THE AMERICAN BOARD OF PEDIATRICS®

CONTENT OUTLINE

Pediatric Infectious Diseases

Subspecialty In-Training, Certification, and Maintenance of Certification (MOC) Examinations

INTRODUCTION

This document was prepared by the American Board of Pediatrics Subboard of Pediatric Infectious Diseases for the purpose of developing in-training, certification, and maintenance of certification examinations. The outline defines the body of knowledge from which the Subboard samples to prepare its examinations. The content specification statements located under each category of the outline are used by item writers to develop questions for the examinations; they broadly address the specific elements of knowledge within each section of the outline.

Pediatric Infectious Diseases

Each Pediatric Infectious Diseases exam is built to the same specifications, also known as the blueprint. This blueprint is used to ensure that, for the initial certification and in-training exams, each exam measures the same depth and breadth of content knowledge. Similarly, the blueprint ensures that the same is true for each Maintenance of Certification exam form. The table below shows the percentage of questions from each of the content domains that will appear on an exam. Please note that the percentages are approximate; actual content may vary.

	Content Categories	Initial Certification and In-Training	Maintenance of Certification (MOC)
1.	Organ System Infections	20%	20%
2.	Pathogens of Infectious Diseases	21.5%	22%
3.	Use of Laboratory and Diagnostic Testing	6%	7%
4.	Treatment	15.5%	17%
5.	Prevention of Infectious Diseases	12%	12%
6.	Immunity and Host Defense	2%	2%
7.	Mechanisms of Infectious Disease	2%	2%
8.	Infections in Special Circumstances	6%	6%
9.	Infections in High-Risk Hosts	9%	9%
10.	Epidemiology and Principles of Epidemiologic Research and Biostatistics	1%	1%
11.	Core Knowledge in Scholarly Activities	5%	2%

Pediatric Infectious Diseases

1. **Organ System Infections**
   A. Unspecific systemic infections
      1. Fever of unknown origin
         a. Know the most likely age-related causes of fever of unknown origin
         b. Formulate the differential diagnosis of fever of unknown origin, including noninfectious causes and disorders of temperature regulation
      2. Shock
         a. Evaluate the most likely infectious and noninfectious age-related causes of shock
         b. Recognize the clinical manifestations of various causes of shock
         c. Know the metabolic derangements associated with shock
         d. Plan the anti-infective and supportive therapies of shock
      3. Bacteremia
         a. Recognize risk factors for occult bacteremia, including host- and age-related factors
         b. Know the organism-specific complications of occult bacteremia
         c. Identify causes of occult bacteremia according to age and other risk factors
   B. Upper respiratory tract infections
      1. Sinusitis
         a. Know the most likely infective agents that cause sinusitis, including acute, subacute, and chronic
         b. Recognize the clinical manifestations and predisposing factors for sinusitis (cystic fibrosis, allergy, immune deficiency, mechanical and vasomotor factors, foreign body)
         c. Recognize the complications of sinusitis (epidural, subdural, lung, and brain abscesses)
         d. Appreciate the relative value and accuracy of diagnostic tests for sinusitis
         e. Plan antimicrobial and other aspects of therapy for acute sinusitis
         f. Plan antimicrobial and other aspects of therapy for chronic sinusitis
      2. Odontogenic infections
         a. Know the most likely etiologic agents of odontogenic infections
         b. Recognize the clinical manifestations of odontogenic infections with regard to anatomic considerations (periapical abscess, periodontal infection, fascial space infections, osteomyelitis of the jaw)
         c. Plan the initial management of a patient with suspected odontogenic infection
      3. Stomatitis (including herpangina)
         a. Know the causes of stomatitis in normal and immunocompromised hosts
         b. Recognize the causes of noninfectious stomatitis (Behcet syndrome, Stevens-Johnson syndrome, cancer chemotherapeutic drugs)
         c. Recognize the organism-specific clinical manifestations of viral stomatitis
      4. Pharyngitis
         a. Know the common age- and season-specific causes of pharyngitis, including group A streptococcus, common viruses, herpes simplex, and Mycoplasma pneumoniae

b. Recognize the specific clinical manifestations and relative frequency of different pharyngeal infections, including diphtheria, Arcanobacterium haemolyticum, Neisseria gonorrhoeae, herpes virus, adenovirus, EBV, and CMV
c. Recognize normal flora and likely pathogens isolated on throat culture from a patient with pharyngitis
d. Know the indications for obtaining a bacterial throat culture in a patient with pharyngitis
e. Know that specific laboratory tests (special media) identify uncommon agents as a cause of pharyngitis, including diphtheria, Arcanobacterium haemolyticum, and Neisseria gonorrhoeae
f. Plan the treatment of uncommon causes of pharyngitis, including diphtheria, Arcanobacterium (Corynebacterium) haemolyticum, Neisseria gonorrhoeae

5. Parapharyngeal infections
   a. Identify the most likely agents of parapharyngeal infections, including peritonsillar and retropharyngeal abscess, and Ludwig angina
   b. Know the age of occurrence and predisposing factors that contribute to pharyngeal and parapharyngeal infections, including peritonsillar, retropharyngeal, and Ludwig angina
   c. Recognize the clinical manifestations of abscesses at different sites in the parapharyngeal areas following peritonsillar and retropharyngeal infection and Ludwig angina
   d. Anticipate the complications (eg, obstruction, pulmonary embolic infection, jugular thrombophlebitis, mediastinitis) of parapharyngeal infections, including peritonsillar or retropharyngeal abscess, and Ludwig angina
   e. Plan the treatment of parapharyngeal infection, including peritonsillar or retropharyngeal abscess and Ludwig angina
6. Otitis externa
   a. Know the clinical manifestations and the most likely predisposing factors and causes of otitis externa, including malignant otitis externa
   b. Differentiate the clinical manifestations of uncomplicated otitis externa from those of chronic suppurative otitis media and malignant otitis externa
   c. Recognize the complications of malignant otitis externa
   d. Interpret culture results obtained from drainage from the external ear
   e. Plan the management of a patient with malignant or uncomplicated otitis externa
7. Acute otitis media
   a. Know the predisposing factors, clinical manifestations, and natural history of acute otitis media
   b. Recognize the common and less common age-related infectious causes of acute otitis media
   c. Recognize the complications associated with acute otitis media (mastoiditis, facial palsy, sinus thrombosis, hydrocephalus, otitis media with effusion, meningitis), including their relative frequencies
   d. Know the indications for tympanocentesis or other diagnostic tests in a patient with otitis media
   e. Plan the management of a patient with acute otitis media in whom initial antimicrobial therapy has been ineffective

f. Know that indications for prophylaxis against recurrent acute otitis media are uncommon

8. Chronic suppurative otitis media
    a. Identify the etiologic agents most likely responsible for chronic suppurative otitis media
    b. Recognize the complications associated with chronic suppurative otitis media
    c. Plan the management for chronic suppurative otitis media (antibiotic, surgical)
9. Mastoiditis
    a. Identify bacterial pathogens usually recovered from patients with acute and chronic mastoiditis
    b. Recognize the clinical manifestations of mastoiditis
    c. Plan the evaluation of a patient with suspected mastoiditis
    d. Plan the management of a patient with mastoiditis, including empiric antibiotic therapy, further diagnostic tests, and surgery
    e. Anticipate the complications of mastoiditis
10. Parotitis
    a. Know the etiologic agents most likely responsible for parotitis (including HIV) according to predisposing factors and clinical presentation
    b. Identify the clinical manifestations of viral versus suppurative parotitis
    c. Understand when the diagnosis of recurrent juvenile parotitis should be considered
11. Tracheitis and epiglottitis
    a. Recognize the clinical manifestations and predisposing causes of bacterial tracheitis (eg, laryngotracheobronchitis, trauma)
    b. Know the most likely etiologic agents of bacterial tracheitis
    c. Anticipate the complications of bacterial tracheitis
    d. Formulate a differential diagnosis of a patient with fever and stridor (epiglottitis versus croup versus bacterial tracheitis)
    e. Plan the management of a patient with suspected bacterial tracheitis
    f. Plan the evaluation of a patient with fever and stridor
    g. Recognize the etiologies, clinical manifestations, management, and complications of epiglottitis
12. Laryngotracheobronchitis
    a. Recognize the age- and season-related etiologic agents of laryngotracheobronchitis and related entities
    b. Differentiate laryngotracheobronchitis from other causes of croup by clinical manifestations and results of diagnostic tests
    c. Plan the management of a patient with laryngotracheobronchitis, including indications for hospitalization and for epinephrine and/or corticosteroid therapy
13. Thrush
    a. Differentiate among the causes of thrush, including age-specific differences and predisposing factors

C. Lower respiratory tract infections
1. Bronchiolitis
    a. Identify the most likely etiologic agents in a patient in whom bronchiolitis is suspected, based on age and season

b. Formulate a differential diagnosis in a patient in whom bronchiolitis is suspected, including infectious and noninfectious entities
c. Plan the management of a patient with bronchiolitis

2. Acute pneumonia
   a. Know the factors and etiologic agents predisposing to the development of acute pneumonia (age, anatomic abnormalities, immune deficiency, exposures)
   b. Identify the clinical manifestations of specific infectious causes of pneumonia (eg, Chlamydia, Mycoplasma, M. tuberculosis, S. pneumoniae, viral)
   c. Recommend specific diagnostic laboratory tests in patients with suspected acute pneumonia according to clinical manifestations and host factors
   d. Interpret the results of diagnostic laboratory tests obtained from a patient with suspected acute pneumonia to determine etiology
   e. Plan the empiric treatment of acute pneumonia (drugs, procedures) according to age, clinical setting, and exposure history
3. Chronic or recurrent pneumonia
   a. Plan the evaluation of a patient with chronic or recurrent pneumonia based on clinical and laboratory manifestations
   b. Formulate a differential diagnosis and know the predisposing factors for a patient with suspected chronic or recurrent pneumonia, including anatomic and immunologic abnormalities, and underlying diseases including cystic fibrosis and foreign body
4. Pneumonia in the compromised host
   a. Recognize specific predisposing factors (eg, immunologic, anatomic) for pneumonia in an immunocompromised host
   b. Plan the initial diagnostic testing and treatment of pneumonia in an immunocompromised host
   c. Determine the most likely causes of pneumonia according to specific immune deficiency
5. Empyema and pleural effusions
   a. Identify the most likely infectious causes of pleural fluid accumulations (empyema, effusion)
   b. Interpret results of pleural fluid analysis (eg, cell count, protein, glucose, LDH, pH, and Gram stain)
   c. Formulate the differential diagnosis of a patient with suspected pleural effusion, including infectious and noninfectious entities
   d. Plan the management of a patient with suspected or proven empyema or effusion (drugs, duration, procedures)
6. Pulmonary abscess/necrotizing pneumonia
   a. Identify the most likely infectious causes of lung abscess and/or necrotizing pneumonia according to clinical course (eg, duration of illness, tempo of illness)
   b. Plan the evaluation of a patient with pulmonary abscess for predisposing factors and underlying abnormalities
   c. Plan the management of a patient with pulmonary abscess or necrotizing pneumonia (drugs, procedures)
7. Aspiration pneumonia
   a. Identify the risk factors for aspiration pneumonia

b. Identify the most likely infectious causes of aspiration pneumonia
c. Plan the management of a patient with aspiration pneumonia

D. CNS infections
1. Acute meningitis
a. Know the common and uncommon host-related etiologic agents of meningitis based on age (infant versus child) and immunization history
b. Recognize the clinical manifestations of bacterial meningitis in the neonate versus an older child
c. Recognize the infectious and noninfectious etiologies of bacterial and aseptic meningitis
d. Recognize the specific clinical manifestations of uncommon infectious causes of meningitis
e. Develop a differential diagnosis in a patient with meningitis whose fever is persistent or recurrent
f. Formulate the differential diagnosis of a patient with fever and change in mental status
g. Recognize the complications of meningitis (eg, subdural effusions, seizures, empyema, cerebral venous thrombosis/infarction, fever)
h. Know the manifestations and frequency of sequelae of bacterial and viral meningitis
i. Know which laboratory studies are helpful in defining etiologic agents causing meningitis
j. Interpret Gram stains of cerebrospinal fluid from patients with meningitis
k. Plan the management of a patient with suspected bacterial meningitis (antimicrobials, fluids, anticipation of complications)
l. Know the possible indications for corticosteroid therapy in a patient with meningitis
m. Recognize the presentation and the diagnostic and management approach of acute disseminated encephalomyelitis
2. Subacute/chronic and recurrent meningitis
a. Formulate a differential diagnosis in a patient with subacute/chronic meningitis, including infectious and noninfectious entities
b. Know the predisposing factors for recurrent meningitis (eg, congenital, anatomic, immunologic, traumatic)
c. Recognize the clinical manifestations of subacute/chronic meningitis
d. Recognize the clinical manifestations of recurrent meningitis
e. Plan the evaluation of a patient with recurrent meningitis (eg, anatomic, immunologic)
f. Plan special laboratory tests to detect unusual etiologies in a patient with suspected subacute/chronic meningitis (eg, cryptococcal antigen, Lyme antibody, mycobacterial culture, meningeal biopsy)
3. Viral infections of the central nervous system
a. Know the common and less common viral etiologies of encephalitis, including epidemic causes
b. Differentiate viral from partially treated bacterial meningitis

c. Recognize the importance of the occurrence of focal vs nonfocal clinical or neurodiagnostic features in the etiologic differential diagnosis of infectious causes of encephalitis
d. Formulate a differential diagnosis for a patient with suspected viral meningoencephalitis according to age, season, and exposure
e. Know the diagnostic tests for determining a specific cause of viral meningoencephalitis
f. Formulate a differential diagnosis for a 2-week-old infant with aseptic meningitis, including herpes simplex, enterovirus, syphilis

4. Unusual causes and manifestations of meningitis
   a. Recognize the clinical and epidemiologic features needed to formulate the differential diagnosis of a patient with eosinophilic meningitis
   b. Recognize the clinical and laboratory findings of fungal meningitis
   c. Formulate a differential diagnosis in a patient with CSF findings characteristic of fungal meningitis to include infectious and noninfectious causes
   d. Plan treatment for a patient with fungal meningitis, including Candida, Cryptococcus, and Coccidioides
   e. Plan the clinical and laboratory evaluation of a patient at risk for fungal meningitis
5. Parameningeal infections
   a. Identify the most likely etiologic agent(s) of brain abscess by clinical setting
   b. Identify the most likely etiologic agent(s) of epidural abscess by clinical setting
   c. Recognize the predisposing factors, clinical manifestations, and differential diagnosis of parameningeal infections (brain abscess, epidural abscess, empyema)
   d. Know the complications of parameningeal infections (brain abscess, epidural abscess, subdural empyema)
   e. Plan the appropriate diagnostic evaluation of a patient with suspected parameningeal infection (brain abscess, epidural abscess, subdural empyema)
   f. Plan appropriate management of a patient with suspected parameningeal infection (brain abscess, epidural abscess, subdural empyema)
6. Reye syndrome
   a. Recognize the clinical manifestations, epidemiology, and differential diagnosis of a patient with possible Reye syndrome
   b. Know the appropriate laboratory tests in a patient with suspected Reye syndrome
7. Transverse myelitis
   a. Formulate a differential diagnosis in a patient with suspected transverse myelitis
   b. Recognize the clinical manifestations and diagnostic testing of transverse myelitis
8. Epidural infections
   a. Identify the clinical presentation and likely etiologic agents causing spinal epidural infection by clinical setting
   b. Recognize the predisposing factors of spinal epidural infection
   c. Plan an appropriate laboratory evaluation of a patient with suspected spinal epidural infection
   d. Plan management for a patient with suspected spinal epidural infection (drugs, surgery, urgency)
9. Neuritis/neuropathy
   a. Recognize the clinical manifestations of Guillain-Barré syndrome

b. Recognize the clinical manifestations of peripheral neuropathy/neuritis
c. Formulate a differential diagnosis of weakness in a patient with findings suggestive of Guillain-Barré syndrome
d. Identify the organism most commonly associated with Guillain-Barré syndrome (eg, Campylobacter)
e. Identify the organism most commonly associated with peripheral neuropathy/neuritis (eg, Borrelia, virus)

E. Urinary tract infections
1. Urinary tract infection
a. Differentiate asymptomatic bacteriuria from urinary tract infection based on epidemiology and natural history, and understand management
b. Recognize when asymptomatic bacteriuria is significant
c. Recognize the clinical manifestations of urinary tract infections, including cystitis and pyelonephritis
d. Know how to interpret microbiologic test results for urinary tract infection
e. Know the appropriate imaging studies in patients with suspected or proven urinary tract infection
f. Plan the appropriate treatment of urinary tract infection (drugs, duration of treatment, prophylaxis), including initial empiric therapy
g. Recognize the complications of urinary tract infection (renal abscess, perinephric abscess, reflux uropathy, xanthogranulomatous pyelonephritis)
2. Renal and perinephric abscess
a. Recognize the clinical manifestations and most likely infectious causes of renal or perinephric abscess by clinical presentation
b. Recognize the predisposing factors for renal/perinephric abscess, including endocarditis
c. Formulate the differential diagnosis of a patient with suspected perinephric or renal abscess
d. Plan appropriate diagnostic tests and management of a patient with possible renal or perinephric abscess

F. Cardiovascular infections
1. Endocarditis
a. Recognize the common and less common organisms causing endocarditis (eg, H. aphrophilus, K. kingae, E. corrodens, Actinomycetemcomitans, Cardiobacterium, Bartonella, Legionella)
b. Know the pathogenesis and predisposing factors for the different infectious causes of endocarditis
c. Recognize the clinical manifestations of endocarditis or endovascular infections, including persistent bacteremia and embolic phenomena
d. Identify the typical features of fungal endocarditis
e. Recognize complications of endocarditis (eg, septic emboli, valve dysfunction, nephritis, thrombocytopenia, stroke)
f. Plan the diagnostic evaluation of a patient with suspected endocarditis
g. Formulate a microbiologic differential diagnosis of "culture-negative" endocarditis
h. Recognize the indications for surgery in the management of endocarditis
i. Plan empiric therapy and definitive treatment of endocarditis

j. Plan therapy for treatment of known etiology of endocarditis in a patient allergic to the drug of choice or who has a toxic reaction to the drug of choice
k. Know indications for and drug of choice and alternative drugs for prophylaxis of endocarditis for different clinical settings and procedures in the presence of a prosthetic valve

2. Myocarditis
   a. Know the epidemiologic features and microbial etiologies of viral myocarditis
   b. Recognize the clinical manifestations of infectious myocarditis
   c. Plan appropriate diagnostic tests to identify the etiology of infectious myocarditis
3. Acute rheumatic fever
   a. Know the pathogenesis of acute rheumatic fever
   b. Recognize acute rheumatic fever by the presence of predisposing factors and clinical manifestations (eg, chorea, arthritis)
   c. Plan the evaluation of a patient with suspected acute rheumatic fever
   d. Plan the management of a patient with acute rheumatic fever
   e. Know the choice of drugs and indications for prophylaxis against acute rheumatic fever, and the duration for secondary prophylaxis
4. Pericarditis
   a. Recognize the clinical manifestations and microbial causes of pericarditis
   b. Formulate the differential diagnosis in a patient with an enlarged heart and a narrow pulse pressure
   c. Plan diagnostic studies for pericarditis, including those to identify the pathogen
   d. Plan the management of a patient with infectious pericarditis
5. Mediastinitis
   a. Know the microbial causes, predisposing factors, and differential diagnosis of mediastinitis
   b. Recognize the clinical manifestations of mediastinitis
   c. Plan the treatment (antibiotics and surgery) of mediastinitis
   d. Plan diagnostic tests to identify mediastinitis

G. Bone and joint infections
1. Osteomyelitis
   a. Know the infectious causes of acute osteomyelitis according to age
   b. Recognize the risk factors for sequelae from osteomyelitis (neonate or young infant, delay in diagnosis and initiation of therapy, failure to effect proper surgical drainage when indicated)
   c. Identify the clinical manifestations of osteomyelitis, including multiple sites and the variations according to age
   d. Recognize clinical manifestations of Pseudomonas aeruginosa osteomyelitis following a puncture wound through sneakers (time elapsed since injury, lack of systemic toxicity, mild local findings, changes on imaging studies)
   e. Appreciate the situations (eg, trauma, IV drug abuse, diabetes, sickle cell disease) in which less common organisms may be the cause of osteomyelitis (eg, Mycobacterium tuberculosis, Pseudomonas aeruginosa, Salmonella)
   f. Understand the situations in which joint arthritis is present in the setting of osteomyelitis

g. Know the appropriate laboratory tests for establishing a diagnosis of osteomyelitis and the microbial etiology(eg, radionuclide bone scan, blood culture, site aspirate, biopsy, MRI)
h. Recognize the indications for surgical drainage in osteomyelitis
i. Know the appropriate drugs and route of administration for empiric definitive treatment, and the duration of treatment of acute osteomyelitis
j. Recognize the clinical features, and plan the diagnostic evaluation and management of a patient with chronic osteomyelitis
k. Recognize the clinical features and plan the management of recurrent multifocal osteomyelitis, and manage appropriately
l. Know the complications of acute osteomyelitis recognized with CA-MRSA

2. Pyogenic arthritis
   a. Recognize the clinical manifestations of pyogenic arthritis, particularly with regard to the joint involved and the age of the patient
   b. Formulate the differential diagnosis for a patient with fever, refusal to bear weight, limp and/or decreased range of motion of the hip
   c. Plan and interpret appropriate laboratory tests to establish the diagnosis of pyogenic arthritis
   d. Identify the causes of arthritis when culture results are negative (eg, viral, reactive, rheumatic fever, Lyme)
   e. Know likely/unlikely etiologic agents of pyogenic arthritis by age, site of infection, multiple joints, and underlying conditions (eg, Borrelia, Neisseria, Staphylococcus, Salmonella, Kingella)
   f. Plan the empiric and definitive treatment, route of administration, and duration of treatment of bacterial arthritis, based on the joint involved, the age of the patient, mode of acquisition, and clinical manifestations
   g. Know the indications for surgical drainage of pyogenic arthritis
   h. Know the risk factors for sequelae from pyogenic arthritis (neonate versus young infant, hip and shoulder versus other joints, failure to effect surgical drainage when indicated, concurrent osteomyelitis)
3. Diskitis
   a. Recognize the clinical manifestations and know the differential diagnosis of diskitis
   b. Plan the management of a patient with diskitis
   c. Plan a diagnostic evaluation to establish the etiology of diskitis

H. Skin/soft tissue/muscle infections
1. Superficial skin infections (eg, impetigo, furuncle, ecthyma)
   a. Know the most frequent causes of superficial skin infections according to clinical manifestations
   b. Plan a diagnostic evaluation to establish the cause of superficial skin infections, including recurrent furuncles
   c. Understand possible serious consequences of superficial skin infection (eg, systemic spread, glomerulonephrits)
   d. Recognize the dermatologic manifestations (eg, epidermal necrolysis, erythroderma, ecthyma gangrenosum, scarlatiniform exanthems) of bacterial toxins

e. Identify the pathogens most commonly associated with petechiae (eg, coxsackievirus A, echovirus, Neisseria, Rickettsia)
f. Recognize pathogens most commonly associated with urticaria (eg, S. pyogenes, Epstein-Barr virus)
g. Recognize pathogens most commonly associated with erythema multiforme (eg, herpes simplex virus, Mycoplasma)
h. Plan the treatment of superficial skin infections

2. Subcutaneous infections/abscess/cellulitis
   a. Recognize the clinical manifestations and microbial etiologies of subcutaneous infections/abscesses/cellulitis
   b. Know appropriate means of diagnosing the etiologic agents of subcutaneous infections/abscesses/cellulitis (eg, aspiration/surgical drainage/biopsy)
   c. Plan the appropriate treatment for most likely organisms causing subcutaneous infections/abscesses/cellulitis according to age and clinical manifestations
   d. Appreciate the relative likelihood of complications of subcutaneous infections/abscesses/cellulitis by location and organism
   e. Recognize the clinical manifestations and etiologic agents (infectious and noninfectious) of erythema nodosum
3. Myositis/pyomyositis/fasciitis
   a. Know the clinical manifestations, predisposing causes, and microbial etiologies of muscle infections (ie, myositis/pyomyositis/fasciitis)
   b. Know the appropriate methods to diagnose myositis/pyomyositis/fasciitis
   c. Recognize the indications for surgical drainage and debridement of myositis/pyomyositis/fasciitis
   d. Plan the appropriate empiric and definitive treatment of myositis/pyomyositis/fasciitis
4. Omphalitis and funisitis
   a. Know the clinical manifestations and the most likely agents associated with omphalitis/funisitis
   b. Know the appropriate methods to diagnose omphalitis/funisitis
   c. Plan appropriate empiric and definitive treatment of omphalitis/funisitis

I. Gastrointestinal/intra-abdominal infections
1. Gastroenteritis
   a. Differentiate the pathogenic mechanisms involved in gastroenteritis syndrome (eg, colitis, secretory diarrhea)
   b. Know the epidemiologic features that help distinguish the microbiologic etiology of gastroenteritis: age, season, exposures
   c. Know the major etiologies of infectious colitis versus secretory diarrhea: bacteria, viruses, protozoa
   d. Plan the diagnostic evaluation to determine the etiology of infectious gastroenteritis (eg, Giardia, Norovirus, calicivirus, enteric adenovirus, rotavirus, Salmonella, C. difficile)
   e. Know the clinical indication and choice of antimicrobial agents in gastroenteritis
   f. Recognize the complications of infectious diarrhea (eg, bacteremia in Salmonella, hepatic abscess in amoebiasis, Guillain-Barré in Campylobacter)
2. Antibiotic-associated colitis

a. Formulate the differential diagnosis in a patient receiving antibiotic therapy in whom diarrhea has developed
b. Know the etiology, diagnostic evaluation, and therapy for antibiotic-associated colitis

