/microL • Elevated protein >45mg/L ***NB: Contraindications of lumbar puncture:*** 1. *Signs of raised ICP.* 2. *Shock* 3. *Extensive or spreading purpura* 4. *Coagulation abnormalities* 5. *Localized superficial infection* 6. *Respiratory insufficiency* **OTHER INVESTIGATIONS** • ***Blood culture indicated for all patients with suspected meningitis*** • Complete blood count, ESR, CRP • Malaria blood slide • Electrolytes: calcium, potassium, magnesium, • random blood sugar • HIV test • Coagulation studies

RADIOLOGICAL INVESTIGATIONS	Brain CT scan or MRI, Cranial ultrasound (for < 1-month age) **Indications** • Focal neurological signs • Signs of raised intracranial pressure • Encephalitis • Seizures > 72 hours after start of treatment/ prolonged seizure • Increasing head circumference in young infants • Prolonged obtundation – no improvement in GCS in 48hours • Evidence of continued infection			
EMPIRIC TREATMENT	**ORGANISM**	**ANTIBIOTIC**	**ALTERNATIVE**	**COMMENTS**
	COMMUNITY ACQUIRED **Neonates:** *E.coli* *S.pneumoniae* *K.pneumoniae* *Enterobacteriaceae*	**IV cefotaxime** 200-300 mg/kg / day QID (max 2g/ dose) **PLUS** **IV Benzylpenicillin** 300,000400,00 0 units/kg/day div QID (max 2.4 Mu/day)	**IV Meropenem** 40mg/kg 8 hourly (Max 2g per dose)	
	COMMUNITY ACQUIRED **(>1 month -18 years):** *S. pneumoniae* *H. influenza* *N. meningitides* *E.coli (for those 13 months)*	**High dose Ceftriaxone** 100 mg/kg IV/day in two divided doses (50mg/kg/dose 12 hourly)	**Adjuvant treatment Corticosteroids** to be used in patients > 3 months of age with a diagnosis of probable meningitis (*frankly purulent CSF, CSF white cell count> 1000cells/µl, raised CSF white cells with protein more than 1mg/dL, bacteria on Gram stain*). **Dexamethasone –** 0.15mg/ kg administered before the 1st dose of the antibiotics. To be given every 6 hours for the 1st 48 hours. **(Do not start dexamethasone >12 hours after start of antibiotics)**	

	HEALTH CARE ASSOCIATED MENINGITIS AND VENTRICULITIS Special population: Ventriculitis and meningitis in children with VP shunt, external ventricular drain (EVD), spina bifida, myelomeningocele, neonates: *Coagulase negative S. aureus Gram negative organisms: (E. coli, K. pneumonia P. aeruginosa)*	**IV Meropenem** 40mg/kg 8 hourly (Max 2g per dose)	Duration of therapy: 10 -14 days (average) -N. meningitidis – 7 days -H. influenzae – 10 days -S. pneumoniae – 10 days -S. aureus - 14 days -Group B streptococcus – minimum 14 days -21 days for Gram negative organisms and L. monocytogenes
SPECIAL CONSIDERATIONS	• If no organism isolated on CSF but LP suggestive for bacterial meningitis and patient **is responding** to treatment, continue treatment for 14 days • Correct any electrolyte imbalance • Ensure appropriate use of fluids (avoid overhydration or dehydration) • **If no improvement in 48-72 hours, re-evaluate patient** • **In suspected meningococcal meningitis, do not use high dose corticosteroids** • If immunocompromised consider TB meningitis or cryptococcal meningitis • If there is high suspicion of HSV encephalitis, add acyclovir IV		

1.2 ACUTE BACTERIAL MENINGITIS IN ADULTS

<table>
<tr><td>DEFINITION</td><td colspan="4">Meningitis is an inflammatory disease of the leptomeninges (meninges and the subarachnoid space)</td></tr>
<tr><td>CLINICAL PRESENTATION:</td><td colspan="4">Symptoms: Acute onset< 48hours.
≥2 of: Severe headache, fever, change in mental status, convulsions, skin rash
Signs: nuchal rigidity, positive Kernig's' and Brudzinski sign, cranial nerve palsies, papilledema</td></tr>
<tr><td>LAB INVESTIGATIONS</td><td colspan="4">Lumbar puncture and CSF Analysis is Gold standard test (should be done prior to antibiotic initiation)
CSF analysis are characteristic of bacterial meningitis:
• Low CSF glucose <2.2 mmol/L
• Elevated WBC >1000/microL
• Elevated protein >45mg/L
NB: Contraindications of lumbar puncture:
1. Signs of raised ICP.
2. Shock
3. Extensive or spreading purpura
4. Coagulation abnormalities
5. Localized superficial infection
6. Respiratory insufficiency
OTHER INVESTIGATIONS
1. Blood culture
2. Complete blood count, ESR, CRP, Procalcitonin
3. Malaria blood slide
4. Electrolytes: calcium, potassium, magnesium
5. Random blood sugar
6. HIV test
7. Coagulation studies</td></tr>
<tr><td>RADIOLOGICAL INVESTIGATIONS</td><td colspan="4">A head CT scan should be performed before LP in the following:
• History CNS disease (mass lesion, stroke, or focal infection)
• New onset seizure (within one week of presentation)
• Papilloedema
• Abnormal level of consciousness
• Focal neurologic deficit</td></tr>
<tr><td rowspan="2">EMPIRIC TREATMENT</td><td colspan="4">Once suspected and awaiting lab results, empiric treatment should be started within an hour of presentation to prevent complications and mortality</td></tr>
<tr><td>ORGANISM</td><td>ANTIBIOTIC</td><td>ALTERNATIVE THERAPY</td><td>COMMENTS</td></tr>
</table>

	COMMUNITY ACQUIRED MENINGITIS Caused by: *Streptococcus pneumoniae, Neisseria meningitides*	**IV Ceftriaxone** 2g BD Duration: 10-14 days		Start IV **Dexamethasone** 0.4mg/kg QID **15 to 20 min** before or at the start of the first dose of antibiotics (continue for 4 days if *S. pneumonia)*
	HEALTH CARE ASSOCIATED MENINGITIS AND VENTRICULITIS Caused by: *Staphylococci and aerobic gram-negative bacilli*	IV **Ceftazidime** 2g 8 hourly PLUS **IV Vancomycin** 25-30 mg/kg loading dose Then 15-20 mg/kg/dose every 8-12 hourly (BD/TDS) Duration: **21 days**	**Meropenem** 2g IV 8 hourly Duration: **21 days**	In case of allergy to beta lactams: **Vancomycin** and **levofloxacin** can be used.

2.FEBRILE NEUTROPENIA

DEFINITION	Fever that arises against the backdrop bone marrow suppression due to e.g. cancer, chemotherapy, radiotherapy • Fever: T ≥ 38^0C • Neutropenia: **Absolute neutrophil count (ANC) <1000 cells/µL** (<1.0 x 10^9/L) • Severe neutropenia: **ANC ≤500 cells/µL (0.5 x 10^9/L)** • Profound neutropenia**: ANC <100 cells/µL (0.1 x 10^9/L)**	
CLINICAL PRESENTATION	• Fever (T ≥ 38^0C) • Neutropenia • Other signs and symptoms of infection (look out for septic shock or sepsis)	
CLINICAL EVALUATION	• **Conduct thorough physical exam** • Special focus on neurological system, nose/sinuses, mouth, lower respiratory tract, GIT, GUT, skin • Pay attention to sites with medical devices (NGTs, catheters, CVC), wounds and perianal regions • Assess risk for chronic infections like TB	
LABORATORY INVESTIGATIONS	**Blood culture** (before antibiotics, both for aerobics and anaerobic) OTHER INVESTIGATIONS • FHG, ESR, CRP and/or Procalcitonin • Lactate levels • Malaria slide • LFTs • UECs • Blood gas analysis • Urinalysis	
RADIOLOGICAL INVESTIGATIONS	Imaging will be guided by clinical presentation and is targeted to identify the likely source of infection	
RISK STRATIFICATION	**LOW RISK** • ANC <500 expected to last ≤7 days • Clinically stable (No hypotension, dehydration, altered mental status, hypoxia, oliguria or pneumonia) • No active uncontrolled comorbidities	**HIGH RISK** • ANC <500 expected to last ≥7 days • Clinically unstable (presence of hypotension, dehydration, altered mental status, hypoxia, oliguria or pneumonia) • Presence of active uncontrolled comorbidities

EMPIRIC TREATMENT	CAUSATIVE ORGANISM	RECOMMENDED AND ALTERNATIVE REGIMENS
LOW RISK	**Gram positives:** *Coagulase negative Staphylococci and S.aureus* **Gram Negative:** *Gram negative bacilli* **Other pathogens** fungal	**ADULT:** P.O. **Co-amoxiclav** 1g TDS PLUS P.O. ciprofloxacin 500 mg BD For Fungal infection: P.O Fluconazole 400mg/ day loading dose, maintenance 200mg/ day **CHILDREN:** P.O. Co-amoxiclav 20mg/kg/dose (amoxicillin component) (max 875 mg/dose) BD PLUS **P.O. Ciprofloxacin 10-15mg/kg/dose** (max 500mg/dose) BD **For fungal infection:** Fluconazole 6mg-12mg/kg/ day OD (max 400mg)
HIGH RISK ADULTS	**Gram positive** *S.aurues, Strep Spp* *E.feacalis* **Gram negative:** *E.coli,Klebsiella spp* *Enterobacter spp* *P.aeruginosa (more serious infections)* *Acinetobacter spp* **Other pathogens** *Candida spp* *Aspergillus spp* *Varicella Zoster* *Herpes simplex* *CMV*	Start empiric antibiotics ASAP after taking blood cultures Duration of treatment: until ANC>0.5 x 10^9/L **ADULT:** **IV Meropenem 1gm TDS** PLUS **IV Amikacin 15-20mg/kg/day in two divided doses** ADD antifungal *If fever continues beyond 4-7 days and no source is identified* **IV Amphotericin 0.7-1.0mg/kg OD** **If no improvement, consult Infectious disease specialist/AMS Team**

HIGH RISK CHILDREN	**SPECIAL CONSIDERATION** • Duration of treatment is dictated by the identified organism • In high risk febrile neutropenia, urgent therapy with IV broad spectrum antimicrobials is required. • If fever persists and there is no clinical improvement after 48-72 hours, re-evaluate to look for other non-bacterial causes (such as virus and fungal causes) or complications such as deep abscesses or resistant organism	**1st line** IV meropenem 40mg/kg 8 hourly (Max 2g per dose) **2nd line** Incase of persistent fever >72 hours and no sources identified: **ADD** Vancomycin 60mg/kg/day in 3 divided dosages (max of 2g per day) **ADD antifungal** *If fever continues beyond 4-7 days and no source is identified* **IV Amphotericin 0.5/kg OD and gradually escalate (max 1.5mg/kg/day)** **If no improvement, consult Infectious disease specialist/AMS Team**
PROPHYLAXIS	*Only recommended for high-risk febrile neutropenic patients* **Antibacterial prophylaxis** • **Ciprofloxacin** 500mg P.O. BD until neutropenia is resolved OR • **Levofloxacin** 750mg daily until neutropenia is resolved • **Pediatrics: Co-Amoxiclav 30-50mg/kg/ day 8 Hourly** **Antiviral prophylaxis** • **Acyclovir** 800mg P.O BD • **Pediatrics: Acyclovir 20mg/kg/dose 8 Hourly** **Hepatitis B:** (*those with high risk for reactivation*) • **Tenofovir** 300mg P.O. OD (continued for at least 6 months after completion of chemotherapy) **Antifungal prophylaxis** • **Fluconazole** 400mg P.O. OD • **Pediatrics: Fluconazole 6-12mg/kg/ day**	

3. UPPER RESPIRATORY TRACT INFECTIONS

3.1PHARYNGITIS/TONSILITIS		
Organism	**Antibiotics**	**Comments**
Mostly viral	• **No antibiotics needed.** • Give supportive therapy	Suspect bacterial infection if patient presents with: • fever • sore throat lasting ≥7 days • swollen lymph nodes on the neck.
Bacterial: **Most common organism is *group A beta hemolytic streptococcus***	**ADULT** **Amoxicillin** 1g BD for 5 days **<u>For penicillin allergy:</u>** **Azithromycin** 500mg OD for 3 days or 250mg for 5 days.	**Refer patient to ENT if:** • Sore throat does not go away • Patient presents with difficulty in swallowing or breathing • Fever 38.3 and above • Has hoarse voice or muffled speech
	CHILDREN **Amoxicillin** (40-55mg/kg/) BD for 5 days **<u>For penicillin allergy</u>:** **Azithromycin** 10mg/kg/dose OD for 5 days	

3.2 OTITIS MEDIA		
Organism	**Antibiotics**	**Comments**
Mostly bacterial. **Common organism:** ***S. pneumoniae*** ***H. influenzae*** ***M. caterralis***	**ADULT** **Amoxicillin** 1g BD for 5 days **<u>For penicillin allergy</u>:** **Azithromycin** 500mg OD for 3 days or 250 mg for 5 days Or **Erythromycin** 500mg QID for 5 days	**Refer to ENT specialists** for those with recurrent cases

	CHILDREN **Amoxicillin**(40-45mg/kg/dose BD for 5 days **<u>For penicillin allergy:</u>** **Azithromycin** (15mg/kg/dose) OD for 5 days	

NOTE: Patients who should be considered for immediate treatment with antibiotics

- **Under 2 years**
- **Immunocompromised**
- **Has a cochlear implant**
- **Possibility of complicating into suppurative**
- **The only hearing ear is affected 2. Refer to ENT for further management:**
- **Patients with chronic suppurative otitis media (discharge from the ear for more than 4 weeks)**
- **perforation of tympanic membrane**
- **hearing loss**