3. Appendicitis
   a. Formulate the differential diagnosis of a patient with right lower quadrant pain and leukocytosis
   b. Plan appropriate initial, empiric, and definitive antimicrobial therapy of ruptured appendicitis
   c. Recognize the complications of acute appendicitis
   d. Recognize periappendiceal, hepatic, or subphrenic abscess as a complication of appendicitis
4. Peritonitis
   a. Recognize the clinical manifestations and differential diagnosis of peritonitis (fever, a diffusely tender and rigid abdomen, and absent bowel sounds)
   b. Recognize the factors that predispose to peritonitis (eg, nephrotic syndrome, peritoneal dialysis, perforated bowel)
   c. Recommend diagnostic tests for a patient with suspected peritonitis
   d. Recognize the microbial etiologies of peritonitis
   e. Plan appropriate initial empiric antimicrobial therapy for a patient with suspected peritonitis
   f. Know when surgery should be avoided in patients with peritonitis (ie, gram-positive diplococci on peritoneal aspirate)

J. Lymphoid tissue infections (lymphadenitis, lymphangitis)
1. Know the most likely infectious causes of lymphadenitis/lymphangitis according to clinical manifestations (including anatomic location) and age
2. Recognize infections most frequently associated with regional and generalized lymphadenitis
3. Plan the evaluation for suspected lymphadenitis and/or lymphangitis, including indications for invasive diagnostic testing for the most likely organisms according to age and clinical manifestations (eg, aspiration, biopsy)
4. Plan the empiric and definitive antibiotic management for suspected lymphadenitis and/or lymphangitis, including indications for surgical management for the most likely organisms according to age and clinical manifestations (eg, surgical drainage, excision
5. Recognize the complications and sequelae of lymphadenitis/lymphangitis according to age, clinical manifestations, and organisms (eg, fistulae, facial nerve palsy, postoperative)

K. Hepatic/biliary infections
1. Viral hepatitis
   a. Formulate the differential diagnosis for a patient with nausea, vomiting, icterus, and right upper quadrant pain
   b. Know the epidemiologic exposure factors that predispose a healthy infant or child to each of the causes of viral hepatitis and how each viral illness presents clinically
   c. Know the diagnostic tests for each of the causes of viral hepatitis, including the interpretation of results

d. Know the long-term outcome of viral hepatitis for each of the causes of viral hepatitis
e. Know the indications for antiviral therapy in patients with acute and chronic viral hepatitis
f. Know the means for prevention of each of the causes of viral hepatitis: public health, immunoprophylaxis, blood donor screening, and vaccination
g. Know the agents other than the hepatotropic viruses (hepatitis A,B,C, D,E,G) that can cause hepatitis
h. Know the epidemiologic exposure factors that predispose an immune-compromised infant or child to each of the causes of viral hepatitis and how each viral illness presents clinically

2. Ascending cholangitis
   a. Know the factors and diseases that predispose to ascending cholangitis in children
   b. Know the microbial etiology of ascending cholangitis in children
   c. Know the diagnostic evaluation for children with ascending cholangitis
   d. Recognize the clinical course in a patient with ascending cholangitis
   e. Know the empiric and definitive antimicrobial therapy for children with ascending cholangitis

L. Ocular infections
1. Conjunctivitis
   a. Identify the most likely organisms causing conjunctivitis according to age, clinical manifestations, and predisposing factors
   b. Recognize which viral and bacterial pathogens and situations are associated with epidemics of conjunctivitis (eg, adenoviral infections, nosocomial transmission by contaminated eye devices, S. pneumoniae)
   c. Plan a diagnostic evaluation to determine the infectious cause in a patient with conjunctivitis
   d. Plan the appropriate empiric therapy for patients with conjunctivitis according to age, clinical manifestations, and laboratory findings
   e. Recognize complications and sequelae of conjunctivitis according to age and organism (eg, gonococcal, chlamydial, adenoviral)
   f. Formulate a differential diagnosis in a patient with conjunctivitis that includes illnesses associated with conjunctivitis that may not be caused by direct infection, including Kawasaki disease, and Stevens-Johnson and toxic shock syndromes
   g. Know the differential diagnosis of a neonate with conjunctivitis, considering age, clinical, and laboratory findings
   h. Know the relative advantages and limitations for each of the prophylactic anti-infective drugs for ophthalmia neonatorum
   i. Formulate a plan for the evaluation of and therapy for a neonate with conjunctivitis
2. Keratitis
   a. Know the most frequent etiologic agent for keratitis according to age, clinical manifestations, and predisposing factors (eg, adenovirus 8, HSV, fungus, Pseudomonas, Fusarium)
   b. Identify the organisms and situations associated with epidemics of keratitis (eg, adenovirus, Pseudomonas from swimming pools; Fusarium, Acanthamoeba from contaminated contact lens solution)

c. Plan the appropriate treatment of keratitis according to causative organism
d. Recognize the complications and sequelae of keratitis according to causative organism, including HSV, Pseudomonas, and Acanthamoeba

3. Endophthalmitis
   a. Recognize the predisposing factors for endophthalmitis (eg, immunodeficiency, trauma, systemic fungal or mycobacterial infection)
   b. Identify the most likely etiologic agents causing endophthalmitis according to clinical manifestations and predisposing factors, including surgery, trauma, septicemia
   c. Plan the appropriate evaluation as well as empiric and specific therapy for a patient with endophthalmitis
4. Uveitis
   a. Differentiate acute (non-granulomatous) from chronic (granulomatous) uveitis according to clinical features, epidemiology, and causes (Toxoplasma, fungus, virus, tuberculosis)
   b. Formulate a differential diagnosis for a patient with uveitis (eg, Kawasaki disease, JIA, Lyme disease, sarcoidosis)
5. Periorbital cellulitis, sinus-related swelling, infection from trauma
   a. Distinguish bacterial periorbital cellulitis from sinusitis-related eye swelling based on clinical manifestations and results of laboratory and diagnostic imaging studies
   b. Understand the pathogenesis and predisposing causes of eye swelling and erythema, including bacterial periorbital cellulitis, sinusitis-related eye swelling, orbital cellulitis, and abscess from adjacent sinusitis or trauma
   c. Identify the most frequent infectious causes of bacteremic periorbital cellulitis from a break in skin integrity, sinsusitis-related eye swelling, or orbital cellulitis from penetrating trauma
   d. Know the indications for surgical intervention in a patient with orbital abscess
   e. Plan the appropriate antibiotic therapy for empiric treatment of bacterial periorbital cellulitis (nontraumatic, bacteremic, or as a result of a break in skin integrity), sinusitis related eye swelling, or orbital cellulitis from direct extension from sinuses or trauma
   f. Recognize complications of orbital cellulitis (cavernous sinus thrombosis, optic nerve ischemia)
   g. Formulate a differential diagnosis of the infectious causes of preseptal cellulitis, including bacterial cellulitis (complicating trauma) and inflammatory edema

M. Reproductive system infections/sexually transmitted diseases

1. Urethritis
   a. Formulate the differential diagnosis, including infectious etiologies for male and female infants, children, and adolescents with frequency, urgency, dysuria, and a urethral discharge
   b. Plan appropriate diagnostic tests to define the infectious cause of urethritis in males and females by age
   c. Plan initial empiric antimicrobial therapy of urethritis in males and females
   d. Know which of the agents causing urethritis in males and females can be shed asymptomatically and can be transmitted by sexual contact
   e. Recognize the complications of urethritis in males (eg, epididymitis)

2. Cervicitis
    a. Identify the microbiologic etiologies of cervicitis in a sexually active adolescent female (eg, C.trachomatis, N.gonorrhoeae, herpes simplex virus, Trichomonas)
    b. Plan the appropriate diagnostic tests to define the infectious etiology of cervicitis
    c. Know which cervical infections (based on microbiologic etiology) warrant screening and antimicrobial therapy in at-risk pregnant women
    d. Plan the initial empiric antimicrobial therapy of cervicitis
    e. Identify the clinical presentation as well as the acute and long term complications of cervicitis by pathogen: salpingitis, infertility, tubal pregnancy
    f. Plan the management of a neonate born to a mother with known genital tract culture positive for certain pathogens (eg, C. trachomatis, N. gonorrhoeae, group B streptococcus, herpes simplex virus)
3. Salpingitis/pelvic inflammatory disease
    a. Formulate the differential diagnosis in a sexually active adolescent female with pelvic pain
    b. Identify the microbial etiologies of pelvic inflammatory disease
    c. Plan appropriate diagnostic tests to establish microbial etiology of pelvic inflammatory disease
    d. Know the antimicrobial therapy of pelvic inflammatory disease
    e. Recognize the clinical presentation as well as the acute and long-term complications of pelvic inflammatory disease: tubal pregnancy, infertility
4. Genital vesiculoulcerative disease
    a. Recognize clinical clues (painful versus painless, single versus multiple, regional adenopathy, and laboratory diagnostic tests that suggest particular microbiologic etiologies and formulate a differential diagnosis in a patient with vesiculoulcerative genital lesions
    b. Know the epidemiology and risk for transmission of pathogens causing vesiculoulcerative genital lesions between sexual partners, and from mother to newborn, regardless of symptoms
    c. Plan the treatment and prophylaxis of primary or recurrent vesiculoulcerative genital lesions
    d. Understand the likely clinical course and prognosis of vesiculoulcerative genital lesions, and the association of these lesions with other infectious pathogens, including HIV
5. Vaginitis
    a. Formulate the differential diagnosis of vaginitis in prepubertal females and in sexually active pubertal females, including bacterial vaginosis
    b. Plan the laboratory tests for etiologic diagnosis of vaginitis in prepubertal females and in sexually active pubertal females
    c. Choose the initial empiric antimicrobial therapy of vaginitis in prepubertal females and in sexually active pubertal females
    d. Know that vaginitis in prepubertal girls can be a manifestation of sexual abuse, which diagnostic tests are appropriate, and which pathogens confirm sexual abuse
    e. Know the implications for transmission of the major etiologic agents of vaginitis to sexual partners, and to the neonate during vaginal delivery

N. Kawasaki disease

1. Recognize the clinical manifestations and the expected time course of the various clinical signs and symptoms of Kawasaki disease
2. Know the epidemiology of Kawasaki disease, including age, race, and ethnicity
3. Understand the constellation of clinical and laboratory findings for the diagnosis and incomplete presentation of Kawasaki disease
4. Formulate a differential diagnosis in a patient in whom Kawasaki disease is suspected, including infectious and noninfectious etiologies
5. Recognize prognostic factors for potential complications of Kawasaki disease
6. Plan laboratory evaluation to aid in the diagnosis and management of Kawasaki disease
7. Know the agents used for the appropriate initial treatment of Kawasaki disease, including the time in which each must be initiated, the duration of therapy, and the expected response for immune globulins and anti-platelet therapy
8. Recognize the complications of Kawasaki disease, including time of occurrence and method of detection (eg, echocardiography early, stress test later)

2. **Pathogens of Infectious Diseases**

A. Gram-positive bacteria

1. Staphylococcus aureus
    a. Know the epidemiology of Staphylococcus aureus, MSSA, and MRSA, including normal sites of colonization, routes of transmission, and predisposing factors to infection
    b. Know the epidemiology, nomenclature, (including molecular destinations) prevention and control of community-acquired and hospital-acquired MSSA and MRSA Staphylococcus aureus infections, including nursery outbreaks
    c. Recognize clinical manifestations of toxic shock syndrome and formulate a differential diagnosis
    d. Plan therapy for a patient with toxic shock syndrome, including recognition of the need for aggressive fluid replacement
    e. Plan investigation of a patient with persistent staphylococcal bacteremia (eg, endocarditis, other intravascular focus, secondary sites of infections)
    f. Know the likely in vitro antimicrobial susceptibilities of Staphylococcus aureus for community-associated MSSA and MRSA strains, as well as for hospital-associated MRSA strains, including tests for inducible methylase resistance
    g. Plan antimicrobial and adjunctive therapy for a patient with Staphylococcus aureus infection
    h. Formulate a differential diagnosis in a patient with recurrent staphylococcal infections
    i. Formulate a differential diagnosis in a patient with suspected toxic shock syndrome
    j. Recognize clinical manifestations, diagnosis, and therapy of exfoliative toxin syndromes
    k. Know the approach to investigating and managing community outbreaks of CA-MRSA infections
    l. Plan the management for a patient with catheter-related Staphylococcus aureus bloodstream infection (removal, follow-up cultures)
2. Coagulase-negative staphylococci

a. Compare the epidemiology and routes of transmission of coagulase- negative staphylococci with those of Staphylococcus aureus
b. Recognize that coagulase-negative staphylococci encompass multiple species that have differing predilections for types of infection (eg, S. saprophyticus and UTI)
c. Know the predisposing factors that increase risk for coagulase- negative staphylococcal infection (eg, newborn infants, immunocompromised host, and implanted foreign bodies), including intravascular catheters
d. Identify the characteristic features of coagulase-negative staphylococcal infection in different hosts, such as bacteremia in very-low-birth weight infants and urinary tract infections in adolescent females (eg, S. saprophyticus)
e. Know the approach to antimicrobial therapy of coagulase-negative staphylococci based on the frequency and character of multidrug resistance
f. Interpret the significance of single standard nonquantitative and quantitative blood cultures that are positive for coagulase-negative staphylococci in different clinical circumstances, including normal host, low-birth weight infant, intravascular device
g. Plan the antimicrobial selection on duration of therapy of different types of coagulase-negative staphylococcal infections (eg, CNS shunt, osteomyelitis following insertion of foreign body for repair of fracture, intravascular catheter-related bacteremia)

3. Group A streptococcus
   a. Know the routes of transmission, sites of colonization and communicability of persons infected or colonized by group A streptococcus
   b. Recognize the major cell wall constituents of group A streptococcus and exotoxins associated with disease-producing strains
   c. Recognize the clinical manifestations of group A streptococcal infections at each site of infection
   d. Know the indications and limitations of diagnostic tests for group A streptococcus, including cultures, rapid antigen detection tests, and serologic tests
   e. Know the antimicrobial susceptibility pattern characteristic of strains of group A streptococci
   f. Plan the antimicrobial treatment of the different types of group A streptococcal infections according to clinical manifestations, including drugs, duration, and alternate drugs in penicillin-allergic patients
   g. Understand the epidemiology and management of children with recurrent group A streptococcal pharyngitis
   h. Plan the management of those exposed to patients with documented group A streptococcal infections, including indications for exclusion from school and child-care attendance and hospital infection control
   i. Recognize the suppurative complications of pharyngeal and skin infections with group A streptococcus
   j. Know the cardiac, renal, and central nervous system manifestations of nonsuppurative complications of group A streptococcal pharyngitis and impetigo
   k. Recognize the clinical manifestations of streptococcal toxic shock-like syndrome
   l. Recognize the clinical manifestations of streptococcal necrotizing fasciitis and myositis

m. Know the clinical manifestations, appropriate management, and prognosis of streptococcal toxin syndromes
n. Understand how to distinguish streptococcal carriers from infected individuals and the implications of the carrier state to both the child and to contacts

4. Group B streptococcus
   a. Know the epidemiology of group B streptococcal infection in pregnant women, newborn infants, and children, including sites of colonization and rates of transmission
   b. Know the role of serotype-specific antibody in susceptibility to group B streptococcal infection
   c. Recognize the relative frequency and the clinical manifestations of early- and late-onset group B streptococcal infection in infancy
   d. Understand the value and limitations of group B streptococcal rapid screening tests of cervical secretions in pregnant women
   e. Plan an appropriate intrapartum chemoprophylactic regimen for the prevention of group B streptococcal infection (eg, choice of drugs, route of administration)
   f. Know the recommendations for screening for group B streptococci during pregnancy, including timing, optimal methods, and site for recovery of group B streptococci from vaginal and rectal mucous membranes
   g. Know the potential value and limitations of rapid antigen testing for group B streptococcus in urine and CSF in newborn infants
   h. Plan the antimicrobial therapy and management, including drug(s) and duration of therapy in newborn infants and children with different types of group B streptococcal infections
   i. Understand the rationale and indications for maternal chemoprophylaxis for neonatal group B streptococcal infection and for management of her newborn infant after intrapartum chemoprophylaxis
5. Group D streptococcus and Enterococcus
   a. Identify the sites of colonization for group D streptococcus and Enterococcus
   b. Recognize those infections that are likely to be caused by Enterococcus
   c. Plan the antimicrobial therapy for group D streptococcal or enterococcal infections
   d. Recognize the existence of vancomycin resistant isolates of Enterococcus and plan appropriate antimicrobial therapy for VRE infections
   e. Interpret antimicrobial susceptibility test results for Enterococcus (eg, ampicillin, high level susceptibility to aminoglycosides)
   f. Know when synergistic bactericidal combination therapy for enterococcal infection is indicated (eg, indications for aminoglycosides in addition to ampicillin and vancomycin)
   g. Know the in vitro antimicrobial susceptibilities of Enterococcus
6. Groups C and G streptococci
7. Viridans streptococci
   a. Recognize the different species of viridans (eg, intermedius) and other non-A, B, or D streptococci and their usual sites of colonization
   b. Know the infections associated with viridans and other non-A, B, or D streptococci
   c. Plan the therapy of infections caused by viridans and other non-A, B, or D streptococci

d. Know the significance of nutritionally deficient streptococci and the laboratory characteristics by which they can be identified
e. Interpret the significance of a single blood culture isolate of a viridans streptococcus in different clinical circumstances

8. Streptococcus pneumoniae
   a. Know the epidemiology of Streptococcus pneumoniae infections, including the sites of normal colonization, routes of transmission, and predisposing factors
   b. Know the limitations of rapid antigen or PCR testing for early diagnosis of pneumococcal infections
   c. Know the role of polysaccharide capsule in the pathophysiology of pneumococcal infection and induction of immunity
   d. Interpret the laboratory susceptibility test results necessary to identify strains of Streptococcus pneumoniae with intermediate and high-level resistance to penicillin and other drugs
   e. Understand the mechanism of antimicrobial resistance (eg, beta-lactams, macrolides)
   f. Plan the treatment of pneumococcal infections according to site and susceptibility to penicillin, third-generation cephalosporins, and fluoroquinolones
   g. Know the indications for penicillin chemoprophylaxis for pneumococcal infection in children with repeated or severe pneumococcal infections that may be indicative of certain types of immune dysfunction (eg, splenic dysfunction, HIV)
   h. Know the importance of investigating antimicrobial resistance by pneumococcus as the cause of persistent or recurrent infection (eg, patients with upper or lower respiratory tract infections or those with meningitis or acute otitis media)
   i. Know the likely in vitro antimicrobial susceptibilities of penicillin-resistant Streptococcus pneumoniae
   j. Understand the factors that predispose a patient to infection with an antibiotic resistant Streptococcus pneumoniae infection (child-care center attendance, young age, recent antibiotic treatment)
   k. Differentiate laboratory susceptibility data based on site of isolate (eg, CSF, blood, middle ear) of Streptococcus pneumoniae

9. Other gram-positive cocci
   a. Understand the clinical significance of infections with Pediococcus, Leuconostoc, or Gemella species, and the antimicrobial susceptibilities

B. Gram-negative cocci
   1. Neisseria meningitidis
      a. Understand the epidemiology of meningococcal disease (epidemic disease, serogroups by age, time trends, crowding, environmental tobacco smoke, carrier state)
      b. Know the microbiology of Neisseria meningitidis (serogroups, lipooligosaccharide)
      c. Recognize common clinical manifestations of meningococcal infection (meningitis, petechial and purpuric eruption, shock)
      d. Recognize less commonly encountered clinical manifestations of meningococcal infection (arthritis, pneumonia, pericarditis, myocarditis, chronic meningococcemia, conjunctivitis)

e. Recognize clinical manifestations of immunologically mediated post- meningococcal polyserositis (pericarditis, arthritis)
f. Plan the treatment for a patient with immunologically mediated post-meningococcal polyserositis (pericarditis, arthritis)
g. Plan the diagnostic evaluation for suspected Neisseria meningitidis infection (isolation, Gram stain skin lesions, antigen or PCR detection)
h. Plan treatment for a patient with meningococcal infection (meningococcemia, meningitis, purulent pericarditis, hypopyon)
i. Understand the rationale behind the assessment of risk to healthy and potentially immune compromised patients (including neonates and pregnant women) following exposure to a patient with a meningococcal infection and plan appropriate chemoprophylaxis
j. Evaluate public health measures for outbreak of meningococcal infection (vaccine, chemoprophylaxis)
k. Recognize that complement deficiencies predispose to recurrent meningococcal infection
l. Know the current epidemiology of in vitro antimicrobial susceptibilities of Neisseria meningitidis

2. Neisseria gonorrhoeae
   a. Understand the epidemiology of gonococcal infections (perinatal transmission, sexual transmission, risk factors, resistance patterns)
   b. Recognize common clinical manifestations of gonococcal infection (cervicitis, urethritis, pelvic inflammatory disease, disseminated gonococcal disease)
   c. Recognize less common clinical manifestations of gonococcal infection (pharyngitis, proctitis, epididymitis, perihepatitis, arthritis)
   d. Plan treatment for patients with uncomplicated or disseminated gonococcal infection (urethritis, pharyngitis, pelvic inflammatory disease)
   e. Know that sexually active patients with gonococcal infection are treated for chlamydia as well as Neisseria gonorrhoeae
   f. Know that a significant percentage of strains of Neisseria gonorrhoeae are resistant to antibiotics (mechanisms, laboratory identification, effective drugs)
   g. Plan the management for sexual partner(s) of a patient with gonococcal infection
   h. Plan a prophylactic treatment regimen for an infant whose mother has a gonococcal infection
   i. Understand the importance of terminal complement components in preventing recurrent Neisseria meningitidis infections

3. Moraxella catarrhalis
   a. Recognize the diseases commonly caused by Moraxella catarrhalis (acute otitis media, tracheitis, sinusitis, pneumonia)
   b. Know that the majority of isolates of Moraxella catarrhalis produce beta-lactamase
   c. Plan the treatment of a patient with Moraxella catarrhalis infection (drug of choice, alternative drugs)

C. Gram-positive bacilli
   1. Arcanobacterium haemolyticum
      a. Recognize Arcanobacterium as a cause of pharyngitis with scarletiniform rash predominantly in adolescents, and manage appropriately

2. Bacillus species
    a. Recognize the different clinical manifestations of anthrax and plan appropriate antimicrobial therapy, including empiric therapy following bioterror exposures
    b. Know the exposures, characteristic clinical manifestations, and therapy for healthy and immune-compromised patients with food borne Bacillus cereus infection
    c. Recognize the circumstances in which Bacillus species can be the cause of invasive infection
    d. Plan initial therapy for a patient seriously ill with suspected Bacillus infection
    e. Recognize the risk factors for Bacillus cereus endophthalmitis, and manage appropriately
3. Corynebacterium species
    a. Know the epidemiology of diphtheria, including acquisition, routes of transmission, and communicability
    b. Know that if Corynebacterium diphtheriae is recovered from culture, the strain should undergo toxigenicity testing
    c. Interpret the isolation of a diphtheroid from blood and CSF of patients with different clinical features (eg, foreign body, young infant, immunocompromised host)
    d. Identify the clinical manifestations of diphtheria, including skin disease and complications of pharyngeal infection
    e. Plan the management of a patient with diphtheria, including antitoxin and chemoprophylactic therapy
    f. Plan the management of contacts of a patient with diphtheria
    g. Plan drug of choice therapy (eg, vancomycin) for a non-diphtheria Corynebacterium infection
4. Erysipelothrix rhusiopathiae
    a. Know the epidemiology, risk factors, clinical manifestations, and therapy for children with suspected or documented Erysipelothrix rhusiopathiae infection
5. Gardnerella vaginalis
    a. Know that Gardnerella vaginalis is a normal inhabitant of the vaginal flora
    b. Recognize the role of Gardnerella in bacterial vaginosis
    c. Plan the treatment of bacterial vaginosis
6. Listeria monocytogenes
    a. Know the possible sources of Listeria monocytogenes infection for early and late onset disease in neonates, in pregnant women, and in outbreaks
    b. Recognize factors predisposing to Listeria monocytogenes infection
    c. Differentiate Listeria monocytogenes from other Gram-positive organisms including diphtheroids and group B streptococci on the basis of microbiologic tests
    d. Identify the clinical manifestations of Listeria monocytogenes infection in various patients (eg, at different ages, during pregnancy, and in patients with immunodeficiency)
    e. Plan the antimicrobial therapy for a patient with Listeria monocytogenes infection, including the use of synergistic drug regimens and therapy for patients allergic to penicillin
7. Nocardia species

a. Know the epidemiology of Nocardia species, including the sources of the organism, modes of transmission, and risk factors for infection
b. Know that Nocardia may be isolated on routine culture media and be aware of the microscopic features of Nocardia species, including morphology and staining characteristics
c. Know the likely sites of Nocardia species infection, resulting characteristic clinical manifestations, and possible complications
d. Recognize that nocardiosis may be indicative of certain types of immune dysfunction (eg, chronic granulomatous disease)
e. Plan antimicrobial therapy for a patient with nocardiosis