3.3 PNEUMONIA (>5 YEARS)	
DEFINITION	**Pneumonia is an acute respiratory tract infection characterized by inflammation of the lung parenchyma and the alveoli are filled with exudate (fluid) instead of air leading to limited oxygen intake and painful breathing.**
CATEGORIZATION	
Community acquired pneumonia	Pneumonia acquired in non-hospital environment or within **48 hours** of admission
Healthcare associated pneumonia	Pneumonia acquired within hospital setting Pneumonia that occurs 48 hours or more after admission and did not appear to be incubating at the time of admission
Ventilator associated pneumonia	Pneumonia acquired 48 hours after endotracheal intubation and on mechanical ventilation
Aspiration Pneumonia	Pneumonia resulting from entry of gastric or oropharyngeal fluids, which may contain bacteria and/or be of low PH or exogenous substances
Drug Resistant Pneumonia	MDR is acquired non-susceptible to at least one agent in three or more antimicrobial classes Extensively drug resistance is non-susceptible to at least one agent in all but two antimicrobial types Pan-Drug-Resistant is non-susceptible to all agents in all antimicrobial categories
CLINICAL FEATURES	**Symptoms:** Cough, tachypnea, pleuritic chest pain, fever, difficulty in breathing, sputum production, tachypnea **Signs:** respiratory distress, bronchial breath sounds, crackles, reduced oxygen saturation
LAB INVESTIGATION	**Pneumonia is largely a clinical diagnosis** **SUPPORTING LAB TESTS** • Sputum culture, gram stain and/or gene X-pert only if the patient has failed antibiotic therapy or highly suspicious of TB • Blood culture • NP swab (when indicated e.g. suspected COVID)

	• CRP or procalcitonin **NB:** ***Take specimens for culture prior to initiation of antibiotics***
IMAGING	Chest radiograph In adults: should be done as a routine exam **In children**, indications of CXR are: • Treatment failure • Worsening pneumonia • Non-improvement after 48 hours of treatment • Recurrent pneumonia

	COMMUNITY ACQUIRED (CAP)	**HEALTH CARE ASSOCIATED (HAP)**	**VENTILATOR ACQUIRED (VAP)**
INFECTIVE ORGANISMS	*Strep. pneumoniae, Staphylococci spp.*	*E. coli,K. pneumoniae*	*Acinetobacter baumanii,K. pneumoniae, Pseudomonas sp.*
EMPIRIC THERAPY	For low severity illness, treated as out-patient: **Amoxicillin 40-45 mg/kg / dose** 12 hourly for 5 days For patients who require admission or with co-morbidities: **Amoxicillin 875mg+ clavulanic acid 125mg PO** 12hourly **OR 1.2g IV** 8 hourly for 5 days	**Meropenem 0.5-1mg IV 8** hourly (Max dose 2g) for 7 days	**Meropenem 0.5-1mg IV 8 hourly (Max dose 2g)** **PLUS** **Amikacin 15mg/Kg/day IV** Where there is high risk of MRSA add **Vancomycin** as you await culture results CONSIDER antifungal agent for nonresponsive patients **IV**

	For severe pneumonia, add **Azithromycin 500mg PO** once a day for 3 days		**Amphotericin 0.71.0mg/kg OD** **If no improvement consult ID specialist /AMS Team**

***The CURB-65 scoring can be used to assess for severity of illness:**

- C**- Confusion (1 point)**
- U**- Urea >7mmol/l (1 point)**
- R**- Respiratory rate >30bpm (1 point)**
- B**-Blood pressure <90mmHg systolic or <60mmHg diastolic (1 point)**
- **65 - Age > 65 (1 point)**

*****The CRB-65 score, which does not require laboratory values for its calculation, can also be used, the score value interpretation is the same as for CURB-65***

Clinical judgment should be used for all patients when determining appropriate site of care. Prediction scores such as CURB-65 or PSI are useful but should not be the only determinant of location of care of the patient

For patients not improving:

- **Evaluate for complications e.g. empyema (which will require drainage of infected pleural fluids and intrapleural fibrinolytics eg alteplase with prolonged duration of treatment (10-14 days) to minimize further complications.**

- **Coverage for anaerobic organisms and *staphylococcus aureus* will be required for lung abscess, Clindamycin can be used.**

4. SKIN AND SOFT TISSUE INFECTIONS

DEFINITION	**Involves microbial invasion of the layers of the skin and underlying soft tissues, fascia, or muscle, ranging from simple superficial infections to severe necrotizing infections.**
DIAGNOSIS	**i. Clinical features:** skin erythema, edema, and warmth, extremity swelling, pain, tenderness fever-38°C, **ii. Lab investigations**: •FHG: leukocytosis with neutrophilia, CRP/Procalcitonin. •Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score (based on laboratory indicators including white cell count, hemoglobin, sodium, glucose, creatinine, and CR) •Pus culture if present. iii. Imaging: Ultrasound, CT scan in deep abscess (guided by clinical needs)

4.1 PURULENT CELLULITIS

Common pathogens	Empiric therapy	Alternative therapy	Comments
Staphylococcus aureus, Streptococcus spp	**ADULT** **<u>Mild</u> <u>(Outpatient)**</u> **PO Flucloxacillin 500mg, QID** for 5-10 days	**IV Clindamycin 300-450mg, QID** for 5-10 days (if MRSA is suspected)	• ***Incision and Drainage is the mainstay of treatment.*** • Culture for blood, pus and or bullae are needed when there are signs and symptoms of systemic inflammatory response, extensive involvement of skin and comorbidities • Administer parenteral route for extensive lesions
	<u>Moderate (Inpatient)</u> **IV Flucloxacillin 500mg, QID** for 5-10 days		
	CHILDREN **PO Flucloxacillin 25-50mg/kg/day** QID (Max 500mg/dose) for 7-10 days **OR** **PO Flucloxacillin 50mg/kg/day QID** (Max 2g) for 7-10 days	**PO Clindamycin 10mg/kg/dose QID** for 5-10 days (if MRSA is suspected) **OR** **IV Clindamycin 25-40mg/kg/day QID** for 5-10 days (if MRSA is suspected)	

4.2 NON-PURULENT CELLULITIS

Common pathogens	Empiric therapy	Alternative therapy	Comments
Beta-hemolytic streptococci (group A, B, C, G) *Staphylococcus aureus*	**ADULT** **PO Amoxicillin-Clavulanic acid 1g** TDS for 7-10days	**PO Azithromycin** 500mg OD day 1 then 250mg OD for 5 days	• Treatment includes elevation of the limb to reduce local edema • Change to oral when condition improves
	CHILDREN **PO Amoxicillin-Clavulanic acid (25-45mg/kg /day BD** of amoxicillin component) for 7-10 days **OR** **IV Amoxicillin-Clavulanic acid 90mg/kg/day TDS** for 7-10 days	**PO or IV Clindamycin** 30-40mg/kg/day TDS for 7-10 days (if MRSA is suspected)	

4.3. NECROTIZING FASCIITIS: includes Fournier's Gangrene

- Infections causing necrosis of the muscle fascia and subcutaneous tissues.
- Necrosis manifests with decreased pain, dusky, cyanotic skin often with blood filled bullae.
- May have associated toxic shock symptoms like hypotension, nausea, vomiting, multi-organ failures

Common pathogens	Empiric therapy	Alternative therapy	Comments
Mixed aerobic and anaerobic bacteria	Surgical debridement and antibiotics **ADULT** **IV Piperacillin-Tazobactam 3.375g 6 hourly** (De-escalate once culture results are available or necrotizing fasciitis is ruled out) **CHILDREN** **IV Piperacilin-Tazobactam** **<40kg- 90mg/kg 8 hourly** **>40kg- 3.375g 6 hourly** (De-escalate once culture results are available or necrotizing fasciitis is ruled out)	<u>For penicillin allergy use:</u> **IV Amikacin 15mg/kg/day Plus IV Clindamycin 600 mg hourly for 5-10 days** (De-escalate once culture results are available or necrotizing fasciitis is ruled out)	• Early and aggressive surgical exploration and debridement is critical Emergent surgical consultation is recommended • Combination therapy with clindamycin is needed to block toxin production whether the patient manifest with toxic shock syndrome or not

4.4.BED SORE/ PRESSURE SORE/ DECUBITUS ULCER		
Common pathogens	**Empiric therapy**	**Comments**
• *Streptococcus sp,* • *Staphylococcus aureus,* • *Enterobacteriaae,* • *Pseudomonas aeruginosa Anaerobe* • *Streptococci, Bfragilis*	Wound care is preferred Superficial infection: *If there are signs of cellulitis, bacteremia, fasciitis, intramuscular abscess;* **ADULT:** **Amoxicillin & clavulanic acid 1.2 g IV 8 hourly** **OR** **Doxycycline 100mg PO 12 hourly** **PLUS** **Clindamycin 600mg IV 6 hourly**	• Debride necrotic tissue and use moist dressing • Remove pressure if decubitus ulcer • Elevate limb if venous stasis • Start empiric antibiotic treatment **only if there are local features of inflammation** (surrounding cellulitis or abscess) and **systemic features.** • **DO NOT** use Povidone iodine or Chlorhexidine because they damage granulation tissue and fibroblasts • Obtain a tissue culture for infected wounds
4.5. WOUND INFECTION POST TRAUMA		
Common pathogens	**Empiric therapy**	**Comments**
Polymicrobal *Staphylococcus aureus,Streptococcus sp,Enterobacteriaceae Clostridium tetani Clostridium perfringes, Acinetobacter spp, Pseudomonas spp, Aeromonas spp*	**ADULT** **PO flucloxacillin 500mg QID** for 5-10 days **CHILDREN** **PO flucloxacillin 25mg/kg/day (Max 500mg per day) QID** for 7-10days	▪ **No infection: no antibiotic.** ▪ **Treatment depends on the site of trauma as different protocols may apply. Consult respective specialties** ▪ **Traumatic wounds without evidence of local infection or systemic signs of infection typically do not need antimicrobial therapy** ▪ Debridement of devitalized tissues and source control is critical to successful healing ▪ Give tetanus vaccine if indicated ▪ Obtain sample for culture and sensitivity

5. GASTROINTESTINAL INFECTIONS

5. 0. ACUTE DIARRHEA AND GASTROENTERITIS	
DEFINITION	• Frequent loose watery stool (> 3 episodes /24hrs) with or without vomiting • **Should not be treated empirically with antibiotics except in the presence of dysentery (bloody, mucoid stool)** • Non - bloody infectious diarrhea is generally caused by viruses. • Timely supportive care and rehydration is essential (for pediatrics refer to the national pediatric protocol).
LABORATORY INVESTIGATIONS	• Stool for microscopy, culture and sensitivity prior to starting antibiotics • Blood culture in systemic illness • PCR for Rota virus

5.1. DIARRHEA AND GASTROENTERITIS IN CHILDREN		
DEFINITION	• Acute diarrhea is diarrhea lasting <14 days. • Mainstay of therapy is to give **fluids, zinc supplements and food.**	
ETIOLOGY BY AGE	• <12 months: **Rotavirus**, Enterotoxigenic Escherichia coli (ETEC), Cryptosporidium • 12-23 months: Rotavirus, ETEC, Shigella • 24-59 months: Rotavirus, Shigella, Vibrio cholerae	
INFECTION AND LIKELY CAUSATIVE PATHOGEN	**ANTIBIOTIC CHOICE**	**REMARKS**
Acute Gastroenteritis- **rotaviruses**	**Antibiotics NOT recommended**	• Oral rehydration backbone of treatment • Antibiotics therapy may prolong carriage stage of Salmonellosis • **Where** applicable consider use of pre/probiotics
Dysentery- • ***Shigella,*** • ***Campylobacter*** • ***E.coli*** • ***Salmonella*** • ***E. histolytica***	**Mild or Uncomplicated** PO **Ciprofloxacin** 4-8mg/kg/dose OD (max 400mg /dose) for 5 days **PLUS** PO **Metronidazole** 10mg/kg/dose (max 500mg/dose) for 5 fays	**RULE OUT:** **INTUSSUSSCEPTION IN CHILDREN WITH DYSENTRY**

	<u>Severe illness</u> (hospitalization, invasive or other complications or immunocompromised patients) IV **Ceftriaxone** 50-75mg/kg/dose (max 2g/dose) OD **PLUS** IV **Metronidazole** 15mg/kg/dose (max 500mg/dose) TDS for 5days	

5.2. GASTROENTERITIS (INFECTIOUS DIARRHEA) IN ADULTS		
DEFINITION	• Most community-acquired diarrhea is viral in origin (norovirus, rotavirus and adenovirus) • Antibiotic therapy does NOT shorten the duration of symptoms, and therefore should be discouraged.	
LABORATORY INVESTIGATIONS	• Stool for microscopy, culture and sensitivity prior to starting antibiotics • Switch to oral medication once patient can tolerate.	
INFECTION & LIKELY CAUSATIVE ORGANISM	**ANTIBIOTIC CHOICE**	**REMARKS**
Mild Diarrhea **(<3 unformed stool/day; minimal associated symptoms)**	Oral hydration	
Moderate Diarrhea (**3-4 unformed stools/day; with or without systemic infections)**	Oral or Parenteral hydration	