D. Gram-negative bacilli: Enterobacteriaceae
1. Citrobacter species
a. Recognize the clinical signs and complications of Citrobacter diversus meningitis (eg, brain abscesses) in the neonate
b. Plan the management of a neonate with Citrobacter diversus meningitis (effective drugs, ineffective drugs, duration of therapy, use of computed tomography, repeated examinations of cerebrospinal fluid)
2. Edwarsiella tarda
a. Recognize Edwarsiella tarda as a cause of rapidly progressive wound or skeletal infection and meningitis, particularly in immuno- compromised hosts
3. Escherichia coli
a. Understand the modes of transmission and the mechanisms of diarrhea due to Escherichia coli, including the clinical manifestations and epidemiologic characteristics
b. Recognize that Escherichia coli serotype O157:H7 is associated with endemic and epidemic hemorrhagic colitis and hemolytic-uremic syndrome
c. Know that enterohemorrhagic Escherichia coli produce Shiga-like toxin
d. Recognize the epidemiology, clinical manifestations, and treatment of Escherichia coli meningitis and ventriculitis in a newborn infant
e. Plan the acute and long term management of a neonate with Escherichia coli meningitis or ventriculitis (effective drugs, ineffective drugs, duration of therapy, repeated examinations of cerebrospinal fluid)
f. Plan laboratory screening evaluation for Shiga-like toxin producing Escherichia coli
g. Recognize the possible risks associated with antibiotic treatment of Escherichia coli O157:H7 infection
4. Klebsiella, Enterobacter, and Serratia species
a. Recognize that Klebsiella/Enterobacter/Serratia species are nosocomial pathogens, especially in intensive care units and in patients with indwelling vascular catheters
b. Recognize that resistance to multiple antibiotics commonly occurs with Klebsiella/Enterobacter/Serratia
c. Recognize the usual antibiotic susceptibility pattern of Klebsiella species, including that associated with extended spectrum beta- lactamases and carbapenemases
d. Recognize that strains of Enterobacter and Serratia may be resistant to third-generation cephalosporins by constitutive production of derepressed (inducible)

ampC beta lactamases and may not be detected on routine susceptibility testing in the microbiology laboratory
   e. Plan the management for a patient with catheter-related bloodstream infection caused by gram-negative rods, including the use of antibiotic lock-therapy (remove catheter, attempt catheter salvage, follow-up blood cultures)
5. Proteus, Providencia, Morganella species
   a. Recognize that Proteus/Providencia/Morganella primarily cause nosocomial and urinary tract infections
6. Salmonella species
   a. Understand the epidemiology of non-typhoidal Salmonella infections (animal reservoirs, sanitation, summer peaks)
   b. Understand transmission and acquisition of Salmonella infections (fecal-oral, environmental incubation, infectious dose, gastric acidity)
   c. Understand the pathophysiology of invasive Salmonella infection (small intestinal penetration, reticuloendothelial seeding, intracellular foci, prolonged bacteremia)
   d. Understand risk factors for metastatic foci of bacteremic infection (necrotic tissue, tumor, sluggish blood flow)
   e. Know that Salmonella meningitis occurs almost exclusively in young infants and that prolonged treatment is necessary
   f. Recognize clinical manifestations of typhoid fever
   g. Plan management for a patient with typhoid fever
   h. Recognize discrepancy between in vitro and in vivo antibiotic susceptibility for Salmonella (effective drugs, ineffective drugs)
   i. Predict typical antibiotic susceptibility of Salmonella typhi and non-typhi Salmonella species
   j. Recognize that intestinal carriage of Salmonella infection may be prolonged in young infants
   k. Recognize association of Salmonella osteomyelitis and other extraintestinal infections in certain hosts (sickle cell disease, galactosemia, iron overload states)
   l. Recognize the different clinical manifestations and potential complications of Salmonella infection according to age
   m. Be aware of the role of antibiotic therapy in prolonging the length of shedding of Salmonella
   n. Know the genetic immunodeficiencies that predispose to severe or disseminated Salmonella infection
7. Shigella species
   a. Recognize the epidemiology and transmission of Shigella (no animal reservoirs, person-to-person, fecal-oral, low inoculum)
   b. Recognize clinical and laboratory manifestations of Shigella infection (CNS, systemic, GI, and vaginal)
   c. Recognize the association between Shigella dysenteriae type 2 and hemolytic uremic syndrome; and that bacteremia with these strains is rare
   d. Plan the management of a patient with shigellosis, taking into account that in vitro antimicrobial susceptibilities and antibiotic therapy eliminate intestinal colonization with Shigella

e. Recognize the effects of antidiarrheal drugs that decrease intestinal motility on the clinical course of shigellosis (ie, worsening clinical course)

8. Yersinia enterocolitica
   a. Know the epidemiologic features and mode of transmission of Yersinia enterocolitica
   b. Recognize the age-associated clinical syndromes caused by Yersinia enterocolitica (enteritis, pseudoarthritis, reactive polyarthritis and Reiter syndrome especially in individuals with HLA-B27 antigen)
   c. Recognize risk factors for Yersinia enterocolitica septicemia such as iron overload states, especially at the time of chelation therapy
   d. Know the indications for and type of treatment for patients with localized or disseminated Yersinia enterocolitica infections
9. Yersinia pestis
   a. Recognize the epidemiologic features, including vectors and reservoirs, of Yersinia pestis
   b. Recognize clinical syndromes caused by Yersinia pestis (bubonic, septicemic, and pneumonic plague; cutaneous and meningitic infections) and know the appropriate therapy

E. Gram-negative bacilli: Non-Enterobacteriaceae
1. Acinetobacter species
   a. Recognize that Acinetobacter species are normal inhabitants of skin and mucous membranes and that they can cause nosocomial infections (eg, related to catheters, wounds) often by strains that are resistant to multiple antimicrobial agents
2. Aeromonas species
   a. Know that Aeromonas hydrophila requires selective media to isolate the organism
   b. Identify the clinical manifestations of Aeromonas infection, including sepsis in immunocompromised patients (eg, ecthyma gangrenosum)
3. Alcaligenes species
   a. Recognize Alcaligenes as a cause of hospital-acquired pneumonia, bacteremia, meningitis, and urinary tract infection
4. Eikenella species
   a. Recognize that Eikenella corrodens is a normal inhabitant of oral mucosa and is a pathogen in sinusitis, brain abscess, bite wounds
   b. Plan the management of Eikenella infections
5. Chryseobacterium species
   a. Know that Chryseobacterium meningosepticum is a water and soil organism that causes sporadic cases and outbreaks of meningitis in nurseries
6. Pasteurella multocida
   a. Recognize clinical manifestations of Pasteurella multocida infection (rapid-onset cellulitis following cat/dog bite, excessive toxicity)
   b. Plan treatment for patient with Pasteurella multocida infection (drug of choice, alternative drugs for patient allergic to penicillin)
7. Plesiomonas shigelloides
   a. Recognize Plesiomonas as an uncommon cause of bacterial gastro- enteritis associated with contaminated food (eg, raw seafood) or water
8. Pseudomonas aeruginosa

a. Recognize the epidemiologic characteristics of Pseudomonas aeruginosa (ubiquitous in the environment, colonize moist areas, not part of normal human flora in the majority of individuals, hand transmission)
b. Recognize Pseudomonas aeruginosa as a cause of nosocomial infection related to intravenous and urinary catheters, CNS shunts, surgical wounds, respiratory tract infection, burn wounds, and sepsis in immunocompromised patients
c. Differentiate clinically and diagnostically between Pseudomonas aeruginosa colonization vs infection of the respiratory tract
d. Recognize clinical manifestations of Pseudomonas infection of the eye (keratitis, corneal ulceration, endophthalmitis)
e. Plan the management of special hosts with P. aeruginosa infection (a neutropenic patient with ecthyma gangrenosum, or a patient with cystic fibrosis), including effective drugs, combination therapy
f. Recognize epidemiology, clinical manifestations, and self-limited course of Pseudomonas folliculitis
g. Recognize that Pseudomonas aeruginosa develops resistance to antibiotics, (eg, beta lactams, fluoroquinolones, and aminoglycosides) following exposure to these drugs
h. Recognize clinical settings and rationale for synergistic combination antimicrobial therapy indications and why

9. Burkholderia cepacia
   a. Recognize the clinical association between Burkholderia cepacia infection, severe cystic fibrosis, and chronic granulomatous disease
   b. Plan the management of Burkholderia cepacia infection
10. Stenotrophomonas maltophilia
   a. Plan appropriate management of a patient with Stenotrophomonas maltophilia infection, including consideration of antibiotic susceptibility
   b. Know the epidemiology and mode of acquisition of Stenotrophomonas maltophilia
11. Vibrio cholerae
   a. Know the epidemiology of Vibrio cholerae including the fact that toxigenic V. cholerae is now endemic in the United States
   b. Recognize the characteristic clinical and stool manifestations of cholera
   c. Recognize that noncholera vibrios and Escherichia coli can produce cholera-like enterotoxin
   d. Know the method(s) of diagnosis of Vibrio cholerae (culture, characteristic rapid mobility of comma-shaped bacilli)
   e. Plan the treatment for a patient with cholera (fluid therapy, effective and ineffective drugs) and know the indications for prophylaxis
   f. Know the important factors in spread of cholera (sanitation, contaminated food and water)
   g. Know that non-01 Vibrio cholerae (ie, serogroup 0139) has been associated with outbreaks of diarrhea
12. Other vibrios
   a. Know that need for selective media is the method of diagnosis of Vibrio parahaemolyticus and Vibrio vulnificus infection

b. Recognize the characteristics of disease due to Vibrio parahaemolyticus (geography, self-limited, antibiotics of little benefit, raw seafood, salt water, carrier state rare)
c. Recognize that Vibrio vulnificus causes a life-threatening cellulitis- septicemia illness, especially in immunocompromised hosts and patients with hepatic cirrhosis
d. Recognize the likelihood of Vibrio vulnificus infection in a normal child with rapidly progressive necrotic cellulitis who has exposure to coastal areas

13. Other gram-negative bacilli, including Chromobacterium, Achromobacter
    a. Recognize clinical manifestations of associated cellulitis and the risk factors for Chromobacterium violaceum infection (traumatic skin lesion, neutrophil dysfunction, chronic granulomatous disease)
    b. Identify the possible source of nosocomial infection with Achromobacter species (contaminated fluids, incubators and humidifiers, and disinfectants)

F. Gram-negative coccobacilli
    1. Bartonella species (cat-scratch disease)
        a. Recognize the clinical manifestations, course, and prognosis of cat scratch disease in normal and immunocompromised patients
        b. Understand the epidemiology of the typical cat scratch disease and bartonellosis in normal and immunocompromised patients
        c. Know the appropriate means of determining the diagnosis of bartonellosis, including the indications for biopsy, aspiration of associated lesions, and serologic and microbiologic tests, and the incubation period
        d. Plan appropriate management of cat scratch disease and bartonellosis in normal and immunocompromised patients
        e. Recognize unusual manifestations of cat scratch disease (fever of unknown origin, visceral, CNS, erythema nodosum)
        f. Recognize typical histologic appearance and staining characteristics of Bartonella species in tissue specimens
    2. Brucella species
        a. Understand the clinical manifestations, epidemiology, and risk factors for Brucella infection
        b. Know the appropriate diagnostic evaluation for a patient with suspected brucellosis
        c. Plan treatment for a patient with brucellosis (effective drugs, combination therapy, duration of therapy)
        d. Recognize that relapse of brucellosis is common when monotherapy is used
    3. Bordetella pertussis
        a. Know the diagnostic tests for Bordetella pertussis infection (PCR, culture, serology), and their limitations
        b. Recognize that clinical manifestations, course, and prognosis of pertussis are age-related and vaccination-status related
        c. Recognize complications of pertussis and their relative frequency (bacterial pneumonia, necrotizing bronchitis, apnea, seizures, encephalopathy, hemorrhage)
        d. Evaluate the need for chemoprophylaxis for Bordetella pertussis (indications, effective drug, duration)
        e. Know that immunity to pertussis wanes, and that adults are reservoirs of the pathogen

    f. Formulate a differential diagnosis for a child with suspected pertussis and varying clinical findings (paroxysmal cough, persistent cough, post-tussive vomiting, lymphocytosis)
    g. Plan the treatment of a patient with pertussis
4. Other Bordetella species
    a. Understand the epidemiology and clinical manifestations of Bordetella parapertussis, and that it causes mild pertussis
5. Calymmatobacterium granulomatosis
    a. Recognize the clinical and laboratory findings of granuloma inguinale, and manage appropriately
6. Campylobacter species
    a. Know that the reservoir of Campylobacter jejuni and Campylobacter coli infection is the gastrointestinal tract of wild and domesticated animals, especially young animals
    b. Recognize that fecal-oral transmission is mode of acquisition of Campylobacter jejuni or coli
    c. Recognize the presentation of Campylobacter jejuni infection (eg, bloody stools without fever or diarrhea, or bloody diarrhea)
    d. Plan the treatment of a Campylobacter jejuni infection (effective drugs, ineffective drugs, alternative drugs)
    e. Recognize Campylobacter fetus septicemia in a newborn infant and in an immunocompromised host and plan treatment
    f. Recognize the association of Campylobacter with nonsuppurative disease (eg, Guillain-Barré syndrome, arthritis, erythema nodosum)
7. Capnocytophaga species
    a. Recognize clinical features of Capnocytophaga species (normally inhabit the mouth, associated with periodontal disease, cause septicemia in neutropenic hosts patients with cirrhosis, asplenia, or those receiving corticosteroids)
    b. Plan effective therapy for infection with Capnocytophaga species
8. Chlamydia trachomatis
    a. Know the epidemiology of Chlamydia trachomatis, including the major route of transmission, modes of acquisition, sites of colonization or infection, and prevalence of carriage according to age
    b. Know the diagnostic tests for Chlamydia trachomatis, including rapid diagnostic tests, and their reliability in evaluating specimens from different sites
    c. Recognize the clinical manifestations of Chlamydia trachomatis infection by age and site (conjunctivitis, pneumonia, urethritis, cervicitis, pelvic inflammatory disease, lymphogranuloma venereum)
    d. Plan antibiotic therapy for Chlamydia trachomatis infections
    e. Know the complications of untreated Chlamydia trachomatis infection
9. Chlamydia psittaci
    a. Know the major source and epidemiology of Chlamydia psittaci infections
    b. Plan the diagnosis of Chlamydia psittaci infection
    c. Recognize the clinical manifestations of psittacosis
    d. Plan therapy for a patient with psittacosis
10. Chlamydophila pneumoniae

a. Recognize the limitations of laboratory diagnosis of Chlamydophila pneumoniae infection
b. Know the clinical manifestations, (eg, relative frequency, epidemiology, differential diagnosis) of respiratory infection caused by Chlamydophila pneumoniae
c. Plan the antimicrobial therapy for Chlamydophila pneumoniae

11. Ehrlichia and Anaplasma species
    a. Recognize the clinical manifestations, epidemiology (vector), and laboratory characteristics of ehrlichiosis (lymphopenia, neutropenia, thrombocytopenia, liver dysfunction)
    b. Plan the diagnostic testing (serology) and treatment for ehrlichiosis or anaplasmosis
12. Francisella tularensis
    a. Understand the epidemiology and modes of transmission of tularemia (tick, respiratory droplet, animal contact)
    b. Recognize clinical manifestations of tularemia
    c. Formulate a differential diagnosis of granulomatous lymphadenitis with central necrosis, including cat scratch, tularemia, chlamydia
    d. Plan treatment for a patient with tularemia (effective drugs)
13. Haemophilus influenzae
    a. Understand the epidemiology of Haemophilus influenzae colonization and disease to include type b disease in immunized infants and children
    b. Understand that nontypeable Haemophilus influenzae is a significant pathogen in newborn infants and immunodeficient hosts and can cause invasive infection
    c. Plan the treatment of Haemophilus influenzae infections
    d. Recognize the clinical manifestations of Haemophilus influenzae as a cause of acute infection (otitis media, sinusitis, conjunctivitis, otitis conjunctivitis syndrome)
14. Haemophilus ducreyi
    a. Recognize that Haemophilus ducreyi is a sexually transmitted disease (chancroid) of increasing incidence
    b. Recognize the clinical manifestations of chancroid
    c. Plan an appropriate treatment regimen for a patient with chancroid
15. Helicobacter pylori
    a. Know the epidemiology and pathophysiology characteristic of Helicobacter pylori infection
    b. Distinguish the clinical situations in which Helicobacter pylori infection is a likely etiologic agent (eg, duodenal ulcer, peptic ulcer) or is associated (adenocarcinoma of the stomach, MALTOMA)
    c. Plan the management of Helicobacter pylori infection (effective drugs, combination therapy, duration)
16. Kingella kingae
    a. Recognize Kingella kingae as a causative pathogen in a suppurative skeletal infection, including diskitis, in an infant
    b. Plan the diagnosis of Kingella kingae infection
    c. Plan the most appropriate management for a patient with Kingella kingae infection

17. Legionella species
    a. Know the methods of diagnosis of Legionella infections
    b. Recognize the distinctive clinical manifestations, laboratory findings, and treatment for Legionella pneumonia
    c. Understand principles of prevention of Legionella infection (reservoir disinfection, prevention of aerosolization)
18. Rickettsia
    a. General
        1. Know the arthropod vectors and animal hosts that are critical factors in human Rickettsia infection
    b. Rickettsia rickettsii
        1. Recognize the clinical, epidemiologic, and laboratory features of Rocky Mountain spotted fever
        2. Formulate the differential diagnosis in a patient in whom Rocky Mountain spotted fever is suspected
        3. Plan the diagnostic evaluation for Rocky Mountain spotted fever
        4. Plan the management of a patient with Rocky Mountain spotted fever (fluid therapy, effective antibiotics)
    c. Other Rickettsia species
        1. Recognize the setting, vector, and clinical manifestations of Q fever (Coxiella burnetii)
        2. Plan appropriate diagnostic testing for a patient in whom Q fever is suspected
        3. Recognize the setting, vector, and clinical manifestations of rickettsial pox
        4. Plan appropriate diagnostic testing for a patient in whom rickettsial pox is suspected
        5. Recognize the setting, vector, and clinical manifestations of endemic typhus
        6. Plan appropriate diagnostic testing for a patient in whom endemic typhus is suspected
        7. Recognize the setting, vector, and clinical manifestations of epidemic typhus
        8. Plan appropriate diagnostic testing for a patient in whom epidemic typhus is suspected
        9. Plan appropriate therapy for a patient who has Q fever
19. Streptobacillus moniliformis
    a. Identify a patient with Streptobacillus moniliformis infection based on epidemiology, transmission, clinical manifestations, and laboratory findings
    b. Plan the management of a patient with Streptobacillus moniliformis infection
20. Actinobacillus species
    a. Recognize that aerobic isolation of Actinobacillus actinomycetemcomitans from lung, pleural fluid or chest wall abscess is a clue to anaerobic co-infection with Actinomyces

G. Mycoplasma and Ureaplasma species
1. Mycoplasma pneumoniae
    a. Know the epidemiology of Mycoplasma pneumoniae infection, including mode of transmission, ages of infection and disease, and incubation period
    b. Know the available diagnostic tests for Mycoplasma pneumoniae infection and their relative advantages and disadvantages

c. Recognize the characteristic clinical manifestations of respiratory and non-respiratory tract manifestations of Mycoplasma pneumoniae, including CNS illnesses, Stevens-Johnson syndrome, and arthritis
d. Plan the therapy for a patient with Mycoplasma pneumoniae infection

2. Ureaplasma urealyticum and Mycoplasma hominis
   a. Know the epidemiology of genital mycoplasmas in adults and newborn infants
   b. Know that special medium is necessary to recover Ureaplasma urealyticum and other genital mycoplasmas
   c. Recognize the possible manifestations of Ureaplasma urealyticum disease and Mycoplasma hominis in newborn infants and immune compromised patients
   d. Recognize the possible association of Ureaplasma urealyticum and M. hominis with genitourinary tract infections, urethritis, and reproductive morbidity
   e. Plan the management of a patient with Ureaplasma urealyticum and Mycoplasma hominis infections

H. Anaerobic bacteria
1. General concepts
   a. Recognize that anaerobic bacteria are predominantly normal bacterial flora of mucous membranes from the oropharynx to the rectum
   b. Interpret the significance of isolation of anaerobic bacteria from various culture specimens (eg, blood, skin, CSF, wound, tracheal aspirate)
   c. Recognize that isolation of facultative normal flora from infection contiguous to a mucosal site predicts the presence of anaerobic bacteria as well
   d. Interpret Gram stain showing multiple organism types from pleural empyema, or lung, pelvic, or abdominal abscess
   e. Recognize the association of a positive blood culture for Bacteroides fragilis with a primary gastrointestinal tract focus of infection
   f. Know the impact of specimen collection, transport, and inoculation techniques on recovery of anaerobic bacteria
   g. Know the clinical situations in which anaerobic infection is virtually always present (abscess following human bite, lung abscess in patient with swallowing dysfunction, periappendiceal abscess, recurrent pelvic inflammatory disease)
   h. Know that anaerobic cocci are generally susceptible to penicillins, cephalosporins, clindamycin and vancomycin, but are sometimes highly resistant to metronidazole
   i. Plan the treatment of a patient with suspected anaerobic infection according to clinical site, including the recognition of antibiotic resistance (eg, metronidazole, clindamycin)
2. Clostridium tetani
   a. Recognize the clinical manifestations of Clostridium tetani wound infection and tetanus and formulate the differential diagnosis of a patient with possible tetanus (dental abscess, rabies, hypocalcemic tetany, and extrapyramidal effects of antipsychotic drugs
   b. Know that the diagnosis of tetanus is clinical
   c. Plan the management of a patient with tetanus (effective antimicrobial, immune globulin, or antitoxin, benzodiazepines)
   d. Know the risk factors for tetanus prone injuries (crush injury, soil contamination), and manage tetanus-prone injuries appropriately

e. Understand the pathogenesis of tetanus

3. Clostridium botulinum
   a. Know that Clostridium species other than botulinum are occasional causes of botulism
   b. Know the different pathogeneses for food-borne, wound, and infant botulism
   c. Know the epidemiologic and clinical features of food-borne, wound, and infant botulism (age, exposure, clinical onset)
   d. Recognize the clinical manifestations of infant botulism (progressive descending weakness, autonomic dysfunction)
   e. Plan laboratory tests necessary to diagnose botulism (isolation, mouse-lethality test)
   f. Know how management differs for a patient with food borne botulism (antitoxin), wound botulism (effective antibiotic, antitoxin), or infant botulism (botulism immune globulin and supportive measures)
4. Other Clostridium species
   a. Recognize clinical manifestations of soft tissue infection caused by Clostridium species
   b. Recognize clinical manifestations of Clostridium septicum septicemia in neutropenic patients (gut focus, fulminant course, disseminated crepitus)
   c. Recognize relative frequency, epidemiology (source, incubation), clinical manifestations, and course of Clostridium perfringens food poisoning
   d. Know the diagnostic methods for Clostridium perfringens food poisoning (serology, enterotoxin stool assay, quantitative culture of food sources and stool)
   e. Understand the prevention and management of gas gangrene and other soft tissue infection caused by Clostridium species
5. Clostridium difficile
   a. Understand the means of diagnosing Clostridium difficile colitis (cytoxin detection, antigen detection, culture)
   b. Know the risk factors for and typical clinical settings of Clostridium difficile disease (higher and lower-risk antibiotic use, age, underlying gastrointestinal disease, hospitalization, community-acquired infection)
   c. Recognize the manifestations of Clostridium difficile colitis
   d. Plan the management of a patient with Clostridium difficile disease (discontinuing antibiotic, drugs of choice, alternative drugs) and of a patient with relapsed Clostridium difficile colitis
   e. Know that Clostridium difficile frequently colonizes in neonates and infants and toxin may be present in the stool without associated disease in this age group
   f. Know the infection control measures used to prevent Clostridium difficile disease and to manage an outbreak
6. Bacteroides species
   a. Know the microbiology and normal habitat of species of Bacteroides
   b. Recognize the association between Bacteroides fragilis and abscess formation and phlebothrombosis
   c. Know the in vitro antimicrobial susceptibilities of Bacteroides fragilis
7. Other anaerobic gram-negative bacilli

a. Know that Fusobacterium species are normal inhabitants of the oropharynx, respiratory tract, female genital tract
b. Recognize the association of Fusobacterium with Ludwig angina, suppurative phlebothrombosis of the great vessels in the neck, and secondary septic pulmonary emboli
c. Know the clinical setting and in vitro antimicrobial susceptibilities of Prevotella (Bacteroides) melaninogenicus

8. Actinomyces species
   a. Know the source of Actinomyces and predisposing factors for actinomycoses
   b. Know the transport and culture requirements to isolate Actinomyces in the laboratory
   c. Recognize clinical manifestations of Actinomyces infection (eg, pulmonary lesion, osteomyelitis of rib, soft tissue abscess)
   d. Plan the antimicrobial therapy for a patient with actinomycosis (drug and duration of therapy)

I. Spirochetes
1. Treponema/Leptospira species
   a. Know the modes of transmission of Treponema pallidum, including genital and oral sexual contact, placental, transfusion, accidental direct inoculation, and recognize the most contagious syphilitic lesions (early chancre, mucous patch, condyloma, papulosquamous lesions
   b. Know the natural history (timing), clinical manifestations, and contagiousness according to the stages of syphilis
   c. Plan and interpret diagnostic tests for syphilis in different clinical settings (chancre, asymptomatic contact, secondary, CNS, congenital), including probable false-positive reagin tests for syphilis in given clinical situations (eg, Lyme disease or tuberculosis, low titer only)
   d. Understand the principles of antimicrobial therapy (prolonged course, CNS concentrations) for syphilis
   e. Know that the transmission rate for untreated syphilis to the fetus in any trimester of pregnancy is high, and is greater than 90% in the third trimester
   f. Plan the diagnostic evaluation and treatment for a neonate whose mother has a positive syphilis serology, depending on the clinical scenario
   g. Interpret serologic tests in follow-up evaluation of a patient treated for syphilis (expectation of fall in reagin, unchanging specific treponemal test, indications for retreatment)
   h. Recognize the clinical manifestations suggestive of leptospirosis
   i. Recognize the clinical manifestations of congenital syphilis in infants who are beyond the neonatal period
   j. Know what maternal treatments for spirochetal infection during pregnancy are likely to be effective/ineffective for treating the fetus
   k. Know the modes of acquisition and epidemiology of leptospirosis
2. Borrelia species
   a. Recognize the clinical setting and laboratory features suggestive of relapsing fever (Borrelia recurrentis, Borrelia hermsii)

b. Know the risk factors (vectors, reservoirs, geography) for Borrelia burgdorferi infection
c. Recognize presentations of Lyme disease, especially arthritis, dysrhythmia, neuropathy, and meningitis
d. Know the low risk of fetal disease due to B. burgdorferi infection
e. Plan therapy for a patient with Lyme disease (effective/ineffective drugs, route, duration)
f. Understand the means of diagnosis of Borrelia burgdorferi infection, the limitations, including the likelihood of negative serologic results in early infection, false-positive results in areas of low endemicity, and in patients with certain conditions (eg, arthritis)
g. Order appropriate diagnostic tests (eg, serologic) on CSF in a patient with suspected Borrelia burgdorferi infection of the central nervous system, and interpret the results

3. Southern tick-associated rash illness (STARI)
   a. Recognize the clinical manifestations of Southern tick-associated rash illness (STARI)

J. Viruses
1. Poxvirus
   a. Molluscum contagiosum
      1. Know means and source of spread of Molluscum contagiosum
      2. Recognize the clinical manifestations of Molluscum contagiosum, including the usual course of the lesions in normal and immunocompromised hosts
   b. Smallpox (variola)
      1. Know the classification of smallpox (variola) and the differences among clinical manifestations (variola major, modified variola, hemorrhagic variola, variola sine eruptione, variola minor)
      2. Recognize the complications of severe smallpox (variola) (panophthalitis, encephalitis, pneumonitis) and the risk in immune compromised hosts and those with eczema
      3. Plan the diagnostic approach to a child or adolescent with suspected smallpox (variola), and manage appropriately
      4. Know the potential antiviral therapies for smallpox
   c. Monkeypox
      1. Recognize the usual clinical features of monkeypox infection
2. Herpes simplex virus
   a. Know that most mothers and fathers of neonates with neonatal herpes are asymptomatic or have unrecognized genital herpes
   b. Plan the management of the neonate born vaginally to a mother discovered post delivery to have a positive genital culture for herpes simplex virus or to have vesiculoulcerative genital lesions
   c. Know the advantages and disadvantages of the major methods used for laboratory diagnosis of herpes simplex virus infections (culture, antigen and nucleic acid detection, antibody titers), including the limitations of noninvasive laboratory diagnosis of herpes encephalitis

d. Recognize the major diseases associated with herpes simplex virus type 1 and type 2, including gingivostomatitis and recurrent herpes labialis, genital ulcer disease, dermatologic manifestations keratitis, encephalitis, neonatal disease
e. Understand the clinical significance of acyclovir resistance of herpes simplex virus (immunosuppressed patient treated with several courses of acyclovir, thymidine kinase-deficient virus)
f. Know the pathogenesis of and predisposing factors to recurrent herpes disease, including the importance of latency, the relative role of cellular and humoral immunity, and factors that predispose to reactivation
g. Plan appropriate management of herpes simplex virus infections, including keratitis, gingivostomatitis, recurrent herpes labialis in a normal host and in an immunocompromised patient, herpes encephalitis, neonatal herpes, and recurrent genital disease during pregnancy
h. Recognize the clinical and neurodiagnostic (EEG, brain scan, CT scan or MRI of the head) manifestations of herpes encephalitis and formulate the differential diagnosis in a patient with fever, alteration of consciousness, and a focal seizure
i. Know the neurologic sequelae of herpes encephalitis including the risk factors that are associated with a poor prognosis
j. Identify the clinical and laboratory manifestations of neonatal herpes, including relative frequency of findings, (eg, rash), and formulate the differential diagnosis in a neonate suspected of having disseminated herpes simplex infection
k. Know the risk factors for poor outcome in neonatal herpes (prematurity, disseminated disease, HSV-2 encephalitis, recurrent HSV-2 skin lesions)

3. Varicella zoster virus
   a. Know the incubation period of varicella, including the incubation period in individuals who have received immunoglobulin prophylaxis, and its application to infection control management in the hospital
   b. Know the risk factors for severe varicella (neonates, immunosuppressed patients, adults, pregnancy)
   c. Recognize the clinical presentation of typical varicella and formulate the differential diagnosis in a school age child with fever and a vesicular rash of the trunk or abdomen
   d. Know the major complications of severe varicella including hepatitis, pneumonitis, encephalitis, DIC, secondary bacterial infection (streptococcal impetigo/cellulitis/gangrene, necrotizing fasciitis staphylococcal scalded skin syndrome), and congenital infection
   e. Understand the indications for antiviral therapy, including timing, and route, in a patient with severe varicella
   f. Plan the management of an exposed patient at high risk of severe varicella (timing for administration of immune globulin, indications for acyclovir)
   g. Know the circumstances that contribute to herpes zoster occurring in children (third-trimester fetal varicella, postnatal varicella in neonate or young infant)
   h. Understand the immunity to varicella-zoster virus, and that boosting of immunity may occur after exposure to infected individuals
4. Cytomegalovirus
   a. General

1. Recognize blood transfusion as a means of transmission of CMV to a very low birth weight infant, and the means of prevention

b. Clinical manifestations and predisposing factors
    1. Know the time frame in which urine is an acceptable specimen to diagnose congenital cytomegalovirus infection (within the first 10 days to 3 weeks after birth)
    2. Recognize that congenital cytomegalovirus infection is usually asymptomatic (approximately 90%) in the neonatal period but that hearing loss, low IQ, or behavioral problems may subsequently occur in 10% to 30% of asymptomatically infected patients
    3. Recognize the usual clinical manifestations when symptomatic cytomegalovirus infection occurs in normal hosts and the usual clinical manifestations and complications of cytomegalovirus infections in immunosuppressed hosts
    4. Know the risk factors for cytomegalovirus infection in transplant recipients (relationship to organ, donor, and recipient status)
c. Diagnostic tests
    1. Know the optimal specimens for isolation of infectious virus to demonstrate cytomegalovirus disease (as opposed to asymptomatic shedding) in patients beyond the neonatal period (eg, peripheral blood leukocytes, BAL, tissue)
    2. Understand the means to diagnose cytomegalovirus infection (serology, viral culture, antigen detection, nucleic acid detection)
    3. Know that cytomegalovirus IgM antibody titer results may be false positive (eg, presence of rheumatoid factor), false-negative (eg, immunologically immature or immunosuppressed patients), or associated with re-activation
    4. Know the optimal specimens for isolation of infectious virus to demonstrate cytomegalovirus disease (as opposed to asymptomatic shedding) in patients beyond the neonatal period
d. Epidemiology
    1. Know the major routes or means of transmission of cytomegalovirus: congenital (transplacental), natal (at time of delivery), breastfeeding, infected urine or saliva to mouth, sexual, blood transfusion, organ transplantation
    2. Recognize the relative frequencies of the clinical features and major sequelae of symptomatic congenital cytomegalovirus infection in the neonatal period and the major sequelae of symptomatic congenital infection and their relative frequencies
    3. Know that congenital cytomegalovirus infection occurs in both primary maternal infections (nonimmune mothers) and recurrent ones (immune mothers), but that severe fetal damage occurs most often with primary infections
e. Treatment
    1. Plan the treatment of serious cytomegalovirus infection in immunosuppressed patients, including specific therapy for target organs (eg, ganciclovir alone for retinitis and colitis, ganciclovir plus cytomegalovirus immune globulin for pneumonitis)

2. Understand the goals, timing, and efficacy of prophylactic therapy for cytomegalovirus infection in transplant recipients, including preemptive therapy that can be planned and followed by using plasma PCR for CMV copy number
3. Understand the role of antiviral therapy in an infant with congenital cytomegalovirus infection

5. Epstein-Barr virus
   a. Clinical manifestations and predisposing factors
      1. Know that Epstein-Barr virus infections in infants and toddlers are usually asymptomatic and in school age children and young adults are more frequently symptomatic (classic infectious mononucleosis)
      2. Formulate a differential diagnosis in a school-age child with fever, pharyngitis, cervical adenopathy, and negative rapid streptococcal antigen test
      3. Know the major acute complications of infectious mononucleosis
      4. Know the malignancies associated with Epstein-Barr virus infection
      5. Know the underlying diseases associated with a high risk of either acute or long-term complications of Epstein-Barr virus infection (X- linked lymphoproliferative syndrome, hemophagocytic syndrome, AIDS, transplant recipients)
      6. Recognize the association between Epstein-Barr virus and hairy leukoplakia in AIDS patients, and that it may respond to therapy with acyclovir
      7. Recognize lymphoproliferative syndrome caused by Epstein-Barr virus following transplantation, and manage appropriately (eg, reduction of immunosuppressive therapy)
      8. Recognize the association between Epstein-Barr virus and lymphocytic interstitial pneumonitis (LIP) in patients with AIDS, and manage appropriately
   b. Etiology
      1. Know that Epstein Barr virus replicates in and becomes latent in B lymphocytes in vivo, and "immortalizes" B lymphocytes in vitro
   c. Epidemiology
      1. Recognize the association between group A streptococcus and Epstein-Barr virus
   d. Diagnostic tests
      1. Understand the basis for and interpret results of the rapid slide agglutination (Monospot) tests and Epstein-Barr virus serologic tests (viral capsid antigen [VCA], early antigen [EA], and Epstein-Barr nuclear antigen [EBNA]) according to manifestations and clinical course
   e. Treatment
      1. Recognize the association of rashes with ampicillin in infectious Mononucleosis
      2. Manage a patient with complications of acute infectious mononucleosis, including appropriate use of corticosteroid therapy
      3. Know the indications for and outcomes of antiviral therapy for EBV infections
6. Human herpesviruses (HHV-6, -7, -8)
   a. Be familiar with the epidemiology of HHV-6 infection, including the age of acquisition

b. Recognize the clinical manifestations including roseola of HHV-6 infection in normal and immunocompromised hosts, the usual course of primary infection, and complications
c. Recognize the potential of HHV-6 for persistent and latent infections and the clinical situation in which HHV-6 may be reactivated (eg, immunosuppression, AIDS, other herpes infections)
d. Understand the epidemiologic features of HHV-7 infection and know that infections occur later in life than with HHV-6
e. Recognize the epidemiologic and clinical features of HHV 8 infection, including its association with Kaposi sarcoma
f. Understand the role and limitations of PCR testing of plasma and CSF for HHV-6 infection
g. Recognize the clinical manifestations of HHV-7 infection are primarily mild or asymptomatic, but may include roseola

7. Adenoviruses
   a. Know the major clinical syndromes associated with adenoviruses (eg, conjunctivitis, pharyngitis, pneumonia, undifferentiated febrile illness, meningoencephalitis, gastroenteritis)
   b. Differentiate between the methods of laboratory diagnosis for respiratory adenovirus infection and enteric adenovirus infection
   c. Know that adenoviruses can cause severe disease in neonates and in immunosuppressed patients
   d. Know that enteric adenovirus types 40 and 41 are important causes of pediatric gastroenteritis
   e. Know that adenoviruses remain latent, confounding interpretation of isolation in certain circumstances
   f. Understand the role of adenoviruses in acute rejection-like syndromes following cardiac transplantation
8. Papillomaviruses (warts, laryngeal papillomatosis)
   a. Recognize the clinical manifestations of papillomavirus infection according to source (eg, common warts, anogenital warts, laryngeal papillomas) and mode of transmission (eg, sexual, maternal, newborn)
   b. Understand the usual course of HPV disease and subclinical infection and disease
   c. Know the methods of diagnosis of clinical and subclinical HPV infections
   d. Recognize the epidemiologic associations between anogenital warts and the risk of malignancy
   e. Understand the indications for and types of treatment of HPV infection
9. JC/BK and other polyomaviruses
   a. Understand the ability of polyomaviruses to cause latent and chronic infections and the association between polyomaviruses and progressive multifocal leukoencephalopathy
   b. Understand the mode of transmission of polyomaviruses
   c. Recognize the clinical manifestations of JC/BK viruses causing urinary tract disease in normal hosts and in renal transplant recipients
   d. Recognize that treatment of renal disease caused by BK virus infection in transplant patients is based on reduction of immunosuppressive therapy

10. Hepatitis A virus
    a. Clinical manifestations and predisposing factors
        1. Recognize the clinical characteristics and course of the hepatitis A virus infection (usually asymptomatic in children, rarely causes acute fulminant hepatitis, does not cause chronic hepatitis, and is not associated with carrier state)
    b. Epidemiology
        1. Know the usual means of transmission of hepatitis A virus
        2. Recognize child-care center contact as the probable source of hepatitis A when jaundice develops in an adult contact
        3. Be familiar with the epidemiologic impact of universal immunization with hepatitis A vaccine at 12 months of age and the incidence of hepatitis A infections in the United States in a child-care setting
    c. Diagnostic tests
        1. Know the laboratory methods used to establish a diagnosis of hepatitis A virus infection
        2. Manage an outbreak of hepatitis A infection in food workers or in a dormitory/barracks setting
        3. Know how to manage an outbreak of hepatitis A infection in a child-care center
11. Hepatitis B virus
    a. Clinical manifestations and predisposing factors
        1. Know that etiology of hepatitis can rarely be determined by clinical features
        2. Recognize the clinical manifestation associated with hepatitis B infection
    b. Epidemiology
        1. Know that hepatitis B virus is a major cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma worldwide
        2. Know the major sources and/or means of transmission of hepatitis B virus
        3. Identify the high risk groups for acquiring hepatitis B virus infection
        4. Know the risk factors for acute fulminant hepatitis B (eg, immunosuppressed patients, genetics of the virus, presence of delta virus)
        5. Know the risk factors for developing chronic hepatitis B (neonate born to antigen positive chronic carrier mother, elderly patient, repeated exposures (eg, IV drug addict) and immunosuppressed patient)
        6. Plan preventive measures for hepatitis B virus infection (infection control measures for blood-borne pathogens, blood donor screening, hepatitis B immune globulin, hepatitis B vaccine)
        7. Know the rationale for universal screening of pregnant women for HBsAg
    c. Diagnostic tests
        1. Interpret the molecular and serologic laboratory test results for hepatitis B (antigens, antibodies, nucleic acid detection) in the determination of immunity, acute disease, chronic disease, immunization, and response to antiviral therapy
        2. Plan the histiologic and serologic evaluation of chronic active hepatitis B
    d. Treatment
        1. Plan the management of a newborn infant or child with a known exposure to hepatitis B (ie, birth from an HBV carrier mother, needlestick exposure)
12. Hepatitis C virus and others

a. Clinical manifestations and predisposing factors
    1. Know that the majority of acute hepatitis C virus infections are mild, subclinical, or persistent, and that the major complication is chronic hepatitis
b. Etiology
    1. Know that hepatitis C virus is a flavivirus
c. Epidemiology
    1. Know the risk factors that predispose to the development of hepatitis C virus infection, and that approximately 1/3 of patients with hepatitis C virus antibody have no known source or risk factor for acquisition
    2. Know the most common cause of post-transfusion hepatitis in the US
    3. Recognize the association of hepatitis C virus with cirrhosis and hepatocellular carcinoma
    4. Understand the risk of mother child transmission of hepatitis C, with high risk (30%) in a mother with HIV co-infection, and low risk (about 5% in a mother with no HIV co-infection)
    5. Know that breastfeeding has not been associated with transmission of hepatitis C virus from a non-HIV co-infected mother to her infant
d. Diagnostic test
    1. Understand the methods (and their limitations) for diagnosis of hepatitis C virus infection, including ELISA, recombinant immunoblot assay (RIBA), and PCR
    2. Know that there may be a considerable delay (weeks to months) in the antibody response to hepatitis C virus infection
    3. Know that hepatitis C virus infection followed by clinical recovery may result in an initial antibody response, followed by loss of detectable antibody despite persistence of infectious virus
    4. Understand the utility of the hepatitis C viral load in the management of hepatitis C infection
e. Treatment
    1. Plan the treatment of chronic hepatitis C virus
    2. Recognize the clinical manifestations of enterically transmitted hepatitis E virus
    3. Recognize the epidemiology and lack of clinical manifestations of hepatitis G infection (hepatitis GB virus C)
    4. Understand the utility of genotyping in hepatitis C infection
    5. Recognize the epidemiology of enterically transmitted hepatitis E virus

13. Hepatitis delta virus
    a. Know that hepatitis delta virus uses HBsAg as its surface coat protein and requires current acute or chronic infection with hepatitis B virus
    b. Know the usual routes or mode of transmission of hepatitis delta virus infection
    c. Identify groups at high risk for hepatitis delta virus infection
    d. Understand how to use laboratory markers available for diagnosis of hepatitis delta virus infection (HDag, anti-HD IgG, anti-HD IgM)
    e. Know the preventive measures available for hepatitis delta virus infection (infection control, blood donor screening, hepatitis B vaccine)
14. Parvoviruses
    a. Know the epidemiology of parvovirus B19, including the age of acquisition, source, and means of transmission of parvovirus

b. Understand the pathogenesis of parvovirus infection, including the site and type of cell infected
c. Recognize the clinical manifestations of parvovirus in normal and in special hosts, including pregnant women, fetus, immunocompromised patients, and patients with hemoglobinopathies
d. Understand the potential complications and likelihood of complications of parvovirus infections according to host (eg, normal, with underlying disease, pregnant, fetus)
e. Know the special situations in which immune globulin treatment of parvovirus infection may be considered, including the type of treatment
f. Plan appropriate infection control procedures for hospitalized patients who have parvovirus infection, and for which patients infection control procedures for parvovirus should be instituted
g. Recognize clinical and contagious aspects of acute parvovirus infection (fifth disease) in normal hosts
h. Order appropriate diagnostic tests for parvovirus infection, with consideration of their limitations

15. Coltivirus (Colorado tick fever)
    a. Know that Colorado tick fever virus is a reovirus transmitted by Dermacentor andersoni
    b. Recognize that the clinical features of Colorado tick fever infection are nonspecific flu-like symptoms but that certain features suggest the diagnosis: tick exposure, biphasic clinical illness, neutropenia
    c. Know that laboratory diagnosis of Colorado tick fever is based on documentation of an antibody titer increase or based on PCR
    d. Identify the epidemiologic features of Colorado tick fever
16. Rotavirus
    a. Recognize the epidemiologic features of rotavirus infection, including geographical and seasonal patterns, attack rates by age
    b. Know the source and mode of transmission of spread of rotavirus infection
    c. Plan appropriate infection control procedures for rotavirus, incorporating knowledge of period of virus shedding
    d. Understand differences in the clinical manifestations of rotavirus infection according to age (eg, primary versus recurrent infection)
    e. Understand differences in clinical manifestations and complications of rotavirus infection between normal hosts and those with underlying diseases who are at risk for complicated or severe disease
    f. Know the usual course of rotavirus infection, both clinical and virologic (shedding) in normal and compromised hosts
    g. Appreciate the sensitivity and specificity of currently available diagnostic tests of rotavirus
17. Alphaviruses, flaviviruses, bunyaviruses
    a. Know the major viruses associated with arbovirus encephalitis in the United States: St. Louis encephalitis, California encephalitis, Western equine encephalitis, Eastern equine encephalitis, West Nile virus

b. Know the geographic variations in the United States in occurrence and vector for the major arboviruses causing encephalitis
c. Identify the characteristic clinical and laboratory features of arbovirus encephalitis, including fever, alteration of consciousness, nonfocal seizures, CSF pleocytosis
d. Order appropriate diagnostic tests to confirm the etiology of arbovirus encephalitis
e. Recognize characteristics of infection caused by hantavirus (eg, geographic distribution, vector, clinical manifestations)
f. Plan appropriate management of hantavirus infection
g. Recognize the characteristics of dengue virus infection (eg, geographic distribution, vector, clinical manifestations)
h. Recognize the epidemiology and clinical and laboratory diagnosis of West Nile virus infection

18. Rubella
    a. Know the epidemiology of rubella infection in vaccinated and unvaccinated populations, and understand the role of universal immunization of children to prevent susceptibility to rubella virus in young women during pregnancy
    b. Understand the means of transmission (acquired and congenital) and the relative contagiousness of rubella
    c. Understand the mechanisms of immunity to rubella, including the completeness and duration in acquired and congenital infections
    d. Recognize the clinical manifestations and course of acquired rubella infection, including the differences according to age (eg, increased frequency of arthritis with age)
    e. Understand the pathogenesis and manifestations of congenital rubella, including gestational age at the time of infection, affected anatomic sites, and shedding of the virus
    f. Understand the clinical course and the types and frequency of sequelae in infants with congenital rubella
    g. Know the methods of diagnosis for rubella infection, including acute, past, and congenital infections
19. Human coronaviruses
    a. Understand the relative importance of human coronavirus infection in causing respiratory and enteric illnesses in various age groups and seasons
    b. Recognize the clinical manifestations associated with the respiratory and enteric coronavirus infections
    c. Know the epidemiology of human coronavirus infection, those circumstances in which outbreaks have occurred (eg, neonatal, SARS), and the infection control procedures required
    d. Understand the diagnosis of various coronavirus infections (eg, culture, serology, EM)
20. Parainfluenza viruses
    a. Understand the epidemiology of parainfluenza viruses, type 1-4, including transmission, incidence by age, geographical and seasonal patterns
    b. Appreciate the clinical manifestations of the parainfluenza viruses according to age and the relative importance of parainfluenza virus in causing the different types of respiratory illness (croup, pneumonia, bronchiolitis, URI)

c. Recognize the differences in clinical manifestations of parainfluenza infections between normal hosts and those with underlying disease or compromising conditions
d. Understand the mechanisms of immunity to parainfluenza infection, including the completeness and duration of immunity, and role of serotype
e. Plan appropriate infection control procedures for parainfluenza viruses and when to implement these procedures
f. Appreciate the sensitivity and specificity of currently available diagnostic tests for parainfluenza infection

21. Mumps virus
    a. Know the epidemiology of mumps in vaccinated, partially vaccinated, and unvaccinated populations
    b. Understand the mode and sources of transmission and the appropriate infection control procedures for mumps and when to implement these procedures
    c. Recognize the clinical and pathologic manifestations of mumps, including the relative frequency and manifestations according to organ system and age
    d. Know the course, complications, and prognosis of clinical and subclinical mumps by organ, including testes, ear, CNS, pancreas, and ovaries
    e. Appreciate the sensitivity and specificity of the currently available diagnostic tests for mumps
22. Respiratory syncytial virus
    a. Clinical manifestations and predisposing factors
        1. Identify the clinical manifestations and course of primary and recurrent respiratory syncytial virus infection according to age and underlying disease (eg, immunosuppressed host)
    b. Etiology
        1. Understand the pathogenesis of respiratory syncytial virus illness according to age and type of host, including the incubation period, the anatomic and cellular sites of infection, the pathology and shedding
        2. Recognize the incompleteness and short duration of immunity to respiratory syncytial virus
        3. Recognize the role of different components of the immune system in response to respiratory syncytial virus infection
        4. Recognize the possible association of respiratory syncytial virus infection in the development of asthma
    c. Epidemiology
        1. Appreciate the epidemiology of respiratory syncytial virus, including the geographic, seasonal, and strain patterns
        2. Appreciate the relative importance of respiratory syncytial virus in causing various types of respiratory illness according to age in ambulatory and hospitalized patients
        3. Understand the contagiousness, source, and means of transmission of respiratory syncytial virus
    d. Diagnostic tests
        1. Appreciate the relative sensitivity and specificity of the currently available diagnostic tests for respiratory syncytial virus

e. Treatment
    1. Appreciate the importance of respiratory syncytial virus as a nosocomial agent, situations conducive to the occurrence of nosocomial infections, and appropriate infection control procedures
    2. Know the efficacy and indications for use of inhaled ribavirin for treatment of respiratory syncytial virus infection and the lack of a proven role for corticosteroids
    3. Plan appropriate prophylaxis for respiratory syncytial virus infection with RSV monoclonal antibody on a risk-based assessment for infants
    4. Plan the appropriate timeframe for seasonal prophylaxis with palivizumab for respiratory syncytial virus based on local or regional virus activity if available, rather than by month of the year

23. Human metapneumovirus
    a. Recognize the clinical and epidemiologic features of human metapneumovirus infection
24. Rubeola (measles)
    a. Recognize the clinical and epidemiologic characteristics of outbreaks of measles in different populations, such as vaccinated, unvaccinated, preschool, and school populations
    b. Understand the contagiousness, the methods and source of transmission of measles, and appropriate infection control procedures for inpatient and outpatient facilities when measles is diagnosed
    c. Understand the completeness and duration of immunity to measles after natural infection and after immunization
    d. Recognize the clinical manifestations of measles, including modified and vaccine-associated measles
    e. Appreciate the sensitivity and specificity of the currently available tests for diagnosis of measles and for determining immune status
    f. Know the means of prevention of measles in exposed and unexposed, susceptible patients, including the appropriate measures for control of a rubeola outbreak
    g. Understand the relationship of measles infection and immunization to the incidence and epidemiologic patterns of subacute sclerosing panencephalitis
    h. Recognize the clinical manifestations and course of subacute sclerosing panencephalitis
25. Rabies virus
    a. Know the usual animal reservoirs for rabies in the US
    b. Know the methods by which nonbite exposure to rabies can occur: aerosol in bat infested cave and in laboratory, corneal transplant, and know the importance of bat exposure in dwelling of sleeping child or incapacitated individual
    c. Know the usual incubation period for rabies, including the short and long ends of the curve, and the factors that can influence the incubation period
    d. Recognize the clinical features of rabies
    e. Formulate a differential diagnosis in a patient in whom rabies is suspected
    f. Know the means to establish a laboratory diagnosis of rabies: detection of viral antigen in tissues, demonstration of antibody in serum or CSF, isolation of virus, or detection of viral nucleic acid from saliva

26. Influenza
    a. Understand the antigenic variations of influenza viruses and the relation to the epidemiology and the development of immunity, including the role of hemagglutinin and neuraminidase
    b. Differentiate the clinical manifestations of influenza in patients according to age, severity, and underlying disease
    c. Understand the sources and modes of spread of the influenza viruses, including appropriate infection control procedures for influenza viruses (droplet, contact, airborne) and when they are indicated
    d. Judge the relative value and accuracy of the currently available tests for the diagnosis of influenza virus infection
    e. Know the treatment modalities for influenza infection when indicated and impact of drug resistance on therapy
    f. Know the appropriate means of prevention and control of influenza infection for high-risk individuals, for outbreaks, and nosocomial infections
    g. Understand the unique epidemiology, virulence, and clinical features of pandemic or emerging strains of influenza A
27. Retroviruses (HTLV-1,-2 but not HIV; see IX.G)
    a. Identify the unique epidemiologic features of HTLV-1 infection, including risk factors for acquisition
    b. Recognize the clinical syndrome associated with HTLV-1 infection
    c. Identify the unique epidemiologic features of HTLV-2 infection, including risk factors for acquisitions
    d. Recognize the clinical syndrome associated with HTLV-2 infection
28. Poliovirus
    a. Understand the epidemiology and geographic occurrence of poliovirus infection and disease in vaccinated and unvaccinated populations, including the current epidemiology, cause, and incidence of paralytic polio in the United States
    b. Understand the source and means of transmission of wild polio and vaccine poliovirus, including the duration of shedding, and the appropriate infection control procedures
    c. Understand the principles of prevention and control of wild poliovirus in vaccinated and unvaccinated populations
    d. Understand the pathogenesis and clinical manifestations of wild and vaccine poliovirus infections according to host factors, such as age and immunocompetence
    e. Understand the major components of immunity of poliovirus, including duration of immunity and role of serotype
    f. Understand the methods of diagnosis of wild and vaccine poliovirus infection
29. Enteroviruses (other than polio)
    a. Recognize the epidemiologic features of nonpolio enteroviruses, including the geographic and seasonal patterns
    b. Know the relative importance of the enteroviruses as a cause of the various syndromes according to age (eg, aseptic meningitis, pharyngitis, sepsis-like picture in neonates, exanthems)

c. Recognize the pathogenetic, virologic, and clinical manifestations and course of nonpolio enteroviruses according to age (including the newborn) and other host factors
d. Understand the major mechanisms of immunity to nonpolio enteroviruses, including duration of immunity and role of serotype
e. Recognize the distinctive syndromes caused by enterovirus infection (eg, pleurodynia, hand-foot-mouth, herpangina)
f. Know the usefulness of the available laboratory tests for the diagnosis of enteroviral infection (culture, PCR), understand the diagnostic limitations of finding the virus in stool (prolonged stool virus shedding), and that asymptomatic infections are common
g. Plan the management of nonpolio enteroviral infections
h. Recognize the association of enterovirus 71 with encephalitis and a shock-like syndrome