Severe Diarrhea **(> 6 unformed stools/day; +/- fever, tenesmus, blood or fecal leukocytes)** Bacterial**:** ***Shigella sp,*** ***Salmonella sp,*** ***C.jejuni,*** ***C.difficile (toxin positive) E. coli (enterotoxigenic, enteroaggregative, shiga toxin producing)*** ***K.oxytoca*** Parasitic**:** ***G.lamblia,*** ***E.histolytica,*** ***Cryptosporidium***	**Empiric therapy:** **IV Ciprofloxacin 400mg** BD PLUS **IV Metronidazole 500mg** TDS **DO NOT USE CIPROFLOXACIN IN ETEC INFECTION AS THIS, MAY WORSEN THE DIARRHEA, USE CEFTRIAXONE**	**Duration of treatment** Non-Salmonella infection: 5days Uncomplicated Salmonella infection: 5days Complicated Salmonella infection: 14days If E. histolytica is isolated, to eradicate cysts and prevent relapse after acute treatment, consider adding: • PO **Aminosidine 500mg** TDS for 7 days

6. INTRA-ABDOMINAL INFECTIONS

<table>
<tr><th colspan="3">6.1. INTRA ABDOMINAL INFECTIONS</th></tr>
<tr><td>DEFINITION</td><td colspan="2">Intra-abdominal Infections describe a diverse set of diseases.
Intra-abdominal infections are usually classified into uncomplicated and complicated.
Uncomplicated infection:
• Involves a single organ and does not proceed to peritoneum.
• Patients with such infections can be managed with either surgical source control or with antibiotics alone.
Complicated infection:
• Extends beyond a single organ and causes either localized peritonitis or diffuse peritonitis</td></tr>
<tr><td>RISK STRATIFICATION</td><td colspan="2">Low risk: mild to moderate community acquired intra-abdominal infections with no risk factors for antibiotic resistance or treatment failure
High risk: severe intra-abdominal infections or in patients at high risk for adverse outcomes or re</td></tr>
<tr><td>DIAGNOSTIC TESTS:</td><td colspan="2">1. Clinical features: (features of sepsis)
• Hypotension or low MAP, PR>100 b/min
• Resp rate >22 bpm
• Altered mental state
• urine output <30mL/kg/hour
2. Lab investigations:
• WBC>120,00
• Lactate>2
• Elevated CRP/procalcitonin
• deranged BGA
3. Imaging: Ultrasound, X-ray, Ct scan abdomen (will be directed by the clinical presentation)</td></tr>
<tr><td>COMMON PATHOGENS</td><td>COMMUNITY ACQUIRED
• Escherichia coli
• Bacteroides
• Klebsiella spp.
• Proteus
• Enterobacter spp</td><td>HEALTH CARE ASSOCIATED
• Enterococcus • Pseudomonas spp.
Resistant
• Enterobacteriaceae, streptococci and anaerobes</td></tr>
</table>

EMPIRIC TREATMENT	**Low risk:** **Amoxicillin+ clavulanate** 1.2 g IV 8 hourly **OR** **Amikacin**15mg/kg/day **PLUS** **Metronidazole** 500mg IV 8 hourly **High risk:** **Meropenem** 2 g IV 8 hourly **OR** **Amikacin** 15mg/kg/day **PLUS** **Metronidazole** 500mg IV 8 hourly	**Meropenem** 2g IV 8 hourly Where there is suspicion for MDR organisms, add **Amikacin** 15mg/kg/day Consult ID if patient not improving

Management of IAI:

- **Source control is key in management of complicated intra-abdominal infections (drainage, debridement and definitive Management)**
- **With multiple abdominal surgeries** consider candida infections **and take appropriate samples for fungal cultures. Consult infectious disease specialist**
- **Carbapenems and piperacillin/tazobactam provide adequate anaerobic cover, do not add metronidazole or clindamycin when using these agents**
- **Ensure adequate patient monitoring and fluid management**

6.2. PRIMARY SPONTANEOUS BACTERIAL PERITONITIS			
Organism	**Empiric therapy**	**Alternative therapy**	**Comments**
ADULTS *Enterobacteriacea e (e.g. E. coli, K. pneumoniae,* and *streptococcus spp)* *Enterococcus spy* Anaerobes	**IV ceftriaxone 1g BD** for 5 days	**IV Meropenem 2g** TDS for 5days	• Perform analysis (e.g. bleedings parameters) Gram stain and culture of peritoneal fluid to distinguish primary from secondary peritonitis • Start antimicrobials as soon as possible • Generally managed medically. • Do surgical consult. • Maintain fluid and electrolyte balance • Consider repeat Paracentesis > 48 hours after therapy if no clinical improvement, or unusual organism. Charge antibiotics if PMN count has not declined by 25%
CHILDREN *S. pneumoniae* (most common) *E. coli* *Staphylococci,* *Group A strep,* *Enterococci,* *K. pneumoniae*	**IV cefotaxime 50mg/kg/dose** (max 2g/dose) QID for 5days **OR** **IV ceftriaxone 50mg/kg/dose** (max of 2g/dose) be for 5days		• If blood culture is positive (treat for 2 weeks bacteremia) **Ceftriaxone may cause bile sludge in patients with jaundice or Cirrhosis It should be avoided in liver impaired meant**

6.3. SECONDARY BACTERIAL PERITONITIS
(Perforated viscous/penetrating intraabdominal trauma)

Organism	Empiric therapy	Alternative therapy	Comments
Usually, ***polymicrobial*** *consisting of anaerobes and facultative gram-negative bacilli; Bacteroides fragilis group, Peptostreptococcus, E. coli, Klebsiella, P. aeruginosa, Enterococcus*	**ADULT** IV **piperacillin/tazobactam 300mg/kg/day** TDS **PLUS** **IV Amikacin 15-20 Mg/Kg Daily in two divided doses** **CHILDREN** IV **Piperacillin/ tazobactam 300mg/kg/day** (max 16g/day) TDS/QID for 7-14 days **PLUS** **IV Amikacin 15mg/kg Daily in two divided doses**	IV **Meropenem 2g** 8 Hourly **PLUS** **IV Amikacin 15-20 mg/kg Daily in two divided doses** **CHILDREN** **IV Meropenem 10-40mg/kg/ day**	Patient may require **either immediate surgery** to control the source of contamination and to remove the necrotic tissue, blood and intestinal content from the peritoneal cavity OR **Drainage procedure** if a limited number of large abscesses can be shown

6.4. CHOLECYSTITIS AND CHOLANGITIS			
Organism	**Empiric therapy**	**Alternative therapy**	**Comments**
Community Acquired Common Organisms *Enterobacteriacea e* is the commonest organism *Bacteroides* only comprise about 20% of biliary infection	**ADULT** **IV Ceftriaxone 1 g BD** PLUS/ MINUS IV **Metronidazole 500mg** TDS for 4-7 days (if biliary enteric anastomosis or obstruction is present)	**IV** **Meropenem 2**g TDS For 47 days	Appropriate source **control to drain infected foci** and restoration of anatomic and physiologic function is recommended for all patients, as antibiotic will not enter bile duct in the presence of obstructions. **Obtain surgical consult** **Antianaerobic therapy is NOT indicated** unless there is biliary enteric anastomosis Convert to oral antibiotic if Clinical improvement.
	CHILDREN **IV cefotaxime 200300mg /kg/day IV** QID (max 2g/dose) PLUS **IV Metronidazole 22.5-40mg/kg/day TDS (max 4g/day**) for 5-7 days with adequate source control	**IV ceftriaxone 100mg/kg/day** in OD/BD (max 2g per dose; 4g/day) PLUS **IV Metronidazole 22.5-40mg/kg/day TDS (max 4g/day)** for 57 days with adequate source control	

7. SEPSIS

7.1. NEONATAL SEPSIS IN INFANTS < 60 DAYS	
DEFINITION	**Acute life-threatening suspected or proven infection characterized by organ dysfunction in new born infants < 60 days.** **May be divided into early and late onset neonatal sepsis:** • Early onset neonatal sepsis **(EONNS): < 72 hours** • Late onset neonatal sepsis **(LONNS): > 72 hour after birth.**
CLINICAL PRESENTATION	**Symptoms:** **Nonspecific presentation, thus high index of suspicion** • Temperature instability (Temperature > 38.0 C or lower than 35.5 C) • Convulsions • Apnea • inability to feed • central cyanosis or SPO2 <90% • bulging fontanelle • persistent vomiting • movement only when stimulated **Signs:** • **General**: fever, jaundice pallor, petechiae, purpura, bleeding, mottling, sclerema, • **Abdominal**: Abdominal distention, hepatomegaly, splenomegaly • **Respiratory**: Apnea, tachypnoea, retractions, grunting, cyanosis, • **Cardiovascular**: Tachycardia, bradycardia, hypotension • **Central nervous system**: tremors, seizures, hypotonia, abnormal reflexes, full fontanelle, high pitched cry
CATEGORIZATION	**Neonate at risk of sepsis:** Risk factors include: • prolonged rupture of membranes (PROM) > 18 hours • maternal fever > 38°C • suspected or confirmed chorioamnionitis

	• mother treated for sepsis during labour or 24 hours before or after delivery **Neonatal sepsis:** One of the following: • Not feeding well on observation • temperature ≥ 38°C or ≤35.5°C, • severe chest wall in-drawing • movement only when stimulated **Severe neonatal sepsis:** One of the following: • Unconscious • history of convulsions • unable to feed/poor feeding • apnea • Unable to cry/high pitched cry • central cyanosis/SPO2 < 90% ☐ bulging fontanelle • persistent vomiting.		
LAB INVESTIGATIONS:	• **Blood culture (gold standard)** • Full blood count, CRP, procalcitonin • LP for CSF studies • urine MCS • any other supportive investigation as dictated by clinical presentation		
IMAGING	As indicated based on clinical presentation		
	COMMUNITY ACQUIRED	**HEALTH CARE ASSOCIATED**	**COMMENTS**
	COMMON PATHOGENS **Early onset sepsis:** • *Group B Streptococcus* • *Gram negative enteric bacilli (Escherichia coli, Klebsiella pneumoniae)* **Late onset sepsis** • *CONS, Staph. Aureus* • *Group B Strep.* • *E. coli,K. pneumonia*	COMMON PATHOGENS • *K. pneumonia* • *Coagulase negative Staph* • *E. faecium* • *E. faecalis* • *A. baumanii*	

	• *P. aeruginosa* • *Candida*		
EMPIRIC TREATMENT	**Neonate at risk of sepsis**: Stop IV antibiotics after 48 hours if all signs of possible sepsis have resolved, neonate is feeding well, and LP if done is normal. **Early onset sepsis:** 1st line: **Benzylpenicillin** <7 days of age 50,000iu/kg/dose for BD 5 days >7 days of age 50,000iu/kg/dose QID for 5 days **Plus** **Gentamicin** <7 days <2kg 3mg/kg OD for 5 days <7 days>2kg 5mg/kg OD for 5 days >7 days 7.5mg/kg OD For 5 days **If Staphylococcus is suspected:** **Flucloxacillin** <7 days of age 50mg/kg/dose 12 hourly >7 days of age 50mg/kg/dose 8 hourly Plus	**1st line:** **IV Meropenem** **10-40 mg/kg 8** **Hourly** PLUS **IV Vancomycin** **10-15mg/kg 6-8** **Hourly**	When prescribing for neonates, **take into account age of neonate (</>7days**) plus birth weight especially for gentamicin (refer to Basic pediatric protocol) Add metronidazole if there is necrotizing enterocolitis

	Gentamicin <7 days <2kg 3mg/kg OD for 5 days <7 days>2kg 5mg/kg OD for 5 days >7 days 7.5mg/kg OD For 5 days		
	Late onset sepsis 1st line: **Benzylpenicillin** Plus **Gentamicin** 2nd line/ deranged renal function: **Ceftazidime 50mg/kg 8 Hourly** <7 Days 12 Hourly >7Days 8 Hourly		

SPECIAL **CONSIDERATIONS**	Adjust treatment based on culture results **Duration of therapy:** 1. **Neonate at risk of sepsis**: • Well baby, breastfeeding well, no signs of sepsis • 48 hours of antibiotics • Reassess after 48-72 hours of antibiotics both clinically and lab results • If well and lab parameters are normal/negative - discharge without antibiotics. • Follow-up at 48 hours at nearest facility 2. **Neonatal sepsis:** • 48 hours of iv antibiotics • Reassess at 48-72 hours both clinically and lab results • If breastfeeding is well and clinically stable, discharge on oral treatment – dispersible high dose amoxicillin 45 mg/kg 12 hourly to complete 5 days of antibiotic treatment. 3. **Severe neonatal sepsis**: • Complete 7 days of iv antibiotic • Reassess at 48-72 hours: clinically and lab results • Improving: complete antibiotics and discharge • Confirmed sepsis: Complete 7-10 days of iv antibiotics Reassess at 48-72 hours: clinically and lab results 4. **Meningitis: Gram positive** IV treatment for 14 days Gram **negative** organisms: Treat for 21 days 5. **Treatment failure:** • Administer antibiotics for at least 48-72 hours • If baby is not improving, or deteriorating during treatment, do complete clinical re-evaluation • Repeat FHG, blood culture, CRP and appropriate investigations before switching antibiotics

7.2. SUSPECTED SEPSIS IN PEDIATRICS

DEFINITION	**Systemic inflammatory response syndrome (**SIRS) **in the presence of suspected or proven infection constitutes sepsis**
SIRS	SIRS combined with acute organ dysfunction = severe sepsis or septic shock
RECOGNITION	SIRS requires**> 2 abnormal** measures of the following (one of which must be HR or RR, and the other must one of the following: temperature, WBC or % banding) • Core temperature **>38.5°C** (if axillary, < 37.9C) OR **<36°C** (if axillary, • 35.4°) • HR abnormal (Tachycardia, or <1yr old, bradycardia) • RR abnormal for age or mechanical ventilation for an acute pulmonary process • WBC abnormal (Leukocyte count elevated or depressed for age), or >10 percent • Immature neutrophil (> 10% neutrophil banding)
RECOGNITION	
(A) SIRS components AND 1 major organ dysfunction	• **Respiratory**: requires mechanical ventilation • **Cardiovascular:** Blood pressure below 5" percentile of normal value for age OR Vasoactive agents administered OR Base excess< -5 MEq/L AND at least one of the following: Lactate> 4 mmol/L or Cap refill> 3 sec
B) SIRS components AND 2 minor organ dysfunctions	1. **Respiratory** (not mechanically ventilated) • 2 SPO_2 measurements< 90% **OR** • Requires supplemental oxygen with FiO2 > 50% to maintain oxygen saturation > 90% and < 94% (and has not received asthma and seizure medications within 2 hours) 2. **Hematologic** • Low platelet counts (< 80,000/mm3) or decline in platelet count>50% from the highest value in the past 3 days **OR** • PT > 18.5 sec. **OR** INR > 2.0 3. **Renal** • Elevated creatinine (Age < 1 year: 106 mmol/L Age 21 year: 265 mmol/L **OR** • Creatinine increase > 100% from baseline level **4.** **4 Hepatic** • ALT: Age <2months > 156 units/L; Age 2 2 months > 72 units/L **OR**

	• AST: Age < 1 year> 148 units/L; Age 1-17 years> 92 units/L	
CLINICAL CONSIDERATIONS	• Focused History and physical examination • Identify evidence of shock or sepsis -associated organ dysfunction. • (*Majority of mortality in pediatric sepsis results from refractory shock and/or multiple organ dysfunction syndrome with many deaths occurring within the initial 48-72 hours of treatment*) • **Early identification and appropriate resuscitation and management are critical to optimizing outcomes**.	
WORK UP FOR INFECTION	CBC, CRP/PCT, blood Culture, Urinalysis, LP, wound secretion stool **Look for source of infection** **OTHER LABS** RBS, Lactate, BUN/serum Creatinine, electrolyte, LFTS, DIC	
RADIOLOGICAL INVESTIGATIONS	As indicated by clinical presentation Chest X ray, Abdominal Ultrasound	
REASSESS	Assess work of breathing and sepsis specific parameters every 15 min: Mental status/ Capillary refill/ Pulse strength/ Extremity temperature Vital signs	
REPEAT TESTS	1. Repeat CBC, CRP and PCT after 24-48 hours to assess response to treatment or pick up delayed changes. 2. Repeat LP in 72 hours to exclude or confirm meningitis if the CSF was a bloody tap with a high white cell count. 3. Or the baby was too unstable initially for an LP 4. A blood culture should be repeated: • Prior to the commencement/addition of a new antibiotic(s). • The baby has a positive blood culture. • The baby does not respond satisfactorily to antibiotic treatment • The initial culture was negative and there is a strong clinical suspicion of infection or there are clinical symptoms or signs suggesting meningitis.	
COMMON PATHOGENS: *Staph aureus, MRSA, Streptococcus pneumoniae, Streptococcus pyogenes, Pseudomonas aeruginosa,*	**<u>Empiric Treatment</u>** • Secure airway and ensure breathing. • Initiate IV fluids 10-20 ml/kg boluses to maximum of 40-60ml/kg:	**<u>Continue Antibiotics for >7 days if:</u>** **a)** The baby is not yet fully recovered **b)** Pathogen identified require longer duration e.g. MRSA or

Escherichia coli, Enterococcus species, Klebsiella species ***Alpha streptococcus* in children with acute myelogenous leukemia with mucositis and neutropenia** *NOTE: The> 2 SIRS components AND organ dysfunction MUST occur within 24 hours of each other to meet the criteria for sepsis*	Fluid refractory shock: assess cardiac function, ICU consult, start vasoactive **Low risk:** No comorbidities and no central line. **IV Benzyl penicillin 50,000** I.U /kg/dose QID (max 4 MU/dose) **PLUS** **IV Gentamicin 5-7.5mg** /kg/dose OD for 5-7 days **High risk**: • Central line • Immuno-compromised • Non-oncology • Receiving immunosuppressive Rx (other than chemotherapy), • Recent hospitalization (> 4 days within 2 months) Long term care facility resident • hemodynamically unstable on vasoactive therapy and/ or ICU admission for shock. **IV Meropenem 40 mg**/kg TDS (max 2g/dose) **PLUS** **IV Amikacin 7.5mg**/kg BD (max 1.5g/day) (if not in renal failure) **ADD** **IV Metronidazole 7.5mg**/kg/dose TDS (max 500mg/dose) if intra-abdominal infection is suspected early. Treat hypoglycemia, hypercalcemia	Gram negative rods mixed infection **c)** Site of infection requires longer treatment duration e.g. osteomyelitis (4-6 weeks) and meningitis (21days**)**

7.3. SUSPECTED SEPSIS IN ADULTS

DEFINITION	**A life-threatening organ dysfunction caused by dysregulated host response to infection.** Septic shock**: identified by:** • **Persistent hypotension requiring vasopressor therapy to elevate MAP>65mmHg** • **Lactate >2mmol/L despite adequate fluid resuscitation**	
RECOGNITION	Suspected infection PLUS qSOFA score > 2 points. qSofa SCORE: • ***Low Blood pressure (SBP<100mg)*** *1* • ***High respiratory rate(>22b/min)*** *1* • ***Altered Mentation (GCS<14)*** *1*	
SEPSIS HOUR-ONE CARE BUNDLE	**1. Measure lactate level** **2. Obtain blood cultures before administering antibiotics.** **3. Administer broad-spectrum antibiotics.** **4. Begin rapid administration of 30mL/kg crystalloid for hypotension or lactate level ≥ 4 mmol/L.** **5. Apply vasopressors if hypotensive during or after fluid resuscitation to maintain MAP ≥ 65 mm Hg.**	
INITIAL MANAGEMENT: **6 STEPS**	1.Oxygen	Target saturation >95% or 88-92 in patients with chronic lung disease.
	2.Blood culture and lab works before antibiotic therapy	Blood culture, CBC, CRP OR Procalcitonin, BGA with lactate, evaluate for end organ failure, LFTs
	3.Lactate	Venous blood gas/serum lactate>2mmol/L; or >4 severe sepsis
	4.IV fluids	Bolus 30 ml/kg NS target MAP >65mmHg or systolic BP >100mmHg If not at target, repeat; early critical care consult for inotropic support

	5.Empiric IV antibiotics **within one hour from recognition** (target suspected source, given antibiotics awaiting results)	1) Unidentified source community acquired infection: **Target organisms: strep/E.coli** IV **Amoxiclav** 1.2gm Q8hr PLUS IV **Amikacin** 15mg/kg/day (2) Unidentified Source with high risk (comorbid conditions/immune suppressed/ elderly/ recent hospital contact or admission) or healthcare associated infection **Target organism*: E. coli/strep/ Pseudomonas/Klebsiella*** IV **Meropenem** 2g TDS PLUS IV **Amikacin** 15 mg/kg/day
	6. Monitoring	Recheck vital signs and fluid balance, Identify possible source of infection
REASSESS	Target: • MAP >65mmHg • Systolic BP >100mmHg • oxygen saturation> 95% • Urine output> 0.5ml/kg/hr • Decreasing serum lactate • Improving level of consciousness	
REFER	Appropriate investigations and management: guided by suspected sources. Admitting team/ critical care review	
NOTES:	**Review cultures within 48hrs-72hrs and tailor antimicrobial therapy.** • If no improvement noted: review appropriate dosing/ source control/ non-bacterial cause of presentation/ Noninfectious cause. • Repeat cultures and consult ID/AMS team	

7.4. BURN SEPSIS

DEFINITION	**A life-threatening organ dysfunction caused by dysregulated host response to infection of a burn wound(s)**
CRITERIA/RECOGNITION (AMERICAN BURN ASSOCITATION)	**Three or more of the following:** 1. Temperature>39° or <36.5°C 2. Progressive Tachycardia > 110 bpm 3. Progressive Tachypnea: • >25 breaths/minute not ventilated • Minute ventilation 12L/min ventilated 4. Thrombocytopenia <100,000/ml 5. Hyperglycemia (in absence of preexisting DM) • >200mg/dl / 11.1 mmol/l 6. Inability to continue enteral feedings >24hrs
MANAGEMENT	**Follow the Sepsis protocol(For Adults/Children)** **Note:** **ANTIBIOTICS ARE GENERALLY NOT RECOMMENDED FOR BURNS UNLESS IN BURN SEPSIS**

8. GENITOURNINARY INFECTIONS

DEFINITIONS	
UTI	An inflammatory response of the urothelium to bacterial invasion that is usually associated with bacteriuria and pyuria. Can involve the lower or lower urinary tract
Uncomplicated UTI	Acute sporadic or recurrent lower or upper urinary tract infection, limited to non-pregnant women with no known relevant anatomical and functional abnormalities within the urinary tract or comorbidities.
Complicated UTI	All UTIs which are not defined as uncomplicated. A UTI in a patient with an increased risk of a complicated course i.e. all men, pregnant women, presence of relevant anatomical or functional abnormalities of the lower urinary tract, indwelling catheters, renal diseases, and/or with other immunocompromising diseases. These infections are more difficult to eradicate.
Recurrent UTI	Recurrence of at least 3 UTIs/year or 2 UTIs within 6 months. Can be complicated or uncomplicated. Should be diagnosed by urine culture.
Urosepsis:	Life threatening organ dysfunction due to dysregulated host immune response to an infection originating from the urinary tract and or male genital organs.
Asymptomatic bacteriuria (ABU)	In an individual without urinary tract symptoms.
	Women: 2 consecutive mid-stream urine samples showing bacterial growth $>10^5$ CFU/ml. Men: A single mid-stream urine sample showing bacterial growth of 10^5CFU/ml. A catheterized sample showing bacterial growth of $>10^2$ CFU/ml in both men and women.
COMMON UROPATHOGENS:	Escherichia coli, Klebsiella, Enterobacter, Proteus, Pseudomonas, Staphylococcus saprophyticus, Enterococcus, Candida.

TREATMENT

8.1 ABU

- Screen and treat ABU before urological procedures involving breach of mucosa.
- Screen and treat ABU in pregnant women with standard short course antibiotic.

8.2 ACUTE CYSTITIS

- Characterized by lower urinary tract symptoms (frequency, urgency, dysuria and occasionally suprapubic pain) in absence of vaginal discharge.
- Urine dipstick analysis can be used to aid diagnosis in acute uncomplicated cystitis.
- Urine culture should be done in: suspected acute pyelonephritis, persistence or recurrence within 4 weeks of treatment, women with atypical symptoms, pregnant women.

Antimicrobial agent	**Dose**	**Duration**	**Considerations**
1st line women			
Nitrofurantoin	100mg BD	5 days	
Fosfomycin trometamol	3g PO STAT	1 day	
In Men			
Ciprofloxacin	500mg BD	7 days	
Nitrofurantoin	100mg BD	7 days	
Fosfomycin trometamol	3g PO STAT	1 day	
In Children			
Sulfamethoxazole Trimethoprim	(Trimethoprim) 8-10mg/kg in two divided doses	7 days	
Amoxicillin-Clavulanic acid	25mg/kg in three divided doses	7 days	

8.3 PYELONEPHRITIS

- Suspect in patient with fever, chills, flank pain, nausea, and vomiting or costovertebral angle tenderness, with or without the typical symptoms of cystitis.
- Perform urinalysis, urine culture and relevant imaging to exclude urgent urologic disorders.
- Uncomplicated: limited to non-pregnant, pre-menopausal women with no known relevant anatomical, functional abnormalities or comorbidities.
- Parenteral antimicrobials should be continued until the patient is afebrile for 24 hours and can take oral medication to complete duration of treatment

Empiric oral treatment for uncomplicated pyelonephritis

Antimicrobial agent	Daily dose	Duration of therapy	Comments
Ciprofloxacin	500-750mg BD	7 days	Fluoroquinolone resistance should be <10%
Cefixime	400mg OD	10 days	
Treatment for complicated pyelonephritis			
Ceftriaxone	1-2g OD		Higher dose recommended
Co-amoxiclav	1.2g TDS		
2nd Line			
Piperacillin/Tazobactam **PLUS** **Amikacin**	3.375g QID 10mg/kg/day		For complicated pyelonephritis convert to oral medication as soon as patient can tolerate (Tailor it to culture results)

8.4 UTI IN PREGNANCY

1st trimester	**Cefixime** **OR** **Nitrofurantoin**	400mg po OD **OR** 100mg PO BD	10 days 7days	
2nd trimester	**Cefixime** **Nitrofurantoin**	400mg PO OD **OR** 100mg PO OD	10days 7days	
3rd trimester	**Cefixime**	400mg PO OD	10days	**Nitrofurantoin is contraindicated at term**

8.5 COMPLICATED UTI

Antimicrobial agent	Dose	Duration	Comments
Amoxicillin-Clavulanic Acid	1g PO BD	7 days	• Obtain urine cultures before initiating treatment • Treat for 10-14 days if upper tract symptoms or delayed response or sepsis
	1.2g IV TDS	7 days	
Alternative			
Ceftriaxone +/Gentamicin	1g QD 7.5mg/Kg QD	7 days	• Preferred in patients with complicated UTI and systemic symptoms • Treat for 10-14 days if upper tract symptoms or delayed response or sepsis