30. Rhinovirus
    a. Know the epidemiology of rhinoviruses and the relative importance of rhinoviruses in causing the various types of respiratory illness according to age and the role of rhinoviruses in precipitating asthma exacerbations
    b. Understand the major mechanisms of immunity of rhinoviruses, including the completeness, duration, and role of serotype
    c. Understand the modes of transmission and the pathogenesis of rhinoviral infections
31. Caliciviruses
    a. Understand the epidemiology of calicivirus infections, including age-related factors and prevalence
    b. Evaluate the relative importance of calicivirus in causing gastroenteritis and outbreaks of gastroenteritis in various age groups
    c. Understand the immunologic relationships in classification of calicivirus and Norwalk agents
32. Astroviruses
    a. Know the types of illness and clinical manifestations associated with astrovirus infection, including the relative importance of astrovirus in causing gastroenteritis and outbreaks of gastroenteritis in various age groups
    b. Understand the available methods for diagnosis of astrovirus infection
33. Norovirus
    a. Appreciate the epidemiology, incidence, and prevalence of infection with Norovirus according to age, relative importance in various age groups, open and closed populations, food- and water-borne outbreaks
    b. Know the sources and various modes of transmission of Norovirus (person-to-person, food- and water-borne)
    c. Understand the pathogenesis, incubation period, clinical manifestations, and course of Norovirus in sporadic cases and in outbreaks
    d. Plan prevention and control of outbreaks of infection with Norovirus agent and related agents of gastroenteritis
34. Prions
    a. Know that prions are the likely etiologic agents of Creutzfeldt-Jakob disease, bovine spongiform encephalopathy, and kuru in humans

b. Recognize the epidemiologic and clinical features and risk factors for nonfamilial spongiform encephalopathies

35. Filoviridae and Arenaviridae
    a. Know the epidemiology and modes of transmission of Ebola and Marburg virus infections
    b. Know the epidemiology (eg, role of rodent exposure) and modes of transmission of lymphocytic choriomeningitis virus infection
    c. Recognize the clinical manifestations and cerebrospinal fluid findings suggestive of lymphocytic choriomeningitis virus infection
    d. Plan appropriate laboratory evaluation for the diagnosis of lymphocytic choriomeningitis virus infection (eg, serology)
    e. Plan appropriate management of Lassa fever virus infection (eg, ribavirin)

K. Fungi
1. General
    a. Recognize that major embolic events are likely to be caused by fungemia in a patient with predisposing condition(s)
    b. Identify the characteristics of pathogenic fungi that are classified as yeast-like and as molds
    c. Know when susceptibility testing of fungal isolates is important
    d. Predict usual in vitro antifungal susceptibility by class, genus, and species
2. Candida species
    a. Differentiate invasive candidiasis from mucocutaneous candidiasis based on predisposing factors
    b. Recognize typical predisposing factors and clinical characteristics of Candida esophagitis
    c. Plan the treatment of Candida esophagitis (effective drugs, routes, duration)
    d. Recognize the clinical manifestations of congenital candidiasis and the differential outcome in term and preterm infants
    e. Recognize clinical setting and manifestations of disseminated candidiasis in a patient in the NICU (older age, very-low-birth- weight, prolonged antibiotic therapy)
    f. Plan the appropriate examination of cerebrospinal fluid in a neonate with disseminated candidiasis, and recognize abnormalities consistent with Candida infection
    g. Plan management for a patient with catheter related candidemia remove catheter, antifungal therapy, follow up blood cultures)
    h. Evaluate a patient with persistent candidemia after removal of venous catheter (suppurative phlebitis, imaging for thrombosis or endocarditis)
    i. Plan management for a patient with candidemia and cardiac valve vegetation
    j. Plan management for a patient with Candida meningitis (effective drugs, combination therapy, duration of therapy)
    k. Plan appropriate management of Candida suppurative phlebitis
    l. Recognize Candida arthritis or osteomyelitis in a neonate days to weeks following catheter-related candidemia
    m. Recognize visceral abscesses and mass lesions in renal pelvis in patients with candidiasis

n. Know that Candida infection related to any foreign body (ventriculostomy, venous catheter, prosthetic valve, urinary catheter) requires removal of the foreign body for control of infection
o. Plan management for a patient with neutropenia and candidemia (effective drugs, follow-up blood cultures, cerebrospinal fluid exam, imaging of liver and spleen)
p. Know in vitro susceptibility of Candida species to antifungal agents (effective, ineffective, synergistic drugs)
q. Understand the diagnostic value of a positive culture for Candida according to site and predisposing factors in the host

3. Aspergillus species
   a. Evaluate the clinical significance of various Aspergillus species isolated from a tissue specimen (contaminant vs pathogen) based on the immune status of the host
   b. Recognize risk factors for disseminated aspergillosis (neutropenia, corticosteroids, T cell abnormalities, foreign bodies, CGD)
   c. Recognize the setting and clinical manifestations of disseminated aspergillosis (immunocompromised, persistent fever, negative blood cultures, major embolic events, infarction of lungs/spleen/liver/ brain)
   d. Know that tissue specimens are usually necessary for diagnosis of Aspergillus infections (histology, culture)
   e. Plan management for a patient with disseminated aspergillosis (effective drugs, synergistic drugs)
   f. Recognize that a patient with aplastic anemia has a high risk for disseminated aspergillosis and that infection usually begins in paranasal sinuses
   g. Recognize the clinical and laboratory manifestations of hypersensitivity aspergillosis
   h. Plan the management for a patient with hypersensitivity aspergillosis (corticosteroids, antifungal therapy)
   i. Plan therapy for a patient with intracavitary fungus ball in the lung
4. Zygomycetes, agents of Mucormycosis, and related species
   a. Recognize the predisposing factors for and clinical manifestations of rhinocerebral mucormycosis
   b. Plan the management of a patient with rhinocerebral mucormycosis (surgical debridement, effective drugs, combination drugs)
5. Cryptococcus neoformans
   a. Know the risk factors for cryptococcosis (phagocytic defects, cellular immune disorders)
   b. Recognize characteristic clinical manifestations of cryptococcal meningoencephalitis (chronic, memory and judgment defects, cranial neuropathies, mass lesion)
   c. Evaluate a patient with suspected cryptococcal meningitis (cerebrospinal fluid typical abnormalities, cryptococcal antigen, culture)
   d. Plan management of cryptococcal meningitis, and understand the indications for chronic suppressive therapy
6. Histoplasma capsulatum
   a. Recognize the predisposing factors for and clinical characteristics of pulmonary histoplasmosis

b. Recognize the clinical and laboratory findings of disseminated histoplasmosis (fever, hepatosplenomegaly, pancytopenia, and CNS disease)
c. Know the methods of diagnosis of histoplasmosis: limitations of serologic testing, role of fungal isolation, role of pathology, use of fungal antigen detection test)
d. Plan management for a patient with disseminated histoplasmosis
e. Formulate a differential diagnosis for a patient with calcified granulomatous lesion in the lung, including Histoplasma, foreign body, Mycobacterium

7. Blastomyces dermatitidis
   a. Know the methods of diagnosis of blastomycosis (histopathology, fungal isolation, limitations of serology)
   b. Plan the treatment for blastomycosis
   c. Recognize the clinical and epidemiologic features of blastomycosis and how they differ from histoplasmosis
8. Coccidioides immitis
   a. Recognize the epidemiology, clinical, and radiographic characteristics of pulmonary coccidioidomycosis
   b. Recognize the clinical (fever, headache, confusion, seizures) and laboratory characteristics of coccidioidal meningitis (cerebrospinal fluid findings: mononuclear, low glucose, high protein)
   c. Know the methods of diagnosis of coccidioidomycosis (microscopic exam, culture, serology, cerebrospinal fluid antibody)
   d. Know the indications and drugs used for acute and chronic suppressive therapy for coccidioidomycosis
9. Dermatophytes
   a. Recognize the infectious causes and clinical characteristics, including skin distribution, of tinea
   b. Recognize a kerion and plan management
   c. Know the diagnostic methods for dermatophytic infections (fluorescing characteristics with Wood light, examination and culture of scrapings)
   d. Plan the management of dermatophytic infections (topical and systemic therapy)
10. Other fungi
   a. Recognize the clinical manifestations of tinea versicolor, and manage appropriately
   b. Know that Malassezia species, a normal inhabitant of skin, causes tinea versicolor
   c. Recognize the predisposing conditions for and clinical characteristics of Malassezia species fungemia in low-birth-weight infants (catheter related fevers, lipid infusions, negative blood culture)
   d. Know that special laboratory procedures are necessary for isolation of Malassezia species (olive oil overlay)
   e. Plan the management of Malassezia species fungemia (catheter removal)
   f. Formulate a differential diagnosis for a patient with suspected sporotrichosis, including Mycobacterium, Nocardia, foreign body granuloma
   g. Order appropriate tests to confirm the diagnosis of sporotrichosis (histologic examination, isolation of Sporothrix schenckii)
   h. Plan the treatment of sporotrichosis
   i. Recognize Fusarium and Alternaria as important pathogens in immunocompromised patients

j. Recognize the clinical manifestations and in vitro antifungal susceptibility of Fusarium and Alternaria infections
k. Recognize and manage Scaedosporium infection, especially in bones
l. Know the clinical setting in which infections due to Trichosporin species occur as well as appropriate treatment of the infection

L. Parasites/protozoa/helminths
1. Entamoeba histolytica
a. Recognize the risk factors and methods of transmission of Entamoeba histolytica
b. Recognize the clinical manifestations and complications of Entamoeba histolytica infestation, including intestinal perforation, liver abscess, peritonitis, other organ system lesions
c. Formulate a differential diagnosis of a patient with dysentery, to include Entamoeba histolytica and Shigella species
d. Plan the diagnostic evaluation of a patient with suspected Entamoeba histolytica infestation, to include microscopy, serologic testing, and imaging studies
e. Plan the management of a patient with symptomatic extra-intestinal manifestations of Entamoeba histolytica infestation
f. Differentiate the clinical manifestations of Entamoeba histolytica infestation from those of inflammatory bowel disease
2. Entamoeba dispar
a. Recognize nonpathogenic Entamoeba (E. dispar) commonly identified on stool examination for parasites
3. Naegleria/Acanthamoeba
a. Know the risk factors for acquiring amoebic infestations of the central nervous system (eg, brackish warm fresh water with coliform bacteria, seasonal occurrence, geographic distribution, no person- to-person transmission)
b. Recognize that Acanthamoeba infestation frequently occurs in immunocompromised hosts
c. Understand the methods of diagnosis of Naegleria fowleri infestation (ie, hanging drop examination of cerebrospinal fluid)
d. Understand the method of diagnosis of Acanthamoeba infestation (eg, examination of brain or eye tissue, serologic tests)
e. Recognize the setting and clinical and CSF manifestations of Naegleria fowleri infestation involving the brain, leading to fatal encephalitis
f. Recognize the clinical manifestations of Acanthamoeba infestation involving the brain, (granulomatous encephalitis) that can be fatal
g. Recognize the epidemiology and clinical manifestations of Acanthamoeba infestation involving the eye (dendritic keratitis) that can cause blindness, eg, contact lens solution
4. Ascaris duodenale/Necator americanus
a. Understand the importance and geographic distribution of hookworm infestation (Ascaris duodenale, Necator americanus)
b. Recognize the clinical manifestations of hookworm infestation involving major organ systems (skin, pulmonary, gastrointestinal)
c. Understand the method of diagnosis and treatment of hookworm infestation
5. Ascaris lumbricoides

a. Recognize the mode of transmission of Ascaris infestations (ingestion of embryonated eggs in soil contaminated by human feces)
b. Understand the life cycle of Ascaris lumbricoides
c. Recognize the clinical and laboratory manifestations of ascariasis (eg, eosinophilia, fever, pulmonary and gastrointestinal symptoms)
d. Recognize the complications of ascariasis (eg, pneumonia, peritonitis, intestinal obstruction, bile duct obstruction)
e. Understand the methods of diagnosis for ascariasis, including eosinophil counts, microscopy of stool, and identification of adult worms and the treatment of Ascaris infestation

6. Giardia lamblia
   a. Know that the Giardia lamblia cyst is the infective form, that humans are the principal reservoirs, and that person-to-person transmission occurs
   b. Know the epidemiology of Giardia infestation in child-care settings, including the frequency and asymptomatic states
   c. Recognize the clinical manifestations of Giardia lamblia infestation (asymptomatic, acute and chronic gastrointestinal tract disease)
   d. Understand the methods of diagnosis of Giardia lamblia infestation, including microscopy and rapid diagnostic tests
   e. Plan the therapy of a patient with a symptomatic Giardia infection
7. Isospora, Cyclospora, and Microsporidia
   a. Recognize the clinical manifestations of Isospora or Cyclospora infestation, especially the protracted diarrhea produced in patients with AIDS
   b. Plan an appropriate therapeutic regimen for Isospora belli infestation (sulfamethoxazole, pyrimethamine, sulfadiazine)
   c. Recognize the epidemiologic and clinical manifestations of Enterocytozoon bieneusi infestation
   d. Recognize the epidemiologic and clinical manifestations of Septata intestinalis infestation
   e. Recognize the epidemiologic and clinical features of infections due to microsporidia, and plan appropriate therapy
8. Pediculosis agents
   a. Manage an outbreak of pediculosis in a school
   b. Recognize the role of fomites and hygiene in transmission of pediculosis
   c. Recognize the clinical manifestations of lice infestation of the head, body, and pubic hair
   d. Plan the treatment of lice infesting the scalp (permethrin, lindane, malathion, trimethoprim with sulfamethoxazole)
9. Plasmodium species
   a. Know that Plasmodium vivax and P. ovale persist in a dormant stage (hypnozoite) that can cause relapses of malaria
   b. Recognize the epidemiologic settings and clinical manifestations of malaria, including those seen with the severe disease caused by P. falciparum
   c. Plan the therapy of malaria caused by various Plasmodium species, including chloroquine-resistant P. falciparum

d. Know that primaquine phosphate must be given to patients with malaria caused by P. vivax or P. ovale to prevent relapse
e. Plan the appropriate chemoprophylactic regimen for travelers at risk of acquiring malaria, including those going to areas where chloroquine-resistant species are found or those returning to high risk areas after living in the U.S.
f. Recognize the delayed presentation of malaria in a patient who was compliant with prophylaxis
g. Plan an appropriate diagnostic evaluation for a child with suspected malaria

10. Pneumocystis jirovecii (carinii)
    a. Recognize the predisposing conditions and characteristic clinical and chest radiographic manifestations of Pneumocystis jirovecii infection
    b. Plan the diagnostic evaluation for a patient with suspected Pneumocystis jirovecii pneumonia infection and differentiate it from other potential causes of lung disease (eg, interstitial pneumonia in infants, lymphocytic interstitial pneumonitis in a patient with AIDS
    c. Plan the treatment for Pneumocystis jirovecii pneumonia, including the use of corticosteroids
    d. Understand the indications for chemoprophylaxis of Pneumocytis jirovecii pneumonia, including the association between CD4 counts and age when considering prophylaxis for P. jirovecii pneumonia in infants and children with HIV infection
11. Scabies
    a. Understand the source and modes of transmission of scabies
    b. Recognize the difference in clinical manifestations of scabies between younger and older children
    c. Plan an appropriate treatment regimen for scabies, including for clinically resistant disease
    d. Order appropriate diagnostic tests for confirmation of scabies infestation
12. Schistosomiasis
    a. Know the principal (humans) and intermediate (snails) hosts of schistosomiasis
    b. Know the geographic distribution of schistosomes, and that organisms gain entry through the skin
    c. Distinguish the clinical manifestations of S. mansoni from those of S. japonicum and S. haematobium infestations
    d. Plan an appropriate treatment regimen for schistosomiasis (praziquantel)
    e. Plan an appropriate prevention regimen for travelers to endemic areas
13. Strongyloides stercoralis
    a. Recognize that Strongyloides infestation involves penetration of the skin, and that autoinfection occurs
    b. Recognize the clinical manifestations of Strongyloides hyperinfection in immunocompromised hosts (disseminated strongyloidiasis, diffuse pulmonary infiltrates, sepsis)
    c. Plan an appropriate diagnostic evaluation for Strongyloides infestation
    d. Plan an appropriate treatment regimen for a patient with strongyloidiasis
    e. Understand the epidemiology and geographic distribution of Strongyloides stercoralis

14. Cryptosporidium
    a. Recognize the clinical manifestations of Cryptosporidium infestation
    b. Know that patients with AIDS can develop severe, chronic diarrhea with malnutrition and wasting caused by Cryptosporidium
    c. Know potential therapies for Cryptosporidium infestation (paromomycin, somatostatin, nitazoxanide)
    d. Understand the epidemiology and modes of transmission of Cryptosporidium in child-care centers and in the community
    e. Know the methods of diagnosis of Cryptosporidium infestation
15. Enterobius vermicularis
    a. Know that humans are the only host of Enterobius vermicularis
    b. Recognize the common and uncommon (vaginitis and appendicitis) clinical manifestations of pinworm infestation
    c. Plan the management of a family with Enterobius vermicularis infestation
16. Filariasis
    a. Identify the geographic distribution, vector, and clinical manifestations of filariasis
    b. Know that microfilaria may remain in a patient's blood for more than one year after death of adult worms
    c. Plan an appropriate treatment regimen for filariasis, including diethylcarbamazine, ivermectin, and corticosteroids
17. Taenia species
    a. Recognize the epidemiology, clinical manifestations, and typical imaging findings of neurocysticercosis
    b. Plan a diagnostic evaluation for a patient with possible intestinal tapeworm infestation
    c. Plan therapy for intestinal tapeworm infestation (praziquantel, niclosamide)
    d. Plan management of a patient with neurocysticercosis, including indications for antiparasitic drug therapy (albendazole, praziquantel)
    e. Plan a diagnostic evaluation for neurocysticercosis
18. Toxoplasma gondii
    a. Recognize the epidemiology and risk factors for transmission of toxoplasmosis, including risk factors in pregnant women
    b. Recognize adverse outcome of congenital toxoplasmosis including an asymptomatic neonate
    c. Recognize the clinical manifestations and long term consequences of intrauterine toxoplasmosis in newborn infants (including those born with asymptomatic infestation)
    d. Recognize the clinical manifestations of toxoplasmosis in patients with HIV infection and other immunocompromised conditions
    e. Plan a diagnostic evaluation of toxoplasmosis in a patient with HIV infection or in a newborn infant suspected of having Toxoplasma infestation, and understand the limitations of serologic testing
    f. Know the therapy for Toxoplasma gondii infestation in patients with congenital infestation, ocular disease, or AIDS
    g. Recognize that ocular toxoplasmosis in older children and in adults is reactivation of intrauterine infection

h. Plan a course of prophylactic therapy for toxoplasmosis in a patient who is undergoing immunosuppression

19. Trichinella spiralis
    a. Recognize the epidemiologic and clinical manifestations of Trichinella spiralis infestation
    b. Understand the methods of diagnosis of Trichinella spiralis infestation, including serology and microscopy of infected tissue
    c. Plan therapy for Trichinella spiralis infestation (antiparasitic, corticosteroid)
20. Trichomonas vaginalis
    a. Know that trichomoniasis is acquired primarily by sexual contact
    b. Recognize the clinical and laboratory manifestations of Trichomonas infestation (wet-mount examination of vaginal fluid)
    c. Plan the management of trichomoniasis
21. Trichuris trichiura
    a. Know that Trichuris trichiura infestation occurs following ingestion of contaminated soil, not following person-to-person contact
    b. Recognize the clinical manifestations of Trichuris trichiura infestation
    c. Plan the management of a patient with Trichuris trichiura infestation
22. Toxocara species
    a. Know that human toxocaral infestation follows ingestion of soil contaminated with eggs of common roundworms of dogs (T. canis) or cats (T. cati)
    b. Recognize the clinical manifestations of infestation with T. canis or T. cati, including the signs and symptoms dependent on the degree of allergic response
    c. Recognize the laboratory clues in the diagnostic evaluation of patients with toxocariasis (hypereosinophilia, hypergammaglobulinemia, microscopic larvae in liver, serology)
    d. Plan the management of patients with visceral larval migrans (thiabendazole, diethylcarbamazine), including those with cardiac or CNS manifestations (corticosteroids)
23. Trypanosoma
    a. Recognize the epidemiologic and clinical features of South American Trypanosomiasis infestation
    b. Plan appropriate therapy for a patient with South American Trypanosomiasis
    c. Recognize the epidemiologic and clinical features of African Trypanosomiasis
    d. Plan the appropriate therapy for a patient with African Trypanosomiasis
24. Miscellaneous parasites/protozoa/helminths
    a. Know the vector, reservoir, geographic occurrence, clinical manifestations, (including dangers of babesiosis in an asplenic individual and diagnostic tests for Babesia microti (babesiosis)
    b. Plan the management of a patient with severe babesiosis (atovaquone and azithromycin; chloroquine ineffective)
    c. Recognize that most Balantidium coli infestations in humans are asymptomatic but that chronic intermittent episodes of diarrhea can occur
    d. Recognize that most Blastocystis hominis infestations are asymptomatic

e. Recognize the epidemiology (ingestion of raw or uncooked freshwater crabs or crayfish containing larvae) and clinical manifestations of paragonimiasis, including insidious onset, a chronic course, eosinophilic response, and pathologic lesions
f. Recognize geographic distribution, clinical manifestations, and etiology of cutaneous larval migrans
g. Recognize the epidemiologic and clinical features of, and plan appropriate management for, Microsporidia infestation
h. Recognize clinical and computed tomographic characteristics of echinococcal cysts
i. Plan appropriate management for a patient with an echinococcal cyst, including surgical indications
j. Recognize the epidemiologic and clinical features of Diphyllobothrium latrum infestation in humans
k. Recognize the clinical features of Baylisascaris (raccoon ascaris) infestation in humans

M. Mycobacteria

1. Mycobacterium tuberculosis
   a. Identify typical microbiologic characteristics of Mycobacterium tuberculosis (staining and growth features)
   b. Recognize the epidemiology and risk factors (infants and adolescents, immunosuppression, steroids, cellular immune defects, international travel) of Mycobacterium tuberculosis infection
   c. Recognize the clinical and radiographic manifestations of primary or reactivated tuberculous pneumonia
   d. Recognize the clinical and cerebrospinal fluid characteristics of tuberculous meningitis
   e. Recognize the history and clinical manifestations of miliary tuberculosis
   f. Understand the indications for and interpretation of tuberculin skin tests, including differential interpretation based on risk factors in the host
   g. Evaluate a patient suspected to have tuberculosis who has a negative tuberculin skin test (timing, anergy, false-negative tests)
   h. Recognize the special clinical and radiographic manifestations of endobronchial tuberculosis, and plan appropriate treatment
   i. Evaluate a child with suspected pulmonary tuberculosis (culture, AFB stain expectation, skin test expectation)
   j. Evaluate a patient with suspected tuberculous meningitis (cerebrospinal fluid findings, CT findings, AFB stain expectation, skin test expectation)
   k. Plan treatment for a patient with tuberculous pneumonia (effective drugs, combination therapy, duration)
   l. Plan treatment for a patient with tuberculosis meningitis (effective drugs, combination therapy, duration)
   m. Understand mechanisms and patterns of antimicrobial resistance and interpretation of susceptibility tests for Mycobacterium tuberculosis
   n. Plan follow-up evaluation for a patient undergoing treatment for tuberculous pneumonia (repeat cultures, sputum, radiographs, clinical assessment hepatoxicity)
   o. Recognize clinical manifestations of Mycobacterium tuberculosis lymphadenitis

p. Plan evaluation and management of a patient with Mycobacterium tuberculosis lymphadenitis
q. Plan evaluation for family members/siblings of patients with asymptomatic infection or with various forms of clinical disease due to Mycobacterium tuberculosis
r. Know the indications for examination of the cerebrospinal fluid in a patient with symptomatic tuberculosis (eg, infancy, adolescence, subtle symptoms)
s. Compare infectivity of individuals with asymptomatic tuberculin skin test reactivity, and with various forms of clinical disease caused by Mycobacterium tuberculosis
t. Recognize clinical conditions (eg, HIV infection) that increase the risk of transmission of Mycobacterium tuberculosis
u. Plan the treatment of a child with multidrug-resistant tuberculosis
v. Understand the advantages and limitations of molecular method of Mycobacterium tuberculosis detection and diagnosis, including DNA detection assays (PCR) and cellular immune response assay
w. Plan infection control guidelines for a child diagnosed with Mycobacterium tuberculosis

2. Other Mycobacterium species
   a. Know the basis for differentiating Mycobacterium species (growth characteristics)
   b. Recognize the clinical manifestations of nontuberculous mycobacterial lymphadenitis
   c. Evaluate a patient with suspected nontuberculous mycobacterial lymphadenitis, including interpretation of skin tests
   d. Plan management for a patient with nontuberculous mycobacterial lymphadenitis (conservative vs surgery, relative inefficacy of drugs, potential antimicrobials)
   e. Formulate the differential diagnosis for a patient with the histologic examination of lymph node showing granuloma with necrosis (TB, nontuberculous mycobacteria, tularemia, lymphogranuloma venereum)
   f. Recognize the clinical manifestations of nontuberculous mycobacterial disease in patients with AIDS (fever, wasting, diarrhea)
   g. Know value of special blood culture and other diagnostic techniques for the diagnosis of mycobacterial infection in HIV-infected patients
   h. Know antituberculous drugs and potential drug regimens of potential benefit for treatment of nontuberculous mycobacterial infection in HIV-infected patients
   i. Recognize the importance of nontuberculous mycobacterial infection related to foreign bodies (porcine heart valve, peritoneal dialysis catheter), and plan management (removal)
   j. Understand the potential for drug susceptibility testing in high risk patients