***8*.6 HEALTHCARE ASSOCIATED URINARY TRACT INFECTIONS**

Nitrofurantoin	**100mg BD**	**5-7 days**
Alternative		
Piperacillin/Tazobactam PLUS Amikacin	15-30mg/Kg QD	10 (female) 14 (Male) days

8.7 UTI IN CHILDREN		
Criteria for hospitalization:	1. Toxemic or septic. 2. Signs of urinary obstruction or significant underlying disease 3. Unable to tolerate orally. 4. If <2 months with febrile UTI (presumed pyelonephritis) 5. All infants <1 month with UTI. Ultrasound should be done for all children 2 months to 2 years age presenting with an index UTI and this may be followed with a micturating cystourethrogram (MCUG).	
Inpatient therapy		
Antimicrobial agent	**Dosage**	**Comments**
Ceftriaxone	50mg/Kg/day IV/IM BD	Transition to effective PO agent against pathogen after 24-48h
Ceftazidime	50mg/Kg q8h	

8.8 GENITAL INFECTIONS:

8.8.1. PELVIC INFLAMMATORY DISEASE	
DEFINITION	Comprises spectrum of inflammatory disorders of upper female genital tract including combination of endometritis, salpingitis, tubo-ovarian abscess and pelvic peritonitis.
COMMON PATHOGENS	***N.Gonorrhea*, C.trachomatis**. Others are *G.Vaginalis*, *H.Influenza*, enteric gram negative rods and *Streptococcus agalactiae*. In addition cytomegalovirus, *T.vaginalis*, M. Hominis , *U.Urealyticum* and *M.geitalicum*.
DIAGNOSIS	It is difficult and symptoms subtle and include • Oral temperature >38.3c • Abnormal cervical mucopurulent discharge or cervical fragility • Presence of abundant number of white blood cells on saline microscopy of vaginal fluid. • Elevated c reactive protein • Laboratory documentation with *N. Gonorrhea* or *C. trachomatis*

CRITERIA FOR ADMISSION	Patients who require admission and parenteral treatment • Surgical emergencies cannot be ruled out, • Tubo-ovarian abscess • Pregnancy • Severe illness, nausea/vomiting temperature over 38.5c • No clinical response to oral antimicrobials • Recommended parenteral treatment

Inpatient management		
Antimicrobial agent	**Dose**	**Comments**
Recommended	**Ceftriaxone** 1g IV OD **PLUS** **Doxycycline** 100mg PO OD **PLUS** **Metronidazole** 500mg IV BD	Switch to oral therapy within 24-48 hours of clinical improvement.
Alternative	**Clindamycin** 900mg IV TDS **PLUS** **Gentamicin** Loading 2mg/Kg IV/IM with 1.5mg/Kg maintenance TDS (or 3-5mg/Kg OD)	

Outpatient Management			
Antimicrobial agent	Dose	Duration	Comments
Ceftriaxone PLUS	500mg IM single dose	STAT	If >150Kg with documented gonococcal infection use 1g of Ceftriaxone
Doxycycline WITH	100mg PO BD	14 days	
Metronidazole	500mg PO BD	14 ays	

8.8.2 URETHRITIS

- May present with lower urinary tract symptoms, mucopurulent discharge, purulent discharge, urethral pruritus. Notably, many urethral infections are asymptomatic.
- Typically spreads via sexual contact.
- Gonococcal urethritis should be distinguished from **non-gonococcal urethritis (NGU).**

Pathogens associated with NGU: *Chlamydia trachomatis, Mycoplasma genitalium, Ureplasma urealyticum* and *Trichomonas vaginalis.*

- Perform a gram stain of urethral discharge or urethral smear prior to initiating empiric therapy.
- Sexual partners within last 60 days be treated whilst maintaining patient confidentiality

Common Pathogen	**Empiric Therapy**	**Alternative**
Gonococcal infection	**Ceftriaxone** 1g IM/IV STAT **PLUS** **Azithromycin** 1g PO STAT	**Cefixime** 400mg PO OD **PLUS** **Azithromycin** 1g PO STAT **<u>In cephalosporin allergy</u>:** **Azithromycin** 2g PO STAT

		OR **Fosfomycin trometamol** 3g PO days 1, 3 and 5
Non-gonococcal urethritis (unknown pathogen)	Doxycycline 100mg Po BD 7 days	Azithromycin 400mg PO Day 1, 250mg PO OD for 4 days
Chlamydia trachomatis	**Azithromycin** 1-1.5mg PO STAT **OR** **Doxycycline** 100mg PO BD 7 days	**Levofloxacin** 500mg PO OD 7 days **OR** **Ofloxacin** 200mg PO BD 7 days
Mycoplasma genitalium	**Azithromycin** 500mg PO Day 1 then 250mg QD 4 days	**<u>In macrolide resistance</u>** **Moxifloxacin** 400mg OD PO 7-14 days
Ureaplasma urealyticum	**Doxycycline** 100mg PO BD 7days	**Azithromycin** 1-1.5g STAT
Trichomonas vaginalis	**Metronidazole** 2g PO STAT **OR** **Tinidazole** 2g PO STAT	**Metronidazole** 500mg BD for 5 days
Persistent non-gonococcal urethritis		
After 1st line doxycycline	**Azithromycin** 500mg PO Day 1, 250mg PO QD 4 days **PLUS** **Metronidazole** 400mg PO BD 5 days	If macrolide resistant *M.genitalium* is detected **Moxifloxacin** should be substituted for azithromycin
After 1st line Azithromycin	**Ciprofloxacin** 500mg PO BD 7-14 days **PLUS** **Metronidazole** 400mg PO BD 5 days	

9. SURGICAL PROPHYLAXIS

Surgical site infections (SSIs) are infections that occur up to 30 days after surgery (up to 90 days after surgery in patients receiving implants). They affect either the incision or deep tissue at the operation sites. SSIs remain a significant clinical problem associated with substantial mortality and morbidity despite improvements in their prevention, the incidence may be as high as 20% depending on the procedure.

General Principles

1. **Timing**
   - IV bolus- should be given within 60 minutes before skin incision (optimal 15-30 minutes). Administration after skin incision or> 60 minutes before skin incision reduces the effectiveness.
   - IV infusion-Should be started 30-60 minutes before skin incision.
2. **Document**
   - Antibiotic prophylaxis should be prescribed on the anesthetic chart.
   - The time the antibiotic is administered should be clearly documented.
   - The time of the skin incision should be clearly documented.
3. **Duration**
   - If the procedure requires antibiotic prophylaxis, a **SINGLE DOSE** of antibiotic(s) is adequate for all surgical procedures, except in exceptional cases, when a further intra-operative dose may be required.
   - The finding of pus or a perforated viscus at surgery implies that infection was present before surgery and warrants a course of treatment, rather than extended prophylaxis.
4. **Intra-operative redosing**

   A single pre-operative dose is sufficient for most procedures; however, repeat intraoperative doses are advisable:

   - for prolonged surgery (> 4 hours from the time of the first pre-operative dose) when a short-acting agent is used (e.g., cefazolin); or if the procedure exceeds two half-lives of the drug **OR**
   - If major/rapid blood loss occurs (over 1.5 liters), and/or following fluid resuscitation.
5. Antimicrobial prophylaxis does not substitute for good surgical technique.
6. Hair should either not be removed or, if necessary, it should be removed only with a clipper. Shaving is strongly discouraged at all times, whether preoperatively or in the operating room
7. A combination of Chlorhexidine gluconate and alcohol is recommended for surgical skin preparation to prevent SSI.
8. Advise patients to shower or bathe with soap at least the night before surgery.

Surgical wound classification and subsequent risk of infection (prophylaxis not recommended)		
Classification	**Description**	Infective Risk(%)
Clean (Class I)	Uninfected operative wound No acute inflammation Closed primarily Respiratory, gastrointestinal, biliary, and urinary tracts not entered No break in aseptic technique Closed drainage used if necessary	<2
Clean• contaminated (Class II)	Elective entry into respiratory, biliary, gastrointestinal, urinary tracts and with minimal spillage No evidence of infection or major break in aseptic technique. Example: appendectomy	< 10
Contaminated (Class III)	Non- purulent inflammation present Gross spillage from gastrointestinal tract Penetrating traumatic wounds < 4 hours Major break in aseptic technique	About 20
Dirty-infected (Class IV)	**Purulent inflammation present Preoperative** **perforation of viscera Penetrating traumatic wounds >4 hours**	About 40
NB: For Dirty/Infected wounds full course of antibiotic therapy should be given **NOT** prophylaxis.		

Surgical Site Infection Criteria (CDC)

Superficial incisional SSI **Must meet the following criteria:**	Date of event occurs within 30 days following the operative procedure (where day 1 = the procedure date) **AND** involves only skin and subcutaneous tissue of the incision **AND** patient has at least *one* of the following: a. purulent drainage from the superficial incision. b. organism(s) identified from an aseptically-obtained specimen from the superficial incision or subcutaneous tissue by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment. c. a superficial incision that is deliberately opened by a surgeon, physician* or physician designee, and culture or non-culture-based testing of the superficial incision or subcutaneous tissue is not performed **AND** patient has at least one of the following signs or symptoms: localized pain or tenderness; localized swelling; erythema; or heat d. diagnosis of a superficial incisional SSI by a physician* or physician designee

Deep incisional SSI **Must meet the following criteria:**	Date of event occurs within 30 or 90 days following the operative procedure (where day 1 = the procedure date) **AND** involves deep soft tissues of the incision (for example, fascial and muscle layers) **AND** patient has at least ***one*** of the following: a. purulent drainage from the deep incision b. a deep incision that is deliberately opened or aspirated by a surgeon, physician* or physician designee or spontaneously dehisces **AND** c. organism(s) identified from the deep soft tissues of the incision by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, or culture or non-culture based

	microbiologic testing method is not performed. A culture or non-culture-based test from the deep soft tissues of the incision that has a negative finding does not meet this criterion. **AND** d. patient has at least ***one*** of the following signs or symptoms: fever(>38°C); localized pain or tenderness e. an abscess or other evidence of infection involving the deep incision detected on gross anatomical exam, histopathologic exam, or imaging test
Organ/Space SSI **Must meet the following criteria:**	Date of event occurs within 30 or 90 days following the operative procedure (where day 1 = the procedure date) **AND** involves any part of the body deeper than the fascial/muscle layers that is opened or manipulated during the operative procedure **AND** patient has at least ***one*** of the following: a. purulent drainage from a drain placed into the organ/space (for example, closed suction drainage system, open drain, T-tube drain, CT-guided drainage) b. organism(s) identified from fluid or tissue in the organ/space by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment. c. an abscess or other evidence of infection involving the organ/space detected on: **gross anatomical exam** or **histopathologic exam** or **imaging t**est evidence definitive or equivocal for infection

NB: * The term physician for applying the SSI criteria may mean a surgeon, infectious disease physician, emergency physician, other physician on the case, or physician's designee (nurse practitioner or physician's assistant)

9.1 Neurosurgery		
Procedure	**Common Organism**	**Recommended Prophylaxis**
Elective Craniotomy procedures	*Coagulase negative staphylococci* *Staphylococcus aureus* *Corynebacteria*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g) Penicillin allergy: **Vancomycin 1g IV** infusion (1.5g for patients > 80kg actual body weight)
Emergency Craniotomy Procedures	*Coagulase negative staphylococci* *Staphylococcus aureus* *Corynebacteria*	**Cefazolin 2g IV** stat (Child 30mg/ kg) Penicillin allergy: **Vancomycin 1g IV** or **Clindamycin** (600mg IV if <70kg, 900mg if>70kg)
Clean contaminated neurosurgery/ maxillofacial (Cranial air sinuses are opened)	*Streptococcus spp.* *Staphylococcus aureus*	**Adult: co-amoxiclav** 1.2g prior to incision **Children and Adolescents:** 30 mg/kg prior to incision
Elective spine surgery	*Gram positive staphylococci and propionibacterium*	**Cefazolin 2g IV or Amoxicillin+ clavulanic acid 1.2g** at induction and a repeat 8 hrs later Penicillin allergy**:** **Vancomycin 1g IV** or **Clindamycin** (600mg IV if <70kg, 900mg if>70kg)
Insertion of Implants	*Coagulase negative staphylococci* *Staphylococcus aureus* *Corynebacteria*	**Vancomycin 1g IV** infusion (1.5g for patients > 80kg actual body weight) and **Ceftazidime 2g IV** Penicillin allergy**:** **Vancomycin 1g IV** or **Clindamycin** (600mg IV if <70kg, 900mg if>70kg)

Ventriculo- peritoneal Shunting and insertion of External ventricular Drains	*Coagulase negative staphylococci. Staphylococcus aureus Corynebacteria*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g) Penicillin allergy: **Vancomycin 1g IV** infusion (1.5g for patients > 80kg actual body weight)

9.2 Cardio-thoracic and vascular surgery		
Procedure	**Common Organism**	**Recommended Prophylaxis**
Pneumonectomy / Lobectomy	*Staphylococcus aureus Coagulase negative staphylococci, Coliforms Streptococcus species*	**Cefazolin 2g** for patients > 80kg and **1g** for < 80kg, initiated 30 to 60 minutes before skin incision **THEN** **Cefazolin 2g IV** (child: 30mg/kg up to 2g) 8hourly for 2 more doses commencing 4 hours after the initial dose *If anaerobic cover required (empyema or abscess) then* ADD: **Metronidazole 500mg IV infusion** commenced 3060 minutes prior to skin incision (child: 12.5mg/kg), repeated 12 hourly for 2 more doses commencing 6 hours after initial dose

Decortication / Pleurectomy	*Staphylococcus aureus* *Coagulase negative staphylococci* *Coliforms*	Peri-operative antibiotics for empyema should be based on culture and sensitivity. If culture and sensitivity results not available: 1. For community acquired: **Cefuroxime 1.5 g** with **metronidazole 500mg OR clindamycin 600mg** alone 2. For hospital acquired empyema: **Ceftazidime 2g**

Tube thoracostomy (in setting of trauma) **No prophylaxis needed for tube thoracostomies done in nontraumatic settings**	*Staphylococcus aureus* or *Streptococcus species*	**Cefazolin 1** to **2g** for a maximum of three doses. In penicillin allergy cases: **Vancomycin 1g (**1.5g for >80kg) as infusion or **clindamycin** 600**-900mg** are appropriate alternative choices.
Esophageal surgery	*Enteric gram-negative bacilli* *Streptococci* *Oropharyngeal anaerobes*	**Cefazolin 2g** for patients > 80kg and **1g** for < 80kg, initiated 30 to 60 minutes before skin incision Repeat dose of **1g** in patients with normal renal function then 1g 8 hourly for 24 hours In penicillin allergy: **Vancomycin 1g (**1.5g for >80kg) as infusion then 12 hourly for 24 hours If high anaerobic burden e.g., with perforation: Add **Clindamycin 600mg** 8 hourly for 3 doses.

9.3General Surgery (GI, Breast, Thyroid)		
Procedure	**Common Organism**	**Recommended Prophylaxis**
Esophageal Surgery, Gastroduodenal and small bowel surgery.	*Coliforms Peptostreptococci*	**Adult: IV Cefazolin 2g prior to incision** **Children:** 50 mg/kg IV prior to incision
Endoscopic Gastroscopy with ERCP, PEG/PEJ and EUS	*Coliforms Peptostreptococci*	**Adult: IV Cefazolin 2g prior to incision** **Children:** 50 mg/kg IV prior to incision
Biliary Surgery (Open/laparoscopic)	*Coliforms anaerobes*	**Adult: IV Cefazolin 2g prior to incision** **Children:** 50 mg/kg IV prior to incision
Uncomplicated Appendectomy	*Coliforms anaerobes Enterococci*	**IV Cefazolin** **Adult:** 2g prior to incision **Children:** 50 mg/kg IV prior to incision **Plus Metronidazole** **Adult:** Metronidazole 500mg **Children:** Metronidazole 7.5mg/kg IV prior to incision
Colorectal surgery	*Anaerobes Enterococci coliforms*	Adult**: IV Cefazolin 2g prior to incision** **Children:** 50 mg/kg IV prior to incision
Inguinal Hernia Repair (with mesh) Open or laparoscopic	*Staphylococcus aureus Coagulase negative, staphylococci*	Adult**: IV Cefazolin 2g prior to incision** **Children:** 50 mg/kg IV prior to incision
Breast and axillary node surgery	**Prophylaxis NOT recommended**	
Thyroidectomy	**Prophylaxis NOT recommended**	
OGD and Colonoscopy	**Prophylaxis NOT recommended**	

9.4 Obstetrics and Gynecology Surgery		
Procedure	**Common Organism**	**Recommended Prophylaxis**
Manual vacuum Aspiration, Dilation & Curettage / Evacuation for lost pregnancy	*Coliforms Enterococci Group B streptococci*	**Amoxicillin clavulanic acid** **1.2g** Stat For penicillin allergy: **Clindamycin 900mg IV** plus **Gentamicin 5mg/kg**
Total abdominal hysterectomy, radical hysterectomy and laparoscopic hysterectomy	*Staphylococcus aureus Coliforms Enterococci Group B Streptococci*	**Cefazolin 2g IV** (3g if patient is >120kg) Repeat dose after 3hours if surgery prolonged
Vaginal Hysterectomy	*Coliforms Enterococci Group B Streptococci*	**Cefazolin 2g IV** plus **Metronidazole 500mg IV**
Open Myomectomy	*Coliforms Enterococci Group B Streptococci*	**Cefazolin 2g IV** Stat
Laparotomy for ectopic pregnancy	*Coliforms Enterococci Group B Streptococci*	**Cefazolin 2g IV** Stat
Recto-vaginal Fistula(RVF)	*Coliforms, Enterococci*	**Amoxicillin+clavulanic acid** **1.2g** Stat **OR** **Gentamicin 80 mg** **PLUS** **Metronidazole 1g** STAT given intraoperatively
Caeserian Section (Elective or Emergency) No labour,No rupture of membranes	*Staphylococcus aureus, Coliforms Enterococci, Group B Streptococci*	**Cefazolin 2g IV**

Emergency Caeserian Section(ruptured mebranes, multiple VEs>5)	*Staphylococcus aureus, Coliforms Enterococci, Group B Streptococci*	**Cefazolin 2g IV**
Emergency ceserian section with chorioamnionitis	*Staphylococcus aureus, Coliforms Enterococci, Group B Streptococci*	**Amoxicillin+clavulanic acid 1.2g** 8hourly **PLUS** **Metronidazole 500mg** 8 hourly **Treat for 5 days**
3rd and 4th degree perineal tear	*Coliforms Enterococci Group B Streptococci*	**Cefazolin 2g IV** Stat
Tubal Ligation		**Laparoscopic- NOT recommended** **Open- Cefazolin 2g IV prior to incision**
Vasectomy	**Prophylaxis NOT recommended**	
Normal Vaginal Delivery	**Prophylaxis NOT recommended**	
Manual removal of Placenta	**Prophylaxis NOT recommended**	
Insertion of IUD, Contraceptive Implants	**Prophylaxis NOT recommended**	
Diagnostic Laparoscopy without breech of bowel,uterine or vaginal cavity	**Prophylaxis NOT recommended**	
Cervical Cerclage	**Prophylaxis NOT recommended**	

9.5 Urologic Surgery		
Procedure	**Common Organism**	**Recommended Prophylaxis**
Endoscopic Procedure • Cystoscopy/TURP • Cystoscopy/TURBT; • Cystoscopy with stone removal; • Ureteroscopy	*Coliforms, Enterococci, Staphylococcus aureus*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g) **PLUS** **Gentamicin 2mg/kg IV** (adults and children) If risk of entry into bowel lumen, **then ADD: Metronidazole 500mg IV** infusion (child: 12.5mg/kg up to 500mg)
Open prostatectomy	*Coliforms, Enterococci, Staphylococcus aureus*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g) PLUS **Gentmicin 2mg/kg IV** If risk of entry into bowel lumen, **then ADD: Metronidazole 500mg IV** infusion (child: 12.5mg/kg up to 500mg
Prostate Biopsy	*Escherichia coli,citrobacter,Klebsiella*	**Amoxicilin-Clavulanic Acid** **OR** **Levofloxacin P.O 750mg** **Stat** **OR** Use **Iodine Rectal Wash**
Suprapubic cystostomy	*Coliforms, Enterococci, Staphylococcus aureus*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g)
Urethroplasty		**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g)

9.6 Plastic and Reconstructive Surgery		
Procedure	**Common Organism**	**Recommended Prophylaxis**
Groin/axilla/neck dissections Open reduction and internal fixation of fractures Insertion of implants, mesh, prostheses, screws, plates etc.	Skin commensals e.g., *Staphylococcus aureus, Coagulase negative staphylococci, Coliforms*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g)
Clean bone or soft tissue injury Hand surgery (without implants) Non-infected lesions & minor excisions	**Prophylaxis NOT recommended**	
Grafts/flaps	**Prophylaxis NOT recommended**	

9.7 Orthopedic surgery		
Procedure	**Common Organism**	**Recommended Prophylaxis**
Elective orthopaedic surgery without prosthesis	Usually, NO prophylaxis is required. Unless surgery expected to last more than 4 hours.	**Adult: IV Cefazolin 2g 30 to 60 minutes prior to incision** **Children:** 50 mg/kg IV prior to incision
Implantation procedures e.g., arthroplasty, internal fixation with screws, plate wires including spinal fusion	Skin commensals especially; *S. aureus* *Coagulase negative staphylococci* *Coliforms*	**Adult: IV Cefazolin 2g 30 to 60 minutes prior to incision** **Children:** 50 mg/kg IV prior to incision
Fractures **The commencement of broad-spectrum antibiotics should be within 3 hours of injury and should continue until first debridement1.** **Farm injuries, heavy contamination, or possible bowel contamination - add high dose penicillin for anaerobic coverage (clostridium)**		

Gustilo type I and II	*Staphylococcus aureus*	**Amoxicillin + Clavulanic acid 1.2g**, 8 hourly **OR** **Cefazolin 1g**, 8 hourly Penicillin allergy: **Clindamycin 600 mg IV**, 6 hourly preoperatively **Duration - 24 hours post surgery**
Gustilo type III	*Staphylococcus aureus*	**Amoxicillin + clavulanic acid 1.2g**, 8 hourly **OR** **Cefazolin 1g**, 8 hourly **PLUS,** Gentamicin **(1.5 mg/kg),** 8 hourly **PLUS, Metronidazole 500mg,** 8 hourly Duration of treatment- 72 hours after surgery or within 24 hours after skin closure.
Type III fractures and potential water or sewage exposure	*Pseudomonas spp.*	**Ceftazidime 2 g IV** 8 hourly **OR** **Cefepime 2 g IV** 6 hourly for 72 hours after surgery
Amputation surgery	*Risk of anaerobic infection e.g., gas gangrene*	**Adult: Amoxicillin + clavulanic acid 1.2g, 30 to 60 minutes** prior to incision **Children and Adolescents:** 30 mg/kg prior to incision
Amputation of ischemic limb	*Staphylococcus aureus Coagulase negative staphylococci Corynebacteria*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child: 30mg/kg up to 2g) repeated 8-hourly for 2 further doses post- operatively **PLUS** **Metronidazole 500mg IV** infusion (child: 12.5mg/kg up to 500mg), repeated 12 hours after initial dose)

9.8 Special Surgeries (Eye, ENT, Maxillofacial)

Procedure	Common Organism	Recommended Prophylaxis
Minor Oral & Maxillofacial Surgical Procedures	**Prophylaxis NOT recommended**	
Antibiotic prophylaxis during dental treatment of patients with prosthetic joint implants		
Skin approach procedures **(oral cavity not involved)**	*Streptococci spp.* *Staphylococcus aureus* *Anaerobes* *Corynebacteria*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child < 12 years: 30mg/kg up to 2g) Penicillin allergy: **Clindamycin 600mg** (child: 15mg/kg up to 600mg) by IV infusion, then 8hourly for 24 hours
Skin approach procedures **(with concurrent oral cavity involvement)**	*Oropharyngeal flora* *Streptococci spp.* *Staphylococcus aureus* *Anaerobes* *Corynebacteria*	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child < 12 years: 30mg/kg up to 2g) **PLUS Metronidazole 500mg IV** infusion (child < 12 years: 12.5mg/kg up to 500mg) before incision, then 12hourly for 24 hours Penicillin allergy: **Clindamycin 600mg** (child: 15mg/kg up to 600mg) by IV infusion, then 8hourly for 24 hours
Implants **(1st stage)**	*Streptococci spp.* *Staphylococcus aureus* *Anaerobes* *Corynebacteria*	**Benzylpenicillin 1.2g IV** initiated 30 to 60 minutes before skin incision (child < 12 years: 30mg/kg up to 1.2g) THEN 2-hourly intraoperatively (for procedures greater than 2 hours duration) Penicillin allergy: **Clindamycin 600mg** (child: 15mg/kg up to 600mg) by IV infusion

Trauma Intraoral compound Operation **(injury of any age, compound to nose/skin/sinuses)**	*Oropharyngeal flora* *Streptococci spp.* *Staphylococcus aureus* *Anaerobes* *Corynebacteria*	**Benzylpenicillin 1.2g IV** infusion (child < 12 years: 30mg/kg up to 1.2g) at presentation, then 4-hourly for 48 hours **PLUS Metronidazole 500mg IV** infusion (child: 12.5mg/kg up to 500mg) at presentation, then 12-hourly for 48 hours Penicillin allergy: **Clindamycin 600mg** (child: 15mg/kg up to 600mg) by IV infusion, then 8hourly for 48 hours
With incision through mucosal (oral, nasal, pharyngeal, esophageal surface	*Oropharyngeal flora* *Streptococci spp.* *Staphylococcus aureus, Anaerobes, Corynebacteria*	**Cefazolin2gIV**initiated 30 to 60 minutes before skin incision (child: 30mg/ kg up to 2g) PLUS **Metronidazole 500mg IV** infusion (child: 12.5mg/kg up to 500mg)
Other uncomplicated or minor clean procedures (e.g.tonsillectomy, adenoidectomy, tympanostomy, nasal septoplasty, endoscopic sinus surgery, rhinoplasty, uncontaminated neck dissection)	**Prophylaxis NOT recommended**	

10. DIAGNOSTICS AND SPECIMEN MANAGEMENT

Specimen Collection

1. **Blood** - should be taken from 2 sites e.g. from a central line and a peripheral site or 2 peripheral sites. When taking a blood culture sample from a peripheral site, clean the site with an alcohol swab and allow 30 seconds to dry before puncture, do not palpate the vessel before puncture unless sterile gloves are worn. For adults draw 10-15ml of blood from each site, for children under 5 years, collect 1-5ml
2. **Urine** - should be a clean catch midstream sample, from a freshly inserted catheter or cleaned catheter hub where urine will be collected directly from the tubing. Do not collect urine from a urine bag or an indwelling catheter. Urine catheter tip cultures are not acceptable. A morning sample is preferred as it is more concentrated.
3. **Abdominal fluid** - should be taken straight from the abdomen or from a newly placed drain. Do not collect specimens from existing drains
4. **Wound swabs** are often not useful due to contamination, to collect a swab, first clean the wound with normal saline and attempt to get a swab from the base or get a tissue specimen for culture. Do not collect a superficial sample from the surface of a wound
5. **CSF** - sterile procedure should always be used for collection of CSF; a mask should be worn to avoid respiratory contamination. Clean the skin over the selected area using 70% alcohol, followed by povidone-iodine. The specimen to be collected in two bottles, 2ml CSF in container NO. 1 and about 2-3mls in Container NO.2.Deliver the samples to the laboratory immediately.
6. **Abscesses, bullae, blisters -** aspirate directly from the abscess with a sterile needle and syringe.