3. **Use of Laboratory and Diagnostic Testing**

A. Bacteriology laboratory
   1. Know optimal collection methods for obtaining and handling specimens for fastidious organisms (anaerobes, Bordetella pertussis, Neisseria gonorrhoeae)
   2. Know that skin and mucosal sites are inappropriate locations from which to obtain specimens for isolation of anaerobic bacteria

3. Know how to disinfect the skin when obtaining blood for culture (effective agents, ineffective agents, technique)
4. Understand importance of collection method and transport time for culture of urine
5. Know for which pathogens the laboratory should use special precautions because of risk of contagion (Francisella, Yersinia pestis, Coccidioides, Blastomyces, Histoplasma, Bacilla anthracis)
6. Know situations when antigen, antibody, or nucleic acid detection in specimens is superior to culture for detection of a potential pathogen (cryptococcal meningitis, CNS toxoplasmosis, CNS syphilis, partially treated meningitis, viral meningitis, pertussis, HIV infection)
7. Know the appropriate microbiologic laboratory tests to request for cervical exudate specimen from patient with pelvic inflammatory disease
8. Understand both the value and limitations of bacterial antigen and nucleic acid testing (appropriate, inappropriate, better alternative, unnecessary expense)
9. Know the appropriate use of Gram stain (predicting polymicrobic anaerobic infection, predicting significance of sputum/leuken isolates, predicting etiology of cervicitis, planning initial antibiotic therapy)
10. Formulate a differential diagnosis of blood isolates of Gram-positive bacillus (Listeria, Corynebacterium, Clostridium, Bacillus)
11. Understand interpretation of testing for resistance to high-level vancomycin, streptomycin, and gentamicin for Enterococcus and staphylococcal isolates
12. Know the principles of reproducible antibiotic susceptibility testing (standard medium, standard inoculum, standard incubation, non-fastidious organism, quality controls)
13. Know the principle of laboratory designation "susceptible" (ie, serum concentration of drug, given usual dose, exceeds minimal inhibitory concentration by 4 to 8)
14. Interpret laboratory susceptibility report based on site of infection (urinary tract vs CNS vs bone/joint)
15. Know for which clinical specimens refrigeration is appropriate (urine, stool for C. difficile toxin, cervical secretions in transport medium for Chlamydia and Ureaplasma, stool in transport solution for ova and parasites)
16. Know for which pathogens immediate inoculation onto growth medium is necessary
17. Understand the interpretation of an intravascular catheter tip culture
18. Interpret multiple isolates from one blood culture (significant and insignificant situations)
19. Know pathogens for which laboratory isolation is not the preferred method for diagnosis (Brucella, tularemia, leptospirosis, rickettsia, syphilis, psittacosis)
20. Recognize pathogens for which nucleic acid detection assays are available for clinical diagnosis and characterization (resistance, genotype)
21. Understand the advantages, limitations, and appropriate use of nucleic acid detection assays for identification, quantification, and characterization of pathogens (eg, DNA probe, PCR, branch chain assays, genotyping, need for controls, potential for false positive
22. Identify bacteria by Gram stain and by morphology
23. Understand major advantages and disadvantages of a two-vial blood culture system
24. Differentiate a bactericidal antibiotic from a bacteriostatic antibiotic

25. Understand the methods utilized to differentiate or classify bacteria in outbreak situations
26. Understand the mechanisms of resistance that can spread organisms that produce extended spectrum beta lactamases

B. Virology laboratory
1. Know optimal techniques for collecting and handling specimens for virus culture (viral transport medium, storage and transport at 40 C, not freezing)
2. Know optimal techniques for collecting and handling specimens for antigen detection (adequate number of cells present)
3. Know the advantages of virus isolation (eg, detection of more than one virus, definitive identification and typing, viral susceptibility)
4. Know the important causes of false positive and false negative results of viral culture, antigen identification, and nucleic acid detection
5. Know the clinical situations and the viruses where antiviral susceptibility testing may be clinically important
6. Know the advantages (eg, speed, less concern for specimen handling, cost) and disadvantages of rapid antigen detection of virus (eg, false-positive and false-negative results)
7. Know the factors that complicate interpretation of rapid antigen detection, nucleic acid detection, and viral isolation (asymptomatic or prolonged shedding)
8. Understand the viruses (eg, EBV, rubella, rubeola, hepatitis, arbovirus, HIV) that do not replicate in the battery of cultures generally used in diagnostic laboratories
9. Understand the laboratory detection methods for HIV infection (antibody, antigen, qualitative and quantitative nucleic acid, genotyping)
10. Know that nucleic acid detection methods may be the optimal diagnostic test for certain diseases (eg, HSV in CSF; HIV or parvovirus in serum; HPV, EBV, hepatitis viruses in tissue rhinovirus, and new respiratory viruses)
11. Know the suspected diagnoses for which antigen detection of virus is the preferred laboratory test (eg, rotavirus diarrhea, respiratory syncytial virus bronchiolitis/pneumonia)
12. Understand the use of quantitative urologic tests in treatment and prognostic decisions
13. Understand the different methods for performing susceptibility testing of viruses (genotyping, phenotyping) and the limitations of each
14. Know the advantages of nucleic acid detection of viruses (speed, less concern for specimen handling, quantitative assays, genotyping) and the disadvantages of nucleic acid detection of viruses (false positive and false negative results)
15. Understand the diagnoses for which nucleic acid detection of virus is the preferred diagnostic method (eg, herpes encephalitis, HIV infection in a neonate)
16. Know optimal techniques for collecting and storing specimens for nucleic acid detection
17. Know the limitations of methods used to establish viral load for herpes group viruses (CMV, HSV, VZV, and EBV)

C. Serology laboratory
1. Know the important causes of false positive and false negative results of IgM serology (eg, rheumatoid factor, delayed response, immunosuppressed host, herpes virus reactivation)

2. Know the factors that complicate interpretation of IgG serology tests (eg, delayed response, age, maternal antibodies, heterologous, cross reactivity, IgG immunotherapy)
3. Interpret a negative IgG serologic test result in a clinical setting when the test results do not exclude a specific diagnosis (eg, acute phase, early treatment)
4. Interpret a positive IgG serologic test result in a clinical setting when the test results do not confirm a diagnosis (eg, CMV, herpes, maternal antibody)
5. Know the suspected diagnoses for which antibody titers (IgG or IgM) against viruses are the preferred laboratory tests (eg, arbovirus encephalitis, infectious mononucleosis, hepatitis)
6. Understand the use of common serologic tests (eg, complement fixation, hemagglutination inhibition, neutralization, immunofluorescence, EIA, Western blot)
7. Understand the limitations of serologic diagnosis in an immunocompromised patient

D. Immunology laboratory
1. Know the assays required for the screening evaluation of the major defects in host defense: immunoglobulins, antibodies, absolute neutrophil counts, CH50, PHA, neutrophil oxidative burst, lymphocyte surface markers
2. Recognize the implications of abnormal CD4, CD8, and CD4/CD8 counts and the concept of age-based normal values
3. Recognize the implications of an abnormal serum complement concentration
4. Recognize the implications of an abnormal serum immunoglobulin (IgA, IgM, IgG, IgG subclass) concentrations, based on age
5. Recognize the implications of an abnormal neutrophil function test (eg, neutrophil oxidative burst, chemiluminescence)

E. Mycology laboratory
1. Interpret isolation of mold from sterile body fluid (contaminant versus pathogen)
2. Know the appropriate source and collection method for identification of dermatophytes (scrapings, KOH, culture)
3. Understand the usefulness of susceptibility testing of antifungal drugs for various fungi
4. Recognize and identify invasive fungi histologically
5. Recognized common growth characteristics of common invasive fungi (eg, dimorphic forms, speed of growth)
6. Know the sensitivity and specificity of methods other than culture to identify fungus (PCR, galactomannan, antigen testing)

F. Parasitology laboratory
1. Know the optimal techniques for collecting and handling stool, blood, and other tissue samples for diagnosis of parasitic infestations using microscopy
2. Recognize commonly encountered pathogenic parasites in stool using microscopy (Giardia, E. histolytica, Isospora, Cryptosporidium, Strongyloides)
3. Recognize parasitic infestations for which antigen detection is useful
4. Know parasites for which stool concentrating techniques are useful (Cryptosporidium)

G. Delayed hypersensitivity skin tests
1. Interpret the results of delayed hypersensitivity skin tests (eg, mumps, diphtheria, tetanus, TST, dermatophyton), including induration at 24-48 hours as a marker of positive results

2. Know clinical settings when delayed hypersensitivity testing is transiently diminished (corticosteroid use, measles, varicella)
3. Know clinical settings where delayed hypersensitivity testing may be falsely negative and how to evaluate this setting

4. **Treatment**

A. Antibacterial therapy

1. General concepts
   a. Understand pharmacokinetic principles of half-life, including plateau effect with repetitive dosing
   b. Recognize clinical circumstances when peak and trough concentrations of antimicrobial drugs are important or under the curve
   c. Distinguish clinical situations when bacteriostatic vs bactericidal drugs are indicated (host, site of infection)
   d. Evaluate clinical uses for combination antibiotic therapy (prevention of emergence of resistance, polymicrobic infections, initial therapy, decreased toxicity, synergism, impaired host)
   e. Recognize inappropriate uses of combination antibiotic therapy (antagonism, cost, adverse effects)
   f. Recognize appropriate and inappropriate routes of administration of antibiotics in reference to site and severity of infection and drug absorption
   g. Know the clinical situations when orally non-absorbed or less-well absorbed antibiotics are appropriate (Clostridium difficile, shigellosis, bowel decontamination)
   h. Understand the mechanisms, and know examples, of antibiotic resistance (mutations, plasmids, transposable elements, alterations of binding proteins, efflux pumps, ribosomal methylation)
   i. Understand that induction of beta-lactamase activity in Gram- negative bacilli by cefoxitin and third-generation cephalosporins leads to resistance to all third-generation cephalosporins and ureidopenicillins
   j. Evaluate safety of antimicrobial drugs during pregnancy
   k. Evaluate safety of antimicrobial drugs during breast-feeding
   l. Evaluate safety of antimicrobial drugs in a newborn infant, including ceftriaxone and trimethoprim-sulfamethoxazole
   m. Understand the principles of pharmacokinetics and how they apply to antimicrobial drugs
   n. Interpret bacteriostatic and bactericidal antibiotic concentrations
   o. Understand the pharmacodynamic principles of bacterial killing by class antibiotic
   p. Know the difference between time-dependent and concentration-dependent antibiotics
   q. Understand population pharmacokinetics as a means to describe the variability of drug exposure among children in defined population groups
   r. Understand that antibiotic exposure (pharmacokinetics) at the level of infected tissue may be far greater for far less than serum antibiotic exposure
2. Aminoglycosides
   a. Understand the spectrum of antibacterial activity of various aminoglycosides

b. Understand the indications and dosage of aminoglycosides for synergy (high level aminoglycoside testing, host, type of infection, site of infection)
c. Know clinical situations when standard dosing predictably yields low serum concentrations of aminoglycosides (patients with burns, malnutrition, patients with cystic fibrosis)
d. Know that gestational and postnatal age and volume of distribution affect pharmacokinetics of aminoglycosides in neonates
e. Plan dosing schedule of an aminoglycoside for a patient with renal impairment
f. Know the circumstances in which nephrotoxicity of aminoglycosides is potentiated (concurrent use of amphotericin or "loop" diuretics)
g. Plan dosage adjustment of aminoglycoside for a patient for given peak and trough serum concentrations
h. Recognize the toxicities of aminoglycoside therapy (ototoxicity, nephrotoxicity)
i. Know that aminoglycosides can contribute to neuromuscular paralysis, especially in patients receiving succinylcholine, magnesium, and those with myasthenia gravis or botulism
j. Know the indications for the use of streptomycin (tuberculosis, tularemia, plague, brucellosis)
k. Know the circumstances in which aminoglycoside activity is impaired (in purulent material, low pH, anaerobic conditions)

3. Tetracycline
   a. Know the indications for use of tetracyclines (Brucella, Chlamydia, Ehrlichia, Borrelia burgdorferi, MRSA, Mycoplasma, Rickettsia, vibrios), including those in young children
   b. Know the toxicity of tetracyclines (skin photosensitivity, enamel discoloration and hypoplasia, esophageal ulcers, hepatotoxicity)
   c. Differentiate doxycycline from other tetracyclines by pharmacokinetics and toxicity
4. Chloramphenicol
   a. Identify the causes of abnormal (increased or decreased) serum chloramphenicol concentrations (liver dysfunction; hypotension; concomitant phenytoin, rifampin, or phenobarbital therapy)
   b. Evaluate the clinical indications for appropriate use of chloramphenicol (penicillin allergic patient, typhoid/enteric fever, Y. pestis meningitis)
5. Rifamycins
   a. Know the pharmacologic properties of rifampin, including excretion, relative cerebrospinal fluid concentration, and gastrointestinal absorption
   b. Know the spectrum of antibacterial activity of rifampin, including antimycobacterial properties
   c. Know why clinical use of rifampin for treatment is always in combination with another drug
   d. Recognize the clinical indications for the use of rifampin for adjunctive treatment (tuberculosis, staphylococcal CNS infection, tolerant staphylococci, methicillin-resistant staphylococci)

e. Understand the drug interactions of rifampin, including its reduction of the half life of many drugs (barbiturates, oral contraceptives, cyclosporin, digoxin, phenytoin, theophylline)
f. Know that rifampin is not recommended for use in pregnant women
g. Know the pharmacologic properties of rifabutin, including excretion, relative CSF concentration, and gastrointestinal absorption
h. Know the indications for rifaximin (traveler's diarrhea)

6. Metronidazole
   a. Know the indications for the use of metronidazole (giardiasis, amoebiasis, vaginal trichomoniasis, C. difficile colitis, anaerobic infections of the CNS)
   b. Know the effectiveness, including limitations as a single drug, of metronidazole in the treatment of polymicrobial anaerobic infections
   c. Identify the adverse effects of metronidazole (peripheral neuropathy, cerebellar dysfunction, encephalopathy, pancreatitis, metallic taste, gastrointestinal disturbances, dark urine, gynecomastia, rashes, disulfuram-like reaction)
   d. Know the precautions for use of metronidazole
7. Sulfonamides and trimethoprim
   a. Understand the mechanism of antibacterial activity of trimethoprim with sulfamethoxazole
   b. Understand the importance of ability of sulfonamides to displace drugs from protein (potentiates methotrexate, thiazides, phenytoin and increases free bilirubin)
   c. Know clinical uses of sulfonamides for treatment (Nocardia, rifampin-resistant Mycobacterium kansasii, Escherichia coli)
   d. Know the clinical uses of sulfonamides for prophylaxis (urinary tract infection, otitis media, chronic granulomatous disease, Pneumocystis jirovecii)
   e. Know clinical uses of sulfonamide combination therapy for toxoplasma, P. falciparum
   f. Know the clinical uses of trimethoprim with sulfamethoxazole for treatment (Pneumocystis, enteric fever, Shigella, other Enterobacteriaceae, Chlamydia, Ureaplasma, Pseudomonas cepacia)
   g. Recognize toxicities of trimethoprim with sulfamethoxazole (rashes, exfoliative dermatitis, Stevens-Johnson, neutropenia, megaloblastic anemia, thrombocytopenia, renal dysfunction in patients with pre-existing renal disease, aseptic meningitis)
   h. Know that Streptococcus pneumoniae may be resistant to trimethoprim with sulfamethoxazole
   i. Know that trimethoprim is contraindicated in pregnancy because of possible teratogenic effects
8. Quinolones
   a. Know the spectrum of antibacterial activity of quinolones, and their approved indications for use
   b. Identify the organisms likely to be partially or completely resistant to quinolones (streptococci, enterococci, anaerobes)
   c. Recognize that initially susceptible Pseudomonas strains are likely to develop resistance during treatment with quinolones

d. Know the indications for use of quinolones in children younger than 18 years of age, including UTI
e. Know the potential toxicity of quinolones including conduction disorders and tendon rupture

9. Penicillins
   a. Know the mechanism of action of and bacterial resistance to penicillins
   b. Know the host factors that necessitate dosage modifications, including age, prematurity, renal insufficiency, and hepatic disease for the different penicillins
   c. Know the spectrum of antibacterial activity of the different penicillins (eg, penicillinase-resistant penicillins, aminopenicillins, and extended spectrum antipseudomonal penicillins)
   d. Know the spectrum of antibacterial activity of penicillins in combination with beta-lactamase inhibitors (amoxicillin-clavulanate, ticarcillin-clavulanate, ampicillin-sulbactam, piperacillin-tazobactam)
   e. Recognize the major adverse effects of penicillins (eg, hypersensitivity reactions; hematologic, renal, and CNS toxicity; hypokalemia)
   f. Plan therapy for a patient who has had an adverse reaction to penicillin (alternate drug therapy, desensitization), or who is in renal failure
10. Cephalosporins and related drugs (cefamycins, carbacephens)
   a. Know the mechanisms of bacterial activity and resistance of the cephalosporins
   b. Know the relative cerebrospinal fluid drug concentrations of the cephalosporins in comparison to those in serum (eg, first- versus third-generation)
   c. Know the spectrum of antibacterial activity and classification of the different cephalosporins (eg, first-, second-, third-, and fourth-generation, including those with anti pseudomonal activity)
   d. Recognize adverse effects of cephalosporins, including hypersensitivity reactions, toxicity, and gastrointestinal reactions of oral formulations
   e. Plan therapy for a patient who has had an adverse reaction to a cephalosporin (safe alternate drug, desensitization)
   f. Recognize the association of ceftriaxone with formation of biliary sludge and manifestations of cholecystitis
   g. Recognize the association of ceftriaxone with fatal hemolysis
11. Imipenem, meropenem, ertapenem
   a. Know the pharmacologic properties of meropenem, including route of elimination and relative cerebrospinal fluid concentration
   b. Know the spectrum of antibacterial activity of meropenem
   c. Know the indications for use of meropenem in children and adolescents, including those with known or suspected penicillin or cephalosporin hypersensitivity
   d. Recognize adverse effects and manifestations of meropenem toxicity
   e. Know the pharmacologic properties of ertapenem, including route of elimination and relative cerebrospinal fluid concentration
   f. Know the spectrum of antibacterial activity of ertapenem (lack of activity against Pseudomonas)
   g. Know the indications for use of ertapenem in children and adolescents, including those with known or suspected penicillin or cephalosporin hypersensitivity
   h. Recognize adverse effects and manifestations of ertapenem toxicity

i. Recognize adverse effects and toxicity of imipenem (seizures)

12. Aztreonam
    a. Know the pharmacologic properties of aztreonam, including route of elimination and relative cerebrospinal fluid concentration
    b. Know the indications for use of aztreonam in children and adolescents, including those with known or suspected penicillin or cephalosporin hypersensitivity
13. Vancomycin
    a. Know the mechanism of action of vancomycin
    b. Know the pharmacology of vancomycin, including the route of elimination and relative cerebrospinal fluid concentration
    c. Know the host factors that necessitate modification of vancomycin dosage
    d. Understand the rationale of and timing for monitoring of serum vancomycin concentrations
    e. Know the spectrum of antibacterial activity of vancomycin
    f. Know the indications for vancomycin therapy
    g. Recognize adverse effects and toxicity of vancomycin, including those from too rapid infusion, and the resulting management
    h. Recognize the association of vancomycin use and the increase in vancomycin-resistant Enterococcus, and situations for restraint of use
14. Macrolides
    a. Know the major site of action, the gastrointestinal absorption of the different preparations, and the route of elimination of macrolides
    b. Know the spectrum of antibacterial activity, pharmacologic properties, indications, and adverse effects of macrolides
    c. Know the drugs whose excretion may be delayed by the concurrent administration with macrolides
    d. Know the spectrum of activity, pharmacologic properties, indications, and adverse effects of clarithromycin
    e. Know the spectrum of activity, pharmacologic properties, indications, and adverse effects of azithromycin
15. Clindamycin
    a. Know the major site of action, the gastrointestinal absorption, and the route of elimination of clindamycin
    b. Know the spectrum of antibacterial and antiprotozoal activity of clindamycin
    c. Know the indications for clindamycin therapy
    d. Know the activity of clindamycin against penicillin-resistant Streptococcus pneumoniae
16. Oxazolidinones
    a. Recognize that linezolid inhibits bacterial protein synthesis through a mechanism of action different from that of other antibacterial agents (eg, unlikely cross-resistance with other antimicrobials)
    b. Understand that linezolid is a therapeutic option for resistant gram-positive organisms
    c. Plan appropriate monitoring (eg, blood counts) in patients receiving oxazolidinone therapy
17. Streptogramin

a. General
    1. Understand that quinupristin/dalfopristin is a therapeutic option for treating Enterococcus faecium infection

18. Daptomycin
    a. Understand the potential toxicities of daptomycin
    b. Understand the current clinical situations (excluding pneumonia) in which daptomycin can be used in pediatrics
    c. Understand the mechanism of action of daptomycin
    d. Understand the antibacterial spectrum of activity of daptomycin
    e. Understand the clinical pediatric situations (excluding pneumonia) in which daptomycin can be used

B. Antiviral therapy
1. Antiviral therapy - General
    a. Understand the mechanism for development of antiviral resistance that may arise in the absence of the use of antivirals, and the most valuable resource for information to track current antiviral resistance during the influenza season
2. Acyclovir
    a. Understand the mechanism of action of acyclovir
    b. Recognize that high dose acyclovir is appropriate in the treatment of varicella zoster and neonatal herpes simplex virus infections
    c. Know the indications for acyclovir therapy
    d. Identify the clinical manifestations of acyclovir toxicity (eg, renal failure, CNS symptoms)
    e. Know the mechanism of resistance to acyclovir, and the circumstances under which it occurs
    f. Plan alternative antiviral therapy when acyclovir resistance occurs
    g. Know that valacyclovir may be an alternative to intravenous or oral acyclovir therapy
3. Ganciclovir
    a. Understand the mechanism of action of ganciclovir
    b. Know the major adverse effects of ganciclovir
    c. Know the mechanism of resistance of CMV to ganciclovir, and plan alternative antiviral therapy when it occurs
    d. Know oral antiviral therapies are suitable for maintenance therapy of CMV retinitis in immunocompromised hosts and in transplant patients
    e. Know that valacyclovir may be an alternative to intravenous or oral ganciclovir therapy
4. Foscarnet
    a. Know the viruses against which foscarnet is active and the indications for use
    b. Know the adverse effects of foscarnet, including in patients with ganciclovir-resistant cytomegalovirus infection
5. Trifluorothymidine
    a. Know the viruses against which trifluorothymidine is active and the indications for use
6. Ribavirin

a. Know the mechanism of action and spectrum of activity of ribavirin, and that resistance does not occur
b. Know the adverse effects associated with aerosolized and intravenously administered ribavirin
c. Understand the guidelines for ribavirin therapy, including types of patients and diseases for which it is and is not indicated and duration of therapy

7. Amantadine/rimantadine
   a. Know the indications for prophylactic and therapeutic uses of amantadine/rimantadine
   b. Know the potential toxicity and adverse reactions to amantadine/rimantadine, including predisposing factors
   c. Appreciate the importance (including frequency and timing) of the development of resistance by influenza A viruses during treatment and prophylaxis with amantadine/rimantadine
   d. Evaluate the expected effectiveness of prevention of influenza infection in various circumstances by amantadine/rimantadine, including use with immunization against influenza A virus
8. Inhibitors of neuraminidase (eg, oseltamivir, zanamivir)
   a. Know the mechanism of action and spectrum of activity of neuraminidase inhibitors (eg, oseltamivir, zanamivir)
   b. Know the indications for prophylactic and therapeutic uses of neuraminidase inhibitors
   c. Know the potential toxicity and adverse reactions to neuraminidase inhibitors, including predisposing factors
   d. Evaluate the expected effectiveness in preventing and treating influenza infections
9. Cidofovir
   a. Understand the mechanism of action, adverse effects, and toxicity of cidofovir
   b. Know the possible indications for cidofovir therapy
10. HIV-nucleoside analogue reverse transcriptase inhibitors
    a. Zidovudine (ZDV)
       1. Understand the mechanism of action of zidovudine (ZDV) against human immunodeficiency virus
       2. Know the clinical indications for and anticipated efficacy of zidovudine (ZDV) therapy
       3. Recognize the manifestations of adverse effects and toxicity versus resistance to zidovudine (ZDV)
       4. Understand the disadvantages of single drug therapy with zidovudine (ZDV)(development of resistance, toxicity) and advantages of combination (ie, sequential) therapies
    b. Dideoxyinosine (ddI)
       1. Know the mechanism of action of dideoxyinosine (ddI)
       2. Know the adverse effects and toxicity of dideoxyinosine (ddI)
       3. Know the clinical indication for administration and anticipated efficacy of dideoxyinosine (ddI) therapy in children
    c. Dideoxycytidine (ddC) (Zalcitabine)
       1. Know the mechanism of action of dideoxycytosine (ddC)

2. Know the adverse effects and toxicity of dideoxycytosine (ddC) in children versus adults
3. Know the possible indications for dideoxycytosine (ddC) therapy for children

d. Lamivudine (3TC)
1. Know the mechanism of action of lamivudine (3TC)
2. Know the adverse effects and toxicity of lamivudine (3TC) in children versus adults
3. Know the possible indications for lamivudine (3TC) therapy for children
4. Understand the role of lamivudine (3TC) in the treatment of hepatitis B

e. Abacavir
1. Understand the mechanism of action of abacavir
2. Recognize the adverse effects and toxicity of abacavir
3. Know the possible indications for abacavir therapy

f. Tenofovir
1. Understand the mechanism of action of tenofovir
2. Recognize the adverse effects and toxicity of tenofovir
3. Know the possible indications for tenofovir therapy

g. Stavudine
1. Understand the mechanism of action of stavudine
2. Recognize the adverse effects and toxicity of stavudine
3. Know the possible indications for stavudine therapy