Diagnostics and Specimen Management

Stool and Rectal Swabs:

For Stool swabs:

1. Pass stool directly into a clean dry, leak-proof, wide-mouthed container.
2. Transport the specimen to the laboratory immediately for processing.

For Rectal swabs:

1. Use a clean sterile swab with a transport medium.
2. Rotate the swab through 360° in the rectum to ensure you get an adequate amount.
3. Transport the specimen to the laboratory immediately for processing.

Eye swabs:

Swab both eyes regardless of the site affected. Collect the sample in a transport medium before administration of antibiotics.

Potential pathogens: P. aeruginosa, N, gonorrhea, Moraxella spp. S. pneumoniae, Group A Strep pathogen, S. aureus, H. influenzae, M. catarrhalis, etc.

Ear Swabs: Tympanocentesis is the method of choice.

1. Clean the external ear canal with an antiseptic solution.
2. Collect as much pus/exudate as you can from the middle or inner ear using a sterile swab or directly in a drainage tube.
3. For external ear infections (otitis media), clean the ear canal with a disinfectant and rinse it with saline before specimen collection.

4. Label the specimen with names of the specific anatomic locations that are sources of the specimens.

Transport: The specimens are placed in the appropriate transport medium and immediately sent to the laboratory for processing.
Pathogens: yeast, group A strep, S, aureus, P, aeruginosa, S. pneumoniae, etc.

Blood samples:

The samples are collected aseptically into sterile blood culture bottles. Clean the site with an alcohol swab and allow 30 sec to dry before the puncture.

Do not re-palpate the puncture site before puncture unless sterile gloves are worn. Blood can either be withdrawn using sterile disposable syringes or vacutainer needles.

The amount of blood for adults is 8- 10ml of whole blood ,2-5ml for children and 0.5ml-2ml for infants. Following the manufacturer's instructions, the specimen should be transported immediately.

Collection Procedure:

1. Wash hands or use an alcohol hand rub.
2. Remove plastic caps from the tops of blood culture bottles.
3. Disinfect the rubber tops with 70% alcohol and allow to dry.
4. Identify the patient and two sites of puncture on both arms.
5. Put on clean examination gloves.
6. Apply a tourniquet on one arm first for the first draw of blood.
7. Swab or wipe concentric circles of tincture of iodine or chlorhexidine, moving outward from the center of the site. Allow to dry for 30-60 seconds. DO NOT re-palpate the site after disinfection. (For neonates, omit the iodine step; use alcohol twice or use chlorhexidine gluconate)
8. Using a winged set, attach the collection set to the adapter cap.
9. Insert the needle into the identified vein.
10. Collect the aerobic bottle first; ensure it is correctly filled to the target fill level. Invert bottles several times after inoculation.
11. Repeat for the anaerobic bottle.
12. Record collection date, time, and site.
13. Label the bottles according to the manufacturer's recommendations. Do not cover the manufacturer's barcode label.

Transport: Send specimens to the laboratory for processing immediately at room temperature.

RECOMMENDATION FOR BLOOD CULTURE COLLECTION

- **Urine Samples**

  Midstream (Clean catch) Urine

  Collection procedure:

  Females:

  1. Wash hands thoroughly with soap and running water, rinse them, and dry them using a disposable paper towel or shake of excess water.
  2. Clean the genitalia area carefully from the front to the back between the skin folds using soap and water.
  3. Hold the container with fingers on the outside; do not touch the rim of the container.
  4. First, pass a small amount of urine into the toilet, then pass enough urine into the container to fill half-full. Do not touch the legs or clothing with the container.
  5. Place the lid on the container and carefully close tightly.

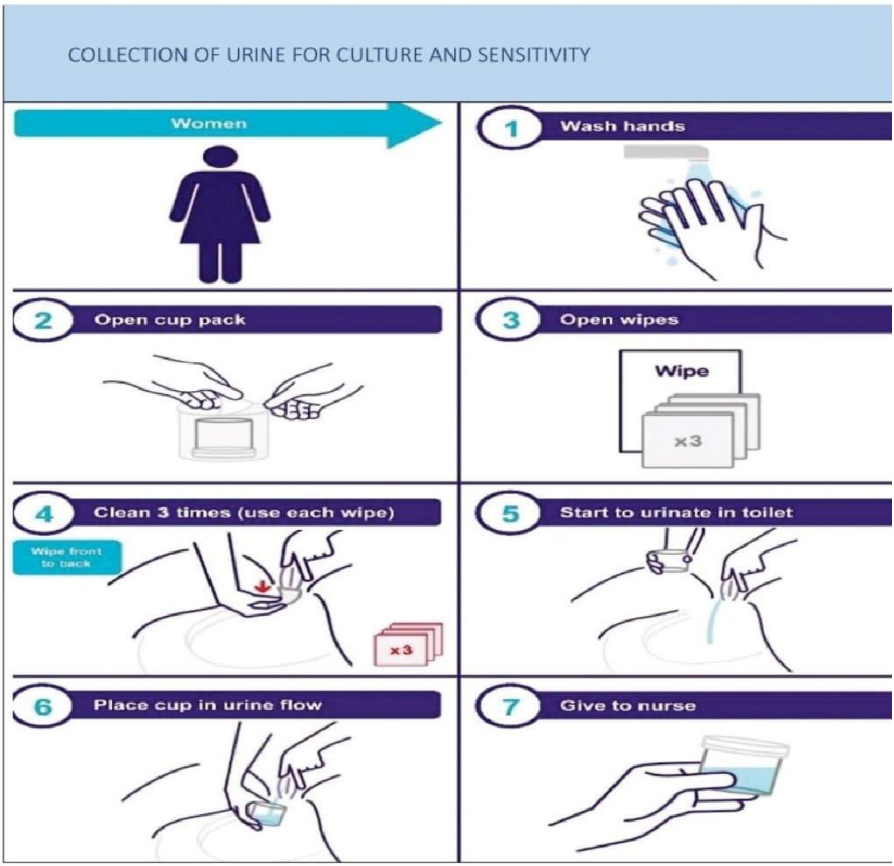
  Males:

  1. Wash hands thoroughly with soap and water, rinse them and dry them using a disposable paper towel or shake off excess water.
  2. Retract the foreskin if uncircumcised and clean the glans.

3. Hold the container with fingers on the outside; do not touch the rim of the container.
4. First pass a small amount of urine into the toilet, then pass enough urine into the container to fill half-full. Do not touch the legs or clothing with the container.
5. Place the lid on the container and carefully close tightly.

NB: Urine sample for patients suspected to have urethritis: collect urine at the beginning (first drop), mid-stream, and terminal urine.

Transport: Transport the specimen immediately for processing.



Suprapubic aspirate for urine culture

This technique avoids contamination of urine with urethral or perineal microorganisms.

It is particularly useful in patients with a spinal cord injury, those for whom a definitive culture has not been obtained, and in pediatrics.

Collection Procedure:

1. Decontaminate the skin (with antiseptics) from the umbilicus to the urethra.
2. Anaesthetize the skin at the insertion site.
3. Introduce the needle into the full bladder at the middle between the symphysis pubis and the umbilicus, 1-2 cm above the symphysis pubis.
4. Aspirate about 20 ml of urine from the bladder.
5. Transfer the urine aseptically into a sterile screw-capped container.

Transport: Send the specimen to the laboratory immediately.

Bladder washout

This can be used in determining whether a bladder infection or a kidney infection exists. If the kidney is involved, the post-bladder rinse specimen should contain a large number of organisms, whereas in bladder infections, this specimen shows no growth.

Collection Procedure:

1. Insert an indwelling catheter into the bladder.
2. Save the last portion of urine flow for culture. Refrigerate it immediately.
3. Introduce a specified amount of neomycin solution (0.1-0.2%).
4. Allow the solution to remain in the bladder for 30 minutes.
5. Wash the bladder with 2 liters of sterile irrigating fluid and drain the bladder.
6. Collect three samples at 10-minutes intervals. Label the initial and subsequent timed collections. (Later specimens should represent urine from the kidney without contamination with organisms located in the bladder)

Transport: Send the specimens immediately to the laboratory for culture.

Reporting: The result is reported in the number of colony forming units per ml of the urine sample (CFU/ml).

Urethral and Cervical Swab

Cervical and urethral swabs for isolation of *N.gonorrhoeae,* collect discharge - immediately place the swab in transport media (Amies with charcoal) & deliver to the laboratory.

DO NOT REFRIGERATE. Vaginal swabs in transport media may be refrigerated if there is a delay in processing. Vagino-anal swab in transport media for detection of Group B beta-hemolytic Streptococcus. The patient should preferably urinate 2at least 2 hours before the specimen collection.

Procedure for collecting urethral swabs:

1. Identify the patient.
2. Use a sterile gauze to clean the urethra at the tip of the penis.
3. Gently insert a cotton swab; approximately 2 cm into the urethra and turn it.
4. Transport the specimen to the laboratory for processing immediately.

Procedure for collecting cervical swabs:

1. Remove any mucus and secretion from the vagina/cervix using a swab and discard.

2. Firmly swab the cervix/vagina using a second swab.
3. Return the swab to its container and transport the specimen immediately to the laboratory for processing.

Fluids:

Ascites, amniotic fluid, synovial fluid, pericardial, pleural, etc.

Collection Procedure:

1. Disinfect the overlying skin with 70% alcohol.
2. Collect the specimen using a sterile needle and syringe (aseptic technique).
3. Transfer the specimen to a sterile container.

Transport to the laboratory within 2 hours or immediately after collection for processing.

Wound Swabs:

Collection Procedure:

1. Clean the wound with saline to remove any contaminating material such as necrotic tissues, dry exudate, and dressing residue.
2. Pick a sterile swab and move it across the wound surface while rotating the swab between your fingers for five seconds.
3. If the wound is large cover at least a quarter of the wound to sample representative material from the wound bed.
4. Return the swab to its container which has a transport medium (Amies and Stuart).
5. Label the container with a unique identifier and the patient's name.

Transport to the lab immediately.

Pus/Abscess Aspirate

Collection Procedure:

1. Aspirate using a sterile needle and syringe.
2. Transfer the specimen to a sterile container.

Transport to the laboratory immediately for processing.

Cerebrospinal fluid:

NB: There should be prompt communication before sample collection because a delay in examining CSF reduces the chances of isolating pathogens; it should be cultured within 1 hour of lumbar puncture.

CSF should **NOT** be refrigerated except for a situation where molecular analysis is required and shipment will take place within a week or frozen for long-term storage.

1. **Collect the fluid in sterile tubes after the lumbar puncture.**
2. **Deliver to the laboratory immediately at room temperature**
3. **Ideal to collect at least 4 sequential tubes:**
   Tube 1 for Chemistry; protein & glucose
   Tube 2 for Microbiology; bacterial & fungal
   Tube 3 for AFB & other special
   tests Tube 4 for Hematology; cell
   count

- **Bone and Tissue:**
  - Submit a piece of tissue or bone in a sterile container with normal saline.
  - Do not allow the specimen to dry out.
  - Do not place specimens for culture in formalin.

  Transport to the laboratory immediately for processing.

Summary of sample collection, transport and interpretation of results:

Specimen	Collection	Quality issues	Transport	Common pathogens	TAT
Blood	Aseptic technique	Quantity Adults: 8-10 ml Paeds: 1-3 ml Neonates: 1 ml	<1hr	S. aureus, Enterobacterales, Enterococci	3-7 days
Urine	Mid-stream catch, aspirate from catheter tube, suprapubic aspirate	Do not obtain from catheter tip or urine bag NB: Urine culture with growth of >2 organisms is a contaminated sample, should be disregarded.	<2 hrs	E. coli, Klebsiella spp., S. saprophyticus, & S. agalactiae (seen in pregnancy)	1-3 days
Sputum	Early morning	Rinse mouth with water prior to collection	<2 hrs	S. pneumonia, H. influenzae, S. pyogenes, Pseudonomas spp.	2-5 days
Pus swab and aspirate	• Use sterile swab and transport media for collection • Aspirates should be collected aseptically and contents dispensed in sterile container for transportation	• For swabs clean area with NS prior to collection • Tissue and pus aspirates are preferred	<1 hr	S. aureus, S. pyogenes, E. coli, and Enterobacterales in surgical site infections NB: Enterics in superficial wounds are usually contaminants	2-5 days

CSF	Collect aseptically into 3 screw capped bottles: -Biochemistry -Microbiology -Hematology	Quantity Adults: 2 mls/bottle Paeds: 1 ml/bottle	Immediate	S. pneumoniae, S. agalactiae, E. coli, C. neoformans, H. influenza, L. monocytogenes	
Tissue	Collect at least 5 mm3 in sterile container	Do not submit samples in formalin	Immediate	S. aureus, S. pyogenes, Anaerobes	2-7 days
Stool	Use clean wide mouthed container Avoid collecting formed stool	Non-formed stool only Avoid contamination with urine or toilet water	Immediate	Salmonella, Shigella, Enteropathogenic E. coli for under fives	2-3 days

11. INTERPRETATION OF CULTURE RESULTS

Factors to consider in microbiology culture and sensitivity result interpretation

1. Probable contaminants vs Probable pathogens
2. Diagnosis/ condition being managed/Site of Infection
3. Source of specimen
4. Preliminary Report-Gram stain report
5. Known bacterial Intrinsic resistance
6. The Immune status of the patient
7. Presence of inserted or implanted foreign bodies.