11. HIV-non-nucleoside reverse transcriptase inhibitors

a. Efavirenz
1. Understand the mechanism of action of efavirenz
2. Recognize the adverse effects and toxicity of efavirenz
3. Know the possible indications and contraindications for efavirenz therapy

b. Nevirapine
1. Recognize the adverse effects and toxicity of nevirapine

C. Antifungal therapy

1. Amphotericin

a. Understand the mechanisms of action (sterol binding) for amphotericin
b. Understand the pharmacology for amphotericin, including lipid-complexed preparations, and the route of elimination
c. Evaluate indications for in vitro testing for fungal susceptibility to amphotericin (clinical failure)
d. Know the clinical situations/pathogens when amphotericin is the drug of choice (Aspergillus, systemic candidiasis, severe coccidioidomycosis, cryptococcosis, disseminated histoplasmosis, blastomycosis, mucormycosis) and how this has changed due to new azoles
e. Recognize adverse effects and toxicities of amphotericin (potassium loss, anaphylaxis, fever, nephrotoxicity)
f. Know topical use of amphotericin (peritoneal, bladder infections)
g. Identify amphotericin-resistant fungi (eg, C. lusitaniae, Trichosporon, Fusarium, Pseudoallescheria boydii)
h. Know the advantages/disadvantages of various amphotericin compounds

2. Flucytosine

a. Know the mechanism of action, spectrum of antifungal activity, route of administration, and pharmacologic properties of flucytosine
b. Recognize that flucytosine alone is not the drug of choice for any fungal infection because of intrinsic resistance or development of resistance
c. Recognize the mechanism/manifestations of flucytosine toxicity (gastrointestinal, bone marrow)
d. Understand the indications for use of flucytosine (in combination with amphotericin B for treatment of cryptococcal and candidal meningitis)

3. Imidazoles
   a. Know the spectrum of activity, absorption, and pharmacokinetics of itraconazole
   b. Know the spectrum of activity, pharmacokinetics, and interactions of fluconazole (IV and oral use, CNS penetration, need for gastric acidity, no effect on testosterone or cortisol)
   c. Understand pathogens against which itraconazole has been used successfully (eg, Cryptococcus, Histoplasma, Aspergillus, Blastomyces, Candida)
   d. Recognize the clinical indications for the use of fluconazole
   e. Recognize the clinical indications for the use of itraconazole
   f. Know the spectrum of activity, absorption, pharmacokinetics, and drug interactions of voriconazole
   g. Recognize the pathogens against which voriconazole therapy has been used successfully
   h. Recognize the clinical indications for the use of voriconazole
   i. Know the spectrum of activity, absorption, and pharmacokinetics of posaconazole
   j. Recognize the pathogens against which posaconazole therapy has been used successfully
   k. Recognize the clinical indications for the use of posaconazole
   l. Know when testing for antifungal susceptibility to fluconazole is appropriate
4. Echinocandins
   a. Understand the mechanism of action of caspofungin and micafungin
   b. Know the spectrum of antifungal activity and pharmacologic properties of caspofungin and micafungin
   c. Recognize the mechanism/manifestations of caspofungin or micafungin toxicity
   d. Know the route of administration and elimination of caspofungin and micafungin
   e. Understand the indications for use of caspofungin and micafungin
5. Topical and other antifungal agents
   a. Know the use of topical drugs/treatments for superficial fungal infections (clotrimazole, ketoconazole, miconazole, cystatin, tolnaftate, terbinafine, gentian violet, sodium thiosulfate)
   b. Know the appropriate use of griseofulvin
   c. Know the important drug interactions for and adverse effects of griseofulvin
   d. Know the spectrum of activity, absorption, and pharmacokinetics of terbinafine
   e. Recognize the pathogens against which terbinafine therapy has been successfully used
   f. Recognize the clinical indications for the use of terbinafine

D. Antiprotozoal/antiparasitic therapy
1. Albendazole

a. Know the role of albendazole in the treatment of echinococcal infection and neurocysticercosis

2. Atovaquone and proguanil
   a. Know the spectrum of activity, pharmacokinetics, pharmacologic properties, and interactions of atovaquone
   b. Know the clinical indications for atovaquone therapy
   c. Know the spectrum of activity, pharmacokinetics, pharmacologic properties, and interactions of proguanil (malarone)
   d. Know the clinical indications for proguanil (malarone) therapy
3. Chloroquine
   a. Know the adverse effects of chloroquine therapy
   b. Know the clinical indications of chloroquine therapy
4. Dapsone
   a. Know the clinical indications for the use of dapsone therapy
   b. Know the adverse effects of dapsone therapy
5. Furazolidone
   a. Know the clinical indications for the use of furazolidone therapy (eg, giardiasis, cholera)
   b. Recognize the clinical manifestations of furazolidone toxicity
6. Iodoquinol
   a. Know the clinical indications for the use of iodoquinol therapy (eg, amoebiasis, D.fragilis)
   b. Know that iodoquinol is lumenicidal for intestinal amoebiasis
   c. Recognize the clinical manifestations of iodoquinol toxicity (optic neuritis)
7. Lindane
   a. Recognize the clinical manifestations of lindane toxicity
8. Mebendazole
9. Mefloquine
   a. Plan therapy for a patient with chloroquine-resistant malaria (mefloquine)
   b. Understand the contraindications for the use and adverse effects of mefloquine therapy (eg, age, weight)
10. Niclosamide
    a. Know the adverse effects of niclosamide
11. Praziquantel
    a. Know the indications for the use of praziquantel (eg, neurocysticercosis, fluke infestation, schistosomiasis, tapeworm infestation)
12. Primaquine
    a. Know the role of primaquine in malaria prophylaxis and treatment
13. Pyrimethamine
    a. Know the role of pyrimethamine in the treatment of toxoplasmosis and its major adverse effects
14. Quinidine gluconate
    a. Know the indications for parenteral quinidine gluconate in the treatment of malaria
    b. Recognize the clinical manifestations of quinidine gluconate toxicity
15. Spiramycin

a. Know the possible role for spiramycin in the treatment of toxoplasmosis during pregnancy

16. Ivermectin
    a. Know the clinical indications for the use of ivermectin therapy (eg, strongyloides, ascariasis, onchocerciasis)
17. Paromomycin
    a. Know the pharmacologic properties of paromomycin
    b. Recognize the clinical indications for the use of paromomycin therapy
18. Nitazoxanide
    a. Recognize the major clinical indications for the use of nitazoxanide therapy (eg, cryptosporidium, Giardia)
19. Artesunate
    a. Recognize the major clinical indications for the use of artesunate therapy

E. Antimycobacterial drugs
1. Isoniazid
    a. Know the antimycobacterial properties of isoniazid, including type of activity
    b. Recognize that resistance to isoniazid can occur and those circumstances in which its incidence is increased
    c. Know the pharmacologic properties of isoniazid, including relative cerebrospinal fluid concentration, metabolism, elimination, toxicities, and drug interactions (eg, phenytoin)
    d. Recognize the clinical manifestations, risk factors (including age), and indications for monitoring for hepatotoxicity caused by isoniazid therapy
    e. Know the indications for pyridoxine supplementation for patients receiving isoniazid
    f. Recognize the interaction of isoniazid with other drugs administered concomitantly (eg, phenytoin)
2. Pyrazinamide
    a. Know the antibacterial properties of pyrazinamide, including type of activity
    b. Know the pharmacologic properties of pyrazinamide, including gastrointestinal absorption and distribution in body fluids such as cerebrospinal fluid and toxicities
    c. Know the adverse effects of pyrazinamide therapy
3. Other
    a. Know the indications for and toxicity of streptomycin therapy in patients with suspected or proven tuberculosis
    b. Know the indications for and toxicity of ethambutol therapy in patients with suspected or proven tuberculosis and its limitations (eg, static at lower dosages; low cerebrospinal fluid concentrations)
    c. Know the indications for and second line therapy and toxicity of ethionamide in patients with suspected or proven tuberculosis
    d. Know the indications for capreomycinin in patients with suspected or proven tuberculosis
    e. Know the indications for and second line therapy of clofazimine therapy in patients with suspected or proven tuberculosis
    f. Know the indications for and second line therapy for para-aminosalicylic (PAS) in patients with suspected or proven tuberculosis

g. Know the indications for and second-line therapy of cycloserine in patients with suspected or proven tuberculosis
h. Plan therapy for a child with a multidrug-resistant strain of Mycobacterium tuberculosis

F. Immunomodulators/biologic modulators
1. Antagonists to inflammation-inducing cytokines
a. Recognize situations in which specific antagonists (eg, monoclonal antibodies, soluble receptor antibodies) to inflammation-inducing cytokines and other targets may have beneficial effects, and understand the immunologic mechanisms for this as well as the complications
2. Pharmacologic inhibitors of inflammation
a. Recognize situations in which pharmacologic inhibitors of inflammation (eg, corticosteroids, cyclo-oxygenase inhibitors) have beneficial effects
3. Interferon
a. Know the three types of interferon, their major mechanisms of actions, and their role in host response to infection and as therapy for infectious diseases
b. Know the indications for interferons for therapy of infectious diseases in humans
c. Recognize the adverse effects of interferon therapy
4. Interleukins
a. Know the major effects of IL-2, -7, and -12 and the Th2 cytokines (IL-4, -5, -13), and their roles in the host response to infection
b. Know the roles of IL-2, -7, and -12 and the Th2 cytokines (IL-4, -5, and -13) in the treatment of infectious diseases
5. Colony stimulating factors
a. Recognize the actions and adverse effects of granulocyte and granulocyte/macrophage colony stimulating factor therapy and their roles in the treatment of infectious diseases
6. Activated protein C
a. Understand the use, indications, and toxicities of recombinant activated protein C (drotrecogin alpha (activated)) in the management of severe septicemia

5. **Prevention of Infectious Diseases**

A. General principles
1. Active immunization
a. Differentiate T-cell independent from T-cell dependent antigens
b. Know the generic contraindications for immunizations, including those for live-virus vaccines
c. Know the recommendations for immunization in a child in whom one or more vaccines may be contraindicated, such as in the case of egg allergy, neomycin allergy, or concurrent illness (eg, deferral, alternate schedules)
d. Know which vaccines are contraindicated in a child who has recently received immune globulin and for how long
e. Know the requirements for health care providers giving immunizations for record keeping, reporting of adverse events, and distribution of vaccine information materials (National Childhood Vaccine Injury Act)
f. Know the recommendations for immunization of preterm infants

g. Know the recommendations for immunization of immunocompromised patients and their household contacts, such as children with malignancy receiving chemotherapy, transplant recipients, or patients taking corticosteroids
h. Know the recommendations for immunization of an HIV-infected patient and household contacts
i. Know the indications and contraindications of vaccines to be considered for foreign travel (eg, typhoid, Japanese encephalitis, cholera, yellow fever)
j. Know which vaccines can be administered concurrently and guidelines for appropriate spacing of vaccines given at separate times (ie, two live-virus vaccines)
k. Know the principles for planning a vaccine schedule for healthy infants and children not immunized or incompletely immunized in the first year after birth
l. Know how to proceed with vaccine administration if the schedule is interrupted
m. Know the effect of active immunization with available childhood vaccines on carriage of the related microorganisms
n. Recognize common adverse reactions to vaccines

2. Passive immunization
   a. Know the differences in preparation and composition between immune globulin (IG) for intramuscular administration and that for intravenous administration (IVIG) and their duration of action
   b. Know the precautions in the use of IG and IVIG
   c. Know the adverse reactions to IG and IVIG
   d. Know the risk of administration of antibody-containing products prepared from animal sera
   e. Know the interval after IG or IVIG administration before specific vaccines (eg, live-virus vs protein vaccines) can be effectively given
   f. Know the indications for use of IG or IVIG
   g. Understand which classes of vaccines (ie, live vs attenuated) are affected by passive immunization
3. Chemoprophylaxis
   a. Know the indications and recommended duration of chemoprophylaxis for surgical wound infections

B. Active immunizations
1. Diphtheria
   a. Know the efficacy of diphtheria vaccine for prevention of disease and effect on C. diphtheriae colonization/carriage
   b. Plan a routine schedule for diphtheria immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if the schedule has been interrupted
   c. Know the duration of immunity following diphtheria immunization, and the recommendations for routine booster doses
   d. Recognize the adverse effects of diphtheria immunization at different ages
   e. Know the contraindications and precautions for diphtheria immunization, including administration during concurrent illness
   f. Manage a patient who has been exposed to diphtheria, including immunization and other therapy
2. Tetanus

a. Know the composition of tetanus vaccine, including nature of antigen(s) and adjuvants
b. Know the efficacy of tetanus vaccine, assuming completion of the primary series and recommended booster doses
c. Plan a routine schedule for tetanus immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted
d. Know the duration of immunity following tetanus immunization, and the recommendations for booster doses
e. Recommend tetanus immunization for a patient preparing for foreign travel based on past history of immunization and nature of the patient's trip
f. Recognize the adverse effects of tetanus immunization, including risks from excessive immunization
g. Assess the need for tetanus immunization (including passive and active) in a patient with a wound, based on prior immunization history

3. Pertussis
   a. Know the composition of different pertussis vaccines, including major antigens, adjuvants, and different product(s), (ie, whole-cell and acellular vaccines)
   b. Know the efficacy of pertussis vaccine, including differences based on definition of illness
   c. Plan a routine schedule for pertussis immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted
   d. Recognize the adverse effects of pertussis immunization, including their approximate frequency (common, occasional, rare) and their timing following immunization
   e. Understand the temporal and possible causal (or lack thereof) relationship between pertussis immunization and acute and chronic neurologic events
   f. Know the contraindications and precautions for pertussis (whole cell, acellular) immunization, including administration during concurrent illness
   g. Recommend immunization for a patient who has a contraindication (or precaution) for pertussis immunization (whole cell, acellular)
   h. Understand the limitations of current timing of pertussis immunization schedule in prevention of pertussis (eg, disease in very young infants and adolescents)
   i. Know the clinical efficacy, safety, and appropriate use of acellular pertussis vaccines
4. Poliovirus
   a. Know the efficacy of different poliovirus vaccines in prevention of disease and induction of gastrointestinal tract immunity (ie, prevention of carriage)
   b. Interpret the finding of poliovirus in the stool of a patient in different circumstances (eg, recent vaccination, presence or absence of symptoms), and determine if further tests are indicated (eg, CDC testing)
   c. Plan a routine schedule for poliovirus immunization, including age of the patient, number of doses and intervals and their reasons, duration of immunity following immunization, the resulting need (or lack thereof) for routine booster doses and recommendation if the schedule has been interrupted

d. Plan a poliovirus immunization schedule for a patient preparing to travel to an endemic area
e. Know the adverse effects of poliovirus immunization, including relative frequency according to number of doses and from contact with vaccine recipient
f. Know the contraindications and precautions for poliovirus immunization, including administration during concurrent illness
g. Know the indications for poliovirus vaccines
h. Manage a patient who requires poliovirus immunization because of special circumstances (eg, exposure to disease, outbreak control, immunocompromised patient, HIV-infected patient and their siblings, pregnancy, prematurity, unimmunized adult contacts)
i. Recognize the adverse effects of inactivated poliovirus vaccine
j. Understand the possible effect of inactivated poliovirus vaccine on subsequent shedding of revertant vaccine poliovirus
k. Understand the epidemiology and the relative importance of vaccine- associated paralytic poliomyelitis (VAPP) and circulating vaccine-derived poliovirus (cVDPV)

5. Measles
   a. Know the composition of measles vaccine, including its nature, tissue culture source, and vaccine constituents
   b. Know the immunogenicity and potential efficacy of measles vaccine in the prevention of infection
   c. Know the indications for administering measles vaccine at different ages (12 to 15 months vs 6 to 9 months) in different epidemiologic circumstances
   d. Plan a routine schedule for measles immunization, including age of the patient, number of doses, and intervals and their reasons
   e. Understand the reasons for a second dose of measles vaccine
   f. Recognize the reasons for measles vaccine failure, including the difference between primary and secondary failures
   g. Recommend a measles immunization schedule for a patient preparing to travel to an endemic area
   h. Recognize the frequency and timing of adverse effects of measles immunization
   i. Know the contraindications and precautions for measles immunization, including administration during concurrent illness
   j. Manage a patient who has a contraindication (or precaution) for measles immunization
   k. Manage a patient who requires measles immunization because of special circumstances (eg, exposure to disease, outbreak control, immunocompromised patient, HIV-infected patient and their siblings, pregnancy, receipt of IG)
   l. Recommend immunoprophylaxis (IG or vaccine) following measles exposure in the household and in a community outbreak
   m. Understand possible benefits and adverse effects of high-titer Edmonston-Zagreb measles vaccine
6. Mumps
   a. Know the composition of mumps vaccine, including nature of antigen and vaccine constituents

b. Know the effectiveness of mumps vaccine in disease prevention
c. Know the recommended schedule for mumps vaccination
d. Know the reasons why young adults may be susceptible to mumps
e. Recognize the frequency and timing of adverse reactions to mumps immunization and their frequency
f. Know the contraindications and precautions for mumps immunization, including administration during concurrent illness

7. Rubella
   a. Know the composition of rubella vaccine, including nature of antigens and tissue culture source
   b. Know the effectiveness of rubella vaccine in disease prevention
   c. Plan a routine schedule for rubella immunization, including age of initiation
   d. Know the duration of immunity following rubella immunization, and the resulting need (or lack thereof) for routine booster doses
   e. Recognize the adverse reactions to rubella immunization, including timing of occurrence, age- and gender-related frequency (ie, arthritis/arthralgia), and prognosis (ie, duration)
   f. Know the contraindications and precautions for rubella immunization, including administration during pregnancy
   g. Counsel a pregnant woman who inadvertently receives rubella vaccine or whose child receives rubella vaccine (eg, risk or lack thereof)
   h. Manage a patient who has a contraindication (or precaution) for rubella immunization
   i. Manage a patient who is found to be seronegative for rubella during pregnancy (ie, postpartum immunization)
   j. Recognize that rubella vaccine administered to a mother who is breast feeding her infant can be transmitted to the infant and know the consequences
8. Haemophilus influenzae type b
   a. Know the composition of Haemophilus influenzae type b vaccines, including nature of antigen(s), source, adjuvants, chemicals, and different product(s)
   b. Know the efficacy of Haemophilus influenzae type b vaccine
   c. Plan a routine schedule for Haemophilus influenzae type b immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted
   d. Know the indications for Haemophilus influenzae type b vaccination in persons older than 60 months of age
   e. Know the recommended schedule of Haemophilus influenzae type b (Hib) immunization for patients with underlying conditions predisposing to Hib disease
   f. Recognize the adverse effects of Haemophilus influenzae type b immunization with polysaccharide and conjugate preparations
   g. Recommend rifampin chemoprophylaxis for household and child-care contacts of patients with invasive Haemophilus influenzae type b disease, based on the immunization status of the contacts
9. Hepatitis B
   a. Know the composition of hepatitis B vaccine, including nature of antigen(s) and source

b. Know the recommended site of administration of hepatitis B vaccine for children and adults
c. Know the efficacy of hepatitis B vaccine
d. Understand the rationale of universal infant immunization against hepatitis B
e. Know the indications for serologic testing for hepatitis B in previously vaccinated persons
f. Know the indications for revaccination for hepatitis B for patients who do not respond to the initial series
g. Know the approach to patients who have the potential not to respond to hepatitis B vaccine
h. Know that hepatitis B immunization is ineffective in persons who are chronic carriers (HBsAg-positive)
i. Manage a patient who requires hepatitis B immunization because of exposure to disease or a chronic carrier in the household or through sexual contact
j. Know the indications for immunizing young adults against hepatitis B, including those traveling to areas with high incidences of hepatitis B infection
k. Know the proper use of hepatitis B immune globulin and hepatitis B vaccine in postexposure prophylaxis, including health care workers who have been previously immunized
l. Plan the schedule of immunization for hepatitis B (active and passive), including the specific timing of hepatitis B immune globulin and hepatitis B vaccine in the neonate born to a mother who is a chronic carrier (HBsAg-positive)
m. Plan a routine schedule for hepatitis B immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted
n. Know the duration of immunity following hepatitis B immunization, and the resulting need (or lack thereof) for booster doses
o. Recognize the possible adverse effects of hepatitis B immunization

10. Influenza
    a. Know the composition of influenza vaccine, including nature of antigen(s) (split- vs whole-virus), source, and different product(s)
    b. Know the effectiveness of influenza vaccine
    c. Plan a routine schedule, including type of vaccine according to age, for influenza immunization, including age of the patient, number of doses and intervals and their reasons based on past history of immunization
    d. Know the frequency and timing of adverse effects of influenza immunization
    e. Know the contraindications and precautions for influenza immunization
    f. Plan the management of a patient who has a contraindication (or precaution) for influenza immunization and is at increased risk for influenza
    g. Manage a patient who requires influenza immunization because of special circumstances (eg, exposure to disease, outbreak control, immunocompromised patient, HIV-infected patient and their siblings, pregnancy)
    h. Plan the appropriate use of cold-adapted influenza immunization
11. Streptococcus pneumoniae
    a. Know the composition of pneumococcal vaccines, including nature of antigen(s)
    b. Know the age-related immunogenicity and effectiveness of pneumococcal vaccines

c. Know the advantages/disadvantages of protein-conjugated and polysaccharide pneumococcal vaccines
d. Plan a routine schedule for Streptococcus pneumoniae immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted
e. Recommend the schedule for pneumococcal immunization in a child 24 to 59 months of age who is at high risk of invasive pneumococcal disease, based upon the number of previous doses of pneumococcal vaccine received
f. Recommend the schedule for pneumococcal vaccination in a patient who will be undergoing splenectomy

12. Neisseria meningitidis
    a. Know the composition of meningococcal vaccine, including nature of antigen(s)
    b. Know the indications for meningococcal polysaccharide and meningococcal conjugate vaccines, including timing of doses, use of the vaccines in outbreaks and as a possible adjunct to chemoprophylaxis (for close contacts of patients with invasive disease)
    c. Know the age-related immunogenicity and effectiveness of meningococcal vaccine
13. Rabies
    a. Know the composition of rabies vaccine, including nature of antigen(s)
    b. Know the indications for pre-exposure prophylaxis for rabies
    c. Know the factors important in the decision about whether to initiate postexposure rabies prophylaxis: type of exposure (bite, saliva in open wound, etc), type of biting animal, particular geographic area, provoked or unprovoked attack
    d. Plan the postexposure prophylaxis of rabies: washing of the wound with soap, administration of human rabies immune globulin (HRIG), initiation of the human rabies vaccine series
    e. Know the frequency and timing of adverse reactions to rabies immunization
14. Salmonella typhi
    a. Know the composition of typhoid vaccines, including nature of antigens and different products
    b. Know the indications for typhoid vaccines, including travel to an endemic area
    c. Know the duration of immunity following typhoid immunization, and the resulting need (or lack thereof) for booster doses
    d. Know the adverse reactions, contraindications, and precautions for typhoid immunization, including administration during concurrent illness
15. Mycobacterium tuberculosis
    a. Know the composition of BCG vaccine, including nature of antigen(s)
    b. Know the efficacy of BCG vaccine when given at different ages for prevention of different types of tuberculosis (pulmonary vs extrapulmonary)
    c. Recognize the adverse reactions to BCG immunization
    d. Interpret the meaning of a TST in a patient who has received BCG vaccination
16. Varicella
    a. Know the composition of and recommended timing of dosing of varicella vaccine
    b. Know the immunogenicity and efficacy of varicella vaccine at different ages
    c. Know the reasons for and concern about universal varicella immunization
    d. Recognize the frequency and timing of adverse effects of varicella immunization

e. Know the contraindications and precautions for varicella immunization

17. Hepatitis A
    a. Know the composition of hepatitis A vaccine, including nature of antigens, source, adjuvants, chemicals, and different products
    b. Know the efficacy of hepatitis A vaccine
18. Smallpox vaccine (vaccinia)
    a. Know the composition of smallpox vaccine
    b. Recognize and manage the complications of smallpox vaccination
    c. Know the contraindications and precautions for smallpox vaccination (severe eczema, immunosuppressed patients, pregnancy)
19. Rotavirus vaccine
    a. Know the composition, immunogenicity, dosing schedule, precautions, contraindications, and efficacy of the rotavirus vaccine
20. Human papillomavirus
    a. Understand the contraindications of the human papillomavirus (HPV) vaccine
    b. Understand the components of the two available vaccines for the prevention of human papillomavirus (HPV)
    c. Know the composition of and indications for human papillomavirus (HPV) vaccine

C. Passive immunoprophylaxis
1. Hepatitis A
    a. Know the special products used for passive immunoprophylaxis for hepatitis A
    b. Know the indications and timing for passive immunoprophylaxis for hepatitis A
    c. Understand the efficacy of passive immunoprophylaxis for hepatitis A, including timing after exposure and duration of protection
    d. Know the role of active and passive immunizations for hepatitis A
2. Hepatitis B
    a. Know the special products used for passive immunoprophylaxis for hepatitis B (ie, hyperimmune globulin)
    b. Know the indications and timing for passive immunoprophylaxis for hepatitis B
    c. Understand the efficacy of passive immunoprophylaxis for hepatitis B and the rationale for concurrent active immunization
3. Measles
    a. Know the products used for passive immunoprophylaxis for measles
    b. Know the indications and timing for passive immunoprophylaxis for measles
    c. Understand the rationale of passive immunoprophylaxis for measles following exposure
4. Varicella
    a. Know the special products used for passive immunoprophylaxis for varicella (ie, VZIG)
    b. Know the indications and timing for passive immunoprophylaxis for varicella
    c. Understand the efficacy and rationale of passive immunoprophylaxis for varicella, including newborn infants whose mothers have varicella
    d. Recognize the effects of passive immunoprophylaxis for varicella on disease recurrence (ie, delay in onset, amelioration of infection)
5. Rabies
    a. Know the special products used for passive immunoprophylaxis for rabies

b. Know the indications and timing for passive immunoprophylaxis for rabies, in combination with active immunization

6. Tetanus
   a. Know the special products used for passive immunoprophylaxis for tetanus
   b. Know the indications and timing for passive immunoprophylaxis for tetanus in wound management in combination with active immunization
7. Cytomegalovirus
   a. Plan the appropriate use of cytomegalovirus hyperimmune globulin in transplant recipients
8. Respiratory syncytial virus
   a. Know the efficacy and potential uses of monoclonal antibodies in the prevention and treatment of respiratory syncytial virus infection
9. Vaccinia immune globulin
   a. Know the indications for the use of vaccinia immune globulin (VIG) for the treatment of complications of smallpox vaccine and for the prevention of smallpox