1. Preliminary microbiology report

Gram stain report and growth appearance is useful in the initial identification of gram positive, gram negative and anaerobes bacteria as well as fungi identification. The clinician should make use of this report to empirically cover for either gram negative or gram-positive infections.

2. Pathogens Vs Contaminants

A) The following microbes are considered significant/probable pathogens for blood cultures:

Staphylococcus aureus,
Enterobacteriaceae
Pseudomonas aeruginosa
Streptococcus pneumoniae
Streptococcus βhaemolytic,
Haemophilus Spp,
Neisseria Spp,
Salmonella Spp
Anaerobes,
HACEK,
Candida Spp,
Brucella Spp
Campylobacter Spp

B) The following microbes are usually considered contaminants for blood cultures:

CONS-Coagulase Negative.
Staphylococcus
Micrococcus spp
Corynebacterium spp.
PropionibacteriumSpp
Bacillus Spp

NOTES:

1. Growth of contaminants in more than one culture or from specimens from a high-risk patient, such as an immunocompromised, enhances the likelihood that clinically significant bacteremia exists; the same organism in repeated cultures obtained at different times from separate anatomic sites strongly suggests true bacteremia.
2. The growth of different organisms in different culture bottles suggests contamination but occasionally may follow clinical problems such as wound sepsis or ruptured bowel.
3. If multiple samples grow the same organism, true bacteremia is usually the result.
4. Only one positive culture is needed to suggest true infection in patients with gram-negative bacteria.
5. Gram-positive bacteria, especially Staphylococcus epidermidis and Corynebacterium species, are more likely to be contaminants.
6. Anaerobic gram-positive organisms are rarely isolated, with the most common being Peptostreptococcus spp, Lactobacillus sp., and Clostridium sp. These organisms will grow in an anaerobic bottle only. They are typically considered contaminants and require no treatment, but clinical judgment should be used

7. **Antibiotic Equivalence:** Equivalence is the prediction of in vivo activity for one antimicrobial based on results obtained by testing another, related antimicrobial agent. In this case, only a category result (S, I, R) can be reported. Eg: Equivalence between erythromycin which is tested and other macrolides (e.g. Azithromycin and Clarithromycin) which are not tested. The category (S, I, or R) results for the other antimicrobials can be predicted from that obtained for erythromycin.
8. Cross-resistance is a resistance mechanism that affects an entire class or subclass of antibiotics. Eg. Streptococci resistance to 14- and 15-membered macrolides can be predicted by testing erythromycin. Resistance to oxacillin in Staphylococci confers in vivo resistance to almost all ßlactams.

"Resistant, Intermediate and Sensitive (RIS)" Meaning:

1. **R ("resistant")** - means there is a high likelihood of therapeutic failure;
2. **S ("susceptible, standard dosing regimen")** - Means there is a high likelihood of therapeutic success using a standard dosing regimen of an antimicrobial agent;
3. **I ("intermediate")** – Means there is a high likelihood of therapeutic success, but only when exposure to an antimicrobial agent is increased by adjusting the dosing regimen or its concentration at the site of infection

Intrinsic resistance: This is inherent or innate (not acquired) antimicrobial resistance, which is reflected in wild-type antimicrobial patterns of all or almost all representatives of a species. Intrinsic resistance is so common that susceptibility testing is unnecessary. For Example;

1. Citrobacter spp. are intrinsically resistant to ampicillin.
2. Staphylococcus Spp is intrinsically resistant to Ceftazidime.
3. Pseudomonas and Acinetobacter are intrinsically resistant to Ampicillin and Cephalosporins except Ceftazidime, Chloramphenicol and Doxycycline
4. Salmonella and shigella Spp,1st and 2nd generation Cephalosporins, Aminoglycosides, and Cephamycins may appear active in vitro but are not effective clinically and should not be prescribed for conditions suspected to be caused by these pathogens.
5. MRSA is resistant to:
    - *All Penicillins Including Flucloxacillin, Co-Amoxyclav, Piperacillin/Tazobactam*
    - *All Cephalosporins Except Ceftaroline*
    - *All Carbapenems Including Meropenem*
    - *All Macrolides*

Note: Methicillin resistance Staphylococcus Aureus is defined by cefoxitin or Oxacillin testing.

a) The results of ampicillin susceptibility tests should be used to predict the activity of amoxicillin.
b) Results for Cefoxitin Predict results for mecA-mediated methicillin (oxacillin) resistance for instance in Methicillin-resistant S. aureus.
c) MRSA is also typically resistant to fluoroquinolones

Urine cultures and Urinalysis:

a. A urine culture must **ALWAYS** be interpreted in the context of the urinalysis and patient symptoms.
b. If a patient has no signs of infection on urinalysis and no symptoms of infection, but a positive urine culture, the patient by definition has asymptomatic bacteriuria.
c. Patients with chronic indwelling catheters, urinary stoma, and neo-bladders will almost universally have positive urine cultures.
d. The only patient populations for which it is recommended to screen for and treat asymptomatic bacteriuria are pregnant women and patients scheduled for a genitourinary surgical procedure.

Avoid routine urine analysis and/or urine cultures for the sole purpose of screening for UTI in asymptomatic patients.

12. AWARe CATEGORIZATION OF ANTIBIOTICS

ACCESS	WATCH	RESERVE
This group of antibiotics have activity against a wide range of commonly encountered susceptible pathogens while also showing lower resistance potential than antibiotics in the other groups. They are recommended a s essential first or second choice empiric treatment options for infectious syndromes to improve access and promote appropriate use	This group of antibiotics have higher resistance potential and includes most of the highest priority agents among the Critically Important Antimicrobials that are at relatively high risk of selection of bacterial resistance. Selected Watch group antibiotics are recommended as essential first or second choice empiric treatment options for a limited number of specific infectious syndromes.	This group of antibiotics are reserved for treatment of confirmed or suspected infections due to multidrug resistant organisms. Reserve group antibiotics should be treated as "last resort" options. Their use should be tailored to highly specific patients and settings, when all alternatives have failed or are not suitable.
Pharmacy supply does not require approval. Close monitoring to check their usage (Indication, quantity and pattern)	Unrestricted use of these antibiotics may be allowed for empirical use for the first 48-72hrs. After that a prescription by a consultant or AMS team along with justification for use. Evidence of Culture and Sensitivity lab request should be provided.	Pharmacy supply requires a prescription by a consultant OR specific indications (e.g sepsis) Evidence of C& S lab request should be provided.
Can be started empirically as per antibiotic guidelines/clinical indication. But to be reviewed after availability of laboratory evidence (C&S report)	There should be **clear indications indications/Laboratory evidence (C&S report)**	There should be **clear indications indications/Laboratory evidence (C&S report)** **SEEK APPROVAL FROM A CONSULTANT BEFORE PRESCRIPTION OF THE RESERVE DRUGS**
• Flucloxacillin • Amoxicillin • Co-Amoxiclav • Benzylpenicillin • Benzathine penicillin • *Ceftriaxone (For Meningitis and Pneumonia) • Gentamicin • Nitrofurantoin • Trimethoprim-sulfamethoxazole • Metronidazole • Doxycycline • Secnidazole	• Piperacillin-tazobactam • **Ceftriaxone • Ceftazidime • Cefixime • Amikacin • Ciprofloxacin • Levofloxacin • Azithromycin • Clarithromycin • Erythromycin • Clindamycin • Fosfomycin PO • Vancomycin • Cefuroxime	• Fosfomycin IV • Linezolid • Imipenem • Ceftazidine/Avibactam • Meropenem

COMMON ANTIMICROBIAL OPTIONS FOR SWITCHING FROM IV TO ORAL

Current Parenteral Regimen	**Oral Regimen (Adult dose)**
IV Amoxicillin/Clavulanate 1.2g TDS	PO Co-Amoxiclav 1g TDS
IV Ampicillin/Sulbactam 1.5gQID	PO Co-Amoxiclav 1g TDS
IV Cefazolin 1g TDS	PO Cephalexin 500mg QID
IV Cefazolin 2g TDS	PO Cephalexin 1G QID
IV Cefepime 2g BD/TDS	PO Co-Amoxiclav 1g TDS **Pseudomonas: seek advice from ID Specialist**
IV Ceftriaxone 1-2g OD	PO Co-Amoxiclav 1g TDS **Pseudomonas: seek advice from ID Specialist**
Ceftazidime 1-2gTDS	PO Co-Amoxiclav 1g TDS **Pseudomonas: seek advice from ID Specialist**
Cefuroxime 750mg-1.5g TDS	PO Cefuroxime axetil 500mg BD
Ciprofloxacin 200-400mg BD	PO Ciprofloxacin 500mg-750mg BD
Clindamycin 300-600mg TDS/QID	PO Clindamycin 300-600mg TDS/QID
Flucloxacillin 1-2g QID	PO Flucloxacillin 500mg-1g QID
Fluconazole 200-400mg OD	PO Fluconazole 200-400mg OD
Levofloxacin 500-750mg	PO Levofloxacin 500-750mg
Linezolid 600mg BD	PO Linezolid 600mg BD
Metronidazole 500mg TDS	PO Metronidazole 400mg TDS
Piperacillin/Tazobactam 4.5g TID/QID	PO Co-Amoxiclav 1g TDS **Pseudomonas: seek advice from ID Specialist**

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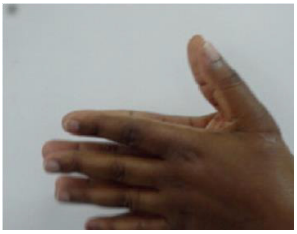
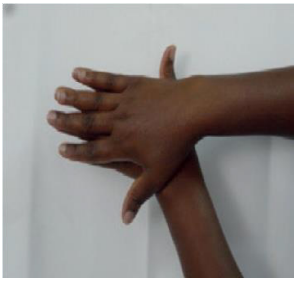
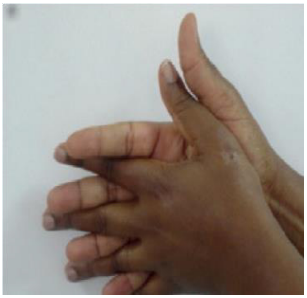
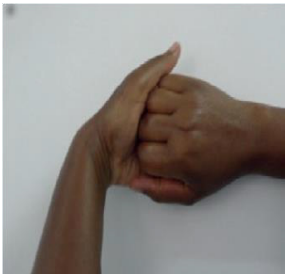
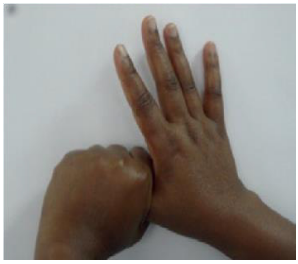
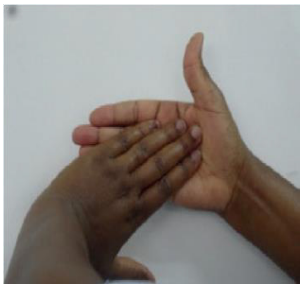
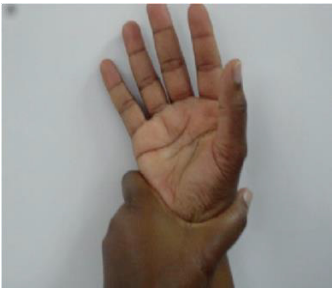
Table 1: Infection prevention measures for invasive procedures

Central line insertion	Peripheral cannula insertion	Urinary catheter insertion
1. Perform hand hygiene 2. Put on sterile Personal Protective Equipment 3. Prepare skin with 4% chlorhexidine gluconate solution 4. Insert the central line avoiding the femoral site 5. Secure line with sterile gauze or transparent dressing. Gauze should be changed after 48hrs and transparent dressing after 7 days or when visibly soiled. 6. Label date of insertion and document procedure. 7. Use aseptic technique while flushing the line 8. Remove central venous lines when no longer required and no longer than 2 weeks	1. Perform hand hygiene 2. Use aseptic technique 3. Prepare skin with 4% chlorhexidine gluconate solution 4. Secure line with transparent dressing 5. Change dressing when visibly soiled 6. Use aseptic technique while flushing the line 7. Remove when no longer required	1. Perform hand hygiene 2. Use aseptic technique 3. Prepare skin with 4% chlorhexidine gluconate solution 4. Insert catheter after applying sterile lubricating gel. Use the appropriate size catheter to minimize bladder neck and urethral trauma 5. Secure catheter to prevent movement and urethral traction. 6. Maintain a closed drainage system. 7. Drain the urine bags observing standard precautions always 8. Clean the metal surface during daily routine bathing - don't use antiseptic baths

HANDWASHINGTECHNIQUE

	1. Wet hands with water
	2. Apply enough soap to cover all hand surfaces
	3. Rub hands palm to palm,
	4. Right palm over left dorsum and left palm over right dorsum

	5. Palm to palm fingers interlaced
	6. Back to fingers to opposing palms with fingers interlocked
	7. Rotational rubbing of right thumb clasped in left palm and vice versa
	8. Rotational rubbing, backwards and forwards with clasped fingers hand in left palm and vice versa

	9. Rotational rubbing of the wrist palm and vice versa
	10. Rinse hands with water
	11. Dry hands thoroughly with a single use towel

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