6. **Immunity and Host Defense**

A. Barriers
   1. Know the mechanical barriers important to host defense (eg, cilia, nonspecific and secretory IgA on mucosa, vascular perfusion)
   2. Know the physical barriers important to host defense (eg, skin, mucous membranes)
   3. Know the chemical barriers important to host defense (eg, pH of vagina and stomach; fatty acids in skin and stomach; defensins and other peptides; nonspecific and secretory IgA on mucosa)

B. Humoral
   1. Secretory antibodies
      a. Understand the properties of secretory antibodies in host defense
   2. Circulating antibodies
      a. Know the mechanism of action in host defense of circulating antibodies
      b. Recognize age-related changes that occur in serum IgG, IgM, and IgA concentrations
      c. Recognize age-related occurrence and laboratory abnormalities of transient hypogammaglobulinemia
      d. Recognize the clinical features and laboratory findings in a patient with X-linked agammaglobulinemia
   3. Complement
      a. Understand the role of complement in host defense
      b. Understand the mechanisms that initiate and control activity of the complement system
      c. Know laboratory assays used to measure serum complement concentrations (eg, total hemolytic component vs specific component concentrations)
   4. Other
      a. Recognize that opsonization may be mediated by mannose-binding lectin and C-reactive protein
      b. Recognize humoral factors that are important in opsonization

C. Phagocyte function
   1. General

a. Understand the role of adherence in phagocyte function
b. Understand the role of chemotaxis in phagocyte function
c. Understand the mechanisms of phagocyte ingestion and killing of microbes and recognize the clinical features of disorders of phagocyte killing (eg. chronic granulomatous disease)

2. Polymorphonuclear neutrophils
   a. Recognize the significance of a leftward shift of PMNs on blood smear
   b. Understand the significance of release of PMNs from bone marrow and how it affects host defense
   c. Understand the significance of release of PMNs from the marginal pool and how it affects host defense
   d. Know the usual cause to consider when specific abnormalities occur in the peripheral blood leukocyte count (eg, lymphocytosis, atypical lymphocytes, eosinophilia, neutropenia, leukemoid reactions)
   e. Recognize the clinical presentation of leukocyte adhesion deficiency
3. Macrophages
   a. Understand the need for macrophage activation to mediate effective host defense
   b. Understand how macrophages function and what diseases are associated with defective function of these cells
4. Dendritic cells
   a. Understand the importance of dendritic cells in the initiation of adaptive immunity

D. Cell-mediated immunity
1. Know that cell-mediated immunity is dependent upon the interaction of T cells with macrophages and dendritic cells
2. Recognize what T-cell, macrophage, and microbial factors are capable of inducing macrophage activation
3. Recognize the subsets of T cells (T helper 1, T helper 2, T helper 17) and how they function in host defense
4. Recognize the clinical features and laboratory findings of severe combined immunodeficiency (SCID) and the Hyper-IgM syndrome
5. Know the age-related ranges for various types of peripheral blood mononuclear cells

E. Toll-like receptors
1. Understand the role of toll-like receptors in the recognition of pathogen-derived molecules (eg, lipopolysaccharide, bacterial flagellin) and in influencing the immune response to infection

F. Other
1. Understand which of the mechanisms of host defense are active in protecting against extracellular bacteria (eg, pyogens)
2. Understand which of the mechanisms of host defense are active in protecting against fungi (neutrophils, cellular immunity)
3. Understand which of the mechanisms of host defense are active in protecting against Chlamydia
4. Understand which of the mechanisms of host defense are active in protecting against intracellular pathogens (eg, mycobacteria, viruses)
5. Understand which of the mechanisms of host defense are active in protecting against protozoa

6. Understand which of the mechanisms of host defense are active in protecting against toxin mediated illnesses (eg, T helper 2 response)
7. Understand how neonatal screening for severe combined immunodeficiency is performed (eg. quantitative PCR for TRECs)

7. **Mechanisms of Infectious Disease**

A. Normal flora
1. Know the normal flora of a full-term newborn infant and the timing of colonization
2. Compare the intestinal and skin flora of infants in an intensive care nursery with the flora of full-term infants in a normal infant nursery
3. Identify possible factors in different patterns of neonatal colonization in patients receiving intensive care, including human milk
4. Recognize likely organisms in the normal flora at different body sites of normal hosts (eg, skin, oral mucous membranes, respiratory tract, conjunctivae, upper gastrointestinal tract, lower gastrointestinal tract, genitourinary tract)
5. Appreciate the difference between transient and resident skin flora on the hands of hospital employees
6. Know the role of bacterial interference in the establishment of host flora

B. Bacteria
1. Recognize the bacterial properties that promote evasion of or deter phagocytosis (eg, polysaccharide capsule)
2. Recognize the bacterial constituents particularly active in promoting inflammation (eg, teichoic acid, endotoxins, and flagellin)
3. Recognize intracellular bacteria (Brucella, Pasteurella, Listeria, mycobacteria), and how they resist elimination by the host
4. Recognize extracellular bacteria (eg, streptococci, pneumococci, H. influenzae) and how they resist elimination by the host
5. Understand the role of humoral immunity in controlling bacterial infection
6. Understand the mechanism of clearance and killing of bacteria by neutrophils and monocytes

C. Virus
1. Know that viruses have proteins or glycoproteins on their surface which attach to specific receptor sites on cell surfaces, and that tropism for particular tissues is influenced by the surface attachment protein or glycoprotein and the cell surface receptor
2. Know that the host immune response may be important in producing clinical disease by immunopathologic damage of tissues (eg, EBV, postinfectious encephalitis, RSV)
3. Know that viruses can become latent in cells by integrating into the host cell genome or by remaining as an episome in the cytoplasm of the cell
4. Understand how viruses cause disease: replicating in surface mucous membrane cells, reaching regional lymph nodes and then spreading through the blood stream (viremia) to seed target organs
5. Know the viruses that cause chronic and/or latent infection
6. Know the major steps in the viral replication cycle and which ones are targets for antiviral and interferon therapy
7. Know that humoral immunity is important for recovery from some viral infections, particularly enteroviruses

8. Know that T cell-mediated immunity is important for recovery from most viral infections
9. Know the viral infections that can be severe and/or chronic in patients with antibody deficiency
10. Know the viral infections that can be severe and/or chronic in patients with impaired cell-mediated immunity
11. Recognize that new viral antigens appearing on cell surfaces are important triggers for host humoral and cell-mediated immunity
12. Understand the mechanism of mucosal and/or serum antiviral antibody in resistance to reinfection and efficacy of viral vaccines
13. Know the viruses etiologically associated with cancer in humans
14. Know that natural killer cells are important in recovery from primary herpes virus infections

D. Parasites
1. Recognize the principles of induction of inflammation by parasites (eg, eosinophilia)
2. Know the mechanism of intracellular persistence of parasitic infestations
3. Identify immune deficiencies associated with parasitic infestations
4. Understand the mechanisms of host defense that are active in protecting against multicellular parasites (eg, worms)

E. Inflammation
1. Know how cytokines (IL-1, IL-6, IL-17, TNF-alpha) contribute to the inflammatory response
2. Understand the clinically relevant roles of neutrophils and macrophages and complement in inflammation

8. **Infections in Special Circumstances**

A. Nosocomial infections
1. Hospital environment
a. Identify frequently encountered organisms that infect children in neonatal and pediatric intensive care units, and manifestations of infections they cause
b. Understand methods of transmission of bacterial pathogens in the hospital environment
c. Understand methods of transmission of viral pathogens in the hospital environment
d. Understand principles of standard precautions
e. Plan appropriate isolation procedures (strict, contact, airborne, and AFB isolation) to be used for hospitalized children with various categories of diseases
f. Understand the rationale for different isolation and barrier precautions for the prevention of transmission of microorganisms
g. Plan management of patients with draining lesions, including S. aureus, gut flora, chronic draining otitis media
h. Plan intervention in a hospital unit after patient exposure to pertussis
i. Plan intervention in various hospital units (eg, full-term nursery, NICU, general unit) after patient exposure to varicella
j. Plan intervention when an excessive number of cases of C. difficile or rotavirus infection occur
k. Know employee illnesses that preclude work (eg, conjunctivitis, diarrhea, vesicular rashes)

l. Plan investigation/intervention for hospital-associated gastroenteritis according to pathogen
m. Know predisposing factors to hospital-acquired infection (eg, catheter, intensive care exposure)
n. Know predisposing factors to surgical wound infections
o. Develop infection control strategies for neonatal nursery outbreaks of various infections (eg, MRSA, Klebsiella, varicella, RSV)
p. Know that bacteria causing nosocomial infection in neonatal and pediatric intensive care units may be resistant to commonly used antibiotics (eg, cephalosporin, aminoglycosides)
q. Develop infection control recommendations for management of patients with methicillin-resistant staphylococcal infections
r. Recognize infections caused by opportunistic pathogens in very-low- birth-weight infants in intensive care units (eg, coagulase-negative staphylococcus, Candida)
s. Recommend infection control measures for a pediatric unit during an outbreak of RSV in the community
t. Recommend appropriate skin and cord care for a newborn infant
u. Recommend appropriate use of isolation rooms to prevent spread of infection
v. Know the risk of transmitting microbial agents via blood and blood products
w. Recognize the relative contamination rate for blood products
x. Know the importance of screening tests to detect microorganisms transmissible in blood products
y. Know the standard procedures for screening blood products for HIV
z. Develop infection control recommendations for a patient with a vancomycin-resistant enterococcal infection

2. Device-related infections
a. Plan the management of a febrile patient with a prosthetic cardiac valve
b. Identify the organisms with which patients with urinary catheters become infected
c. Identify the organisms with which patients with intravascular catheters become infected
d. Identify the organisms with which patients with central nervous system catheters become infected
e. Identify the organisms with which patients with peritoneal catheters become infected
f. Recognize the clinical manifestations of infections in patients with urinary catheters
g. Recognize the clinical manifestations of infections in patients with intravascular catheters
h. Recognize the clinical manifestations of infections in patients with central nervous system catheters
i. Recognize the clinical manifestations of infections in patients with intraperitoneal catheters
j. Know the methods of diagnosis in patients with catheter-induced infection
k. Plan the management of a patient with a catheter-related infection (eg, urinary, intravascular, central nervous system, peritoneal)

l. Recognize the complications of infection related to a catheter (eg, urinary, intravascular, CNS, peritoneal)
m. Know the prognosis, likelihood of cure, and complications depending on catheter site and organism causing catheter-related infection
n. Plan specific methods to control or prevent urinary catheter-related infections
o. Evaluate methods to control or prevent intravascular catheter- related infections (eg, relative risk by site, type of dressing)
p. Plan specific methods to control or prevent central nervous system catheter-related infections
q. Know the organisms to which patients undergoing hemo- or peritoneal dialysis are most susceptible (frequency or severity of infection)
r. Recognize the clinical manifestations of infections to which patients undergoing hemo- or peritoneal dialysis are most prone
s. Know specific measures, and their effectiveness, for prevention and control of infection and for chemoprophylaxis in patients undergoing hemo- or peritoneal dialysis
t. Evaluate methods to prevent or control infections as a result of mechanical ventilation
u. Recognize the clinical manifestations of infections as a result of mechanical ventilation, and manage appropriately

B. Child care
1. Know what diseases are acquired by adults from children who attend child-care centers (eg, CMV, hepatitis A, parvovirus), and the routes of transmission
2. Know what diseases are acquired by children from adults working in child-care centers (eg, tuberculosis)
3. Know the "exclusion policies" for child-care attendance and their rationale
4. Plan the management of child-care contacts when an attending child has hepatitis A
5. Plan the management of child-care contacts when an attending child has acute or chronic hepatitis B infection
6. Plan the management of child-care contacts when an attending child has diarrhea
7. Plan the management of child-care contacts when an attending child has bacterial meningitis
8. Recognize pathogens spread by respiratory secretions and the ability/inability to control spread in child-care center attendees
9. Recognize pathogens spread by the enteric route and the ability/ inability to control spread in child-care center attendees
10. Recognize pathogens that can be spread by blood contact, including blood transfusion, in child-care center attendees
11. Recognize pathogens spread by skin contact and the ability/inability to control spread in child-care center attendees
12. Recognize the risks for adverse fetal outcome for a pregnant woman who is working in a child-care center and is exposed to children with transmissible infection (eg, parvovirus B19)
13. Plan outbreak control for a child-care center with multiple cases of diarrheal disease
14. Make recommendations, according to etiology, for a child-care center for control of herpes virus infections

15. Make recommendations for a child-care center for control of parvovirus B19 infections
16. Make recommendations for child-care center attendees and staff members for control of varicella
17. Make recommendations for a child-care center for control of lice infestation
18. Make recommendations to a child-care center for control of CMV infection
19. Make recommendations to a child-care center for control of varicella-zoster infection
20. Make recommendations for control of infectious diseases in a child-care center (eg, hand washing, food preparation, diaper changing)

C. Internationally adopted and immigrant children
1. Know the infectious diseases which are of special importance to internationally adopted and immigrant children by country of origin (eg, tuberculosis, hepatitis B, HIV)
2. Know what medical evaluation (including screening) internationally adopted and immigrant children should receive
3. Recognize the long-term consequences of infectious diseases that infect internationally adopted and immigrant children
4. Know the recommendations for family members after adoption of or immigration of an HBsAg-positive child

D. Foreign travel
1. Know indications for immune globulin for foreign travel
2. Recognize when malaria prophylaxis is necessary for foreign travel
3. Plan precautions to prevent enteric disease and hepatitis A during foreign travel
4. Know the most common etiologic agents and treatment for enteric disease during foreign travel
5. Recognize the likely pathogens causing enteric disease after return from foreign travel
6. Recommend specific vaccine administration prior to foreign travel (eg, MMR, Salmonella, cholera, Japanese encephalitis, poliovirus vaccines)
7. Know that current data regarding risk of infection and options for chemoprophylaxis for foreign travelers (eg, current regional epidemics such as malaria) are available on the CDC website for physicians
8. Understand indications and contraindications for vaccines for travelers

E. Medical care personnel
1. Make recommendations for medical care personnel who have had standard-care exposure to a patient with hepatitis A
2. Make recommendations for medical care personnel who have been exposed to a patient with hepatitis B
3. Make recommendations for medical care personnel who have been exposed to a patient with varicella
4. Make recommendations for medical care personnel who have been exposed to a patient with tuberculosis
5. Know methods to diminish needle-stick injury to medical personnel
6. Understand the risk of HIV transmission to medical care personnel by needle-stick injury
7. Make recommendations following needle-stick injury from a patient with HIV infection

8. Know risks of pregnant hospital care personnel for exposure to patients with CMV or paravirus B19 infections
9. Make recommendations for medical care personnel exposed to a patient with pertussis
10. Make recommendations for immunization of hospital personnel with varicella vaccine
11. Make recommendations for the adult Tdap vaccine for hospital personnel

F. Facilities for handicapped individuals
   1. Know what diseases children in facilities for the handicapped acquire in excess of the general population (eg, hepatitis A and B, diarrhea, CMV)

G. Bioterroristic threats
   1. Recognize the agents most likely to be used in bioterrorism (eg, smallpox, B. anthracis, C. botulinum, F. tularensis, Y. pestis) and their typical associated symptoms
   2. Make recommendations for personnel regarding immunization and isolation of patients infected as a result of bioterrorism (eg, smallpox, B. anthracis, C. botulinum, F. tularensis, Y. pestis)

H. Zoonoses
   1. Plan the management of an animal bite, including wound care, immunoprophylaxis, and chemoprophylaxis (eg, by type of animal, site of bite, type of wound)
   2. Identify infections acquired from direct or indirect contact with animals (eg, leptospirosis, tularemia, brucellosis)
   3. Understand what animals characteristically carry infection-bearing vectors such as ticks and fleas (eg, rats/fleas/plague; deer/ticks/ B. burgdorferi)

9. **Infections in High-Risk Hosts**

A. Primary immunodeficiency
   1. Leukocyte adhesion defects
      a. Recognize the usual presenting clinical and laboratory features of leukocyte adhesion defects
      b. Identify the usual microorganisms infecting patients with leukocyte adhesion defects
   2. Chronic granulomatous disease
      a. Recognize the usual presenting clinical and laboratory features of chronic granulomatous disease
      b. Identify the usual microorganisms infecting patients with chronic granulomatous disease
      c. Plan a diagnostic evaluation for a patient with suspected chronic granulomatous disease
      d. Plan specific long term preventive therapy for a patient with chronic granulomatous disease (eg, trimethoprim with sulfamethoxazole, interferon gamma, itraconazole)
   3. Hyperimmunoglobulin E syndrome
      a. Recognize the usual presenting clinical and laboratory features of hyperimmunoglobulin E syndrome
      b. Identify the usual microorganisms infecting patients with hyperimmunoglobulin E syndrome
      c. Plan a diagnostic evaluation for a patient with suspected hyperimmunoglobulin E syndrome

    d. Plan specific long-term preventive therapy for a patient with hyperimmunoglobulin E syndrome
    e. Recognize the usual presenting clinical features of and usual microorganisms infecting patients with Chediak-Higashi syndrome
4. Hyperimmunoglobulin M syndrome
    a. Recognize the usual presenting clinical features of hyperimmunoglobulin M syndrome
    b. Identify the usual microorganisms infecting patients with hyperimmunoglobulin M syndrome
    c. Plan a diagnostic evaluation for a patient with suspected hyperimmunoglobulin M syndrome
    d. Plan specific long term preventive therapy for a patient with hyperimmunoglobulin M syndrome, including stem cell transplantation
5. Neutropenia (congenital/cyclic)
    a. Recognize the usual presenting clinical and laboratory features of congenital or cyclic neutropenia
    b. Identify the usual microorganisms infecting patients with congenital or cyclic neutropenia
    c. Recognize that neutropenia can be a manifestation of primary immunodeficiency involving B and T cells
6. Asplenia/hyposplenia
    a. Recognize conditions associated with asplenia/hyposplenia
    b. Identify the usual microorganisms infecting patients with asplenia/hyposplenia
    c. Plan a diagnostic evaluation for a patient with suspected asplenia/hyposplenia
    d. Plan specific long-term preventive therapy for a patient with suspected asplenia/hyposplenia, including immunizations and antibiotics
7. X-linked agammaglobulinemia
    a. Identify the usual microorganisms infecting patients with X-linked agammaglobulinemia
    b. Plan specific long-term preventive therapy for a patient with X-linked agammaglobulinemia
    c. Recognize chronic enteroviral syndrome in a patient with X-linked agammaglobulinemia
    d. Plan a diagnostic evaluation for a patient with suspected X-linked agammaglobulinemia
8. Selective IgA deficiency
    a. Identify the clinical manifestations suggestive of IgA deficiency
    b. Understand the clinical significance of IgA deficiency
    c. Recognize conditions associated with IgA deficiency
    d. Plan a diagnostic evaluation for a patient with suspected IgA deficiency
9. Common variable immunodeficiency
    a. Identify the usual microorganisms infecting patients with common variable immunodeficiency
    b. Plan specific long-term preventive therapy for a patient with common variable immunodeficiency
    c. Recognize the clinical manifestations of common variable immunodeficiency

10. Transient hypogammaglobulinemia of infancy
    a. Identify the usual microorganisms infecting patients with transient hypogammaglobulinemia of infancy
    b. Recognize the laboratory abnormalities associated with transient hypogammaglobulinemia of infancy
11. Complement
    a. Recognize the usual presenting clinical features associated with complement component deficiency
    b. Identify the usual microorganisms causing infection in complement deficient patients
    c. Plan the laboratory diagnosis of complement deficiency
    d. Plan specific long term therapy for a patient with complement deficiency, including immunization with meningococcal conjugate vaccine
12. Cell-mediated immunity
    a. Identify the clinical manifestations and usual microorganisms associated with severe combined immunodeficiency, including but not limited to adenosine deaminase deficiency
    b. Plan the laboratory evaluation for a patient with suspected severe combined immunodeficiency
    c. Recognize the laboratory abnormalities associated with adenosine deaminase deficiency
    d. Identify the clinical manifestations and usual microorganisms associated with purine nucleoside phosphorylase deficiency
    e. Recognize the laboratory abnormalities associated with purine phospnucleoside efficiency
    f. Identify the clinical manifestations and usual microorganisms associated with ataxia-telangiectasia syndrome
    g. Recognize the laboratory abnormalities associated with ataxia- telangiectasia syndrome
    h. Identify the clinical manifestations and usual microorganisms associated with Wiskott-Aldrich syndrome
    i. Recognize the laboratory abnormalities associated with Wiskott- Aldrich syndrome
    j. Recognize the laboratory abnormalities associated with thymic aplasia (eg, DiGeorge, velocardiofacial syndromes)
    k. Plan the laboratory diagnosis of thymic aplasia (eg, DiGeorge, velocardiofacial syndromes), including genetic testing
    l. Plan long-term management of a patient with severe combined immunodeficiency, including prophylactic therapies prior to transplantation
    m. Recognize the usual presenting clinical and laboratory features associated with intestinal lymphangiectasia
    n. Recognize the clinical manifestations of DiGeorge syndrome and the need for special precautions in the use of blood products in affected patients
    o. Understand the role of T-cell immunity in protecting the body from immunologically active graft cells
13. Interferon and interleukin-12 pathway defect

a. Recognize that patients who have genetic mutations have an increased susceptibility to infection (eg, nontuberculous bacteria, vaccine-associated BCG, Salmonella species, some viruses)

B. Congenital, natal, and postnatal infections
   1. Recognize the typical clinical syndrome of congenital infections (eg, small for gestational age, hepatosplenomegaly, petechiae/purpura, icterus, eye defects, cardiac defects, micro- or hydrocephaly)
   2. Identify the specific etiologic agent responsible for congenital infections based on clinical manifestations (eg, CMV, rubella, Toxoplasma, parovirus, syphilis)
   3. Recognize the typical clinical syndrome for organisms (CMV, HIV, HSV, Chlamydia, enterovirus) acquired natally (during the birth process) or postnatally (nosocomial or from family): acute illness days to weeks after birth, fever, pneumonitis, hepatitis, mucocutaneous lesions
   4. Plan the diagnostic evaluation for suspected congenital infection (eg, varies according to pathogen, routine IgG TORCH titers not useful except to rule out congenital infection)
   5. Interpret the laboratory results for diagnostic evaluation for suspected congenital infection
   6. Plan the diagnostic evaluation for suspected nonbacterial natal/ postnatal infection
   7. Interpret the laboratory results from diagnostic evaluation for suspected nonbacterial natal/postnatal infection

C. Premature, low-birth-weight infants, including those with BPD
   1. Understand the pathophysiologic mechanisms and iatrogenic factors that contribute to the susceptibility of premature, low-birth-weight- infants especially those with BPD to infection in the natal and post- natal periods and during the first years after birth (eg, respiratory)
   2. Appreciate the increased frequency and prolonged complications of respiratory infections of infants with BPD compared to normal children of similar age
   3. Know the specific measures for prevention and control of infection in premature, low-birth-weight-infants and evaluate their effectiveness, including the timing of vaccines and other prophylactic measures, such as monovalent RSV antibody

D. Conditions exacerbated by infection
   1. Cystic fibrosis
      a. Know the organisms to which the patient with cystic fibrosis is most susceptible (frequency or severity of infection)
      b. Know the pathophysiologic mechanisms that contribute to susceptibility to infection in the patient with cystic fibrosis
      c. Identify the clinical manifestations, site, course, and prognosis of various infections in the patient with cystic fibrosis, and how they differ from the normal host
      d. Know the preferred empiric therapy for various infections in the patient with cystic fibrosis, and how it differs from the normal host
      e. Know specific measures, and their effectiveness, for prevention and control of infection in the patient with cystic fibrosis (eg, isolation, antibiotics, immunizations, nutrition)
   2. Asthma

a. Know the organisms to which patients with asthma are most susceptible (frequency or severity of infection)
b. Know the pathophysiologic mechanisms that contribute to susceptibility to infection in patients with asthma
c. Identify the clinical manifestations, course, and prognosis of various infections in patients with asthma, and how they differ from the normal host
d. Know specific measures, and their effectiveness for immuno- and chemoprophylaxis, of infection in patients with asthma (eg, influenza vaccine)
e. Know the organisms most likely to trigger an asthmatic exacerbation (rhinovirus, RSV, and metapneumovirus)

E. Burns
1. Know the organisms to which a patient with burn injury is most susceptible (frequency, timing, severity of infection, bacterial resistance)
2. Know the pathophysiologic and immunologic mechanisms that contribute to susceptibility to infection in a patient with burn injury
3. Recognize the clinical manifestations of infection (bacterial or viral such as CMV) in a patient with burn injury, and how they differ from the normal host
4. Recognize the major complications of infection of greatest concern in a patient with burn injury
5. Know specific measures, and their effectiveness, for prevention and control of infection and for chemoprophylaxis in a patient with burn injury

F. Contaminated wounds
1. Recognize predisposing factors responsible for subcutaneous infections/abscesses/cellulitis caused by less common organisms, including those associated with contaminated wounds, and know the appropriate approach to empiric therapy in such instances

G. HIV
1. Recognize the risk factors for acquisition of HIV, and the timing of disease presentation
2. Understand patterns and frequency of transmission of HIV in children, adolescents, and adults
3. Recognize the immunologic aberrations and other laboratory abnormalities in patients with HIV infection according to the age of the patient
4. Identify the clinical manifestations and natural history of common pathogens in patients with HIV infection (eg, recurrent otitis media, pneumococcal septicemia, severe viral infection)
5. Recognize the specific manifestations of HIV infection in children and adolescents (eg, interstitial pneumonia, encephalopathy, lymphadenopathy, parotitis, hepatosplenomegaly)
6. Know the preferred means of diagnosis of opportunistic infection in patients with HIV infection
7. Know specific measures, their indications, and their effectiveness for immuno- and chemoprophylaxis of infection in a patient with HIV (eg, P. jirovecii pneumonia, vaccines)

8. Know the relative value of serology, culture and other laboratory tests (eg, p24 antigen, CD4 counts, HIV DNA PCR) in the diagnosis of HIV infection according to the age of the patient
9. Recognize the clinical course of HIV infection according to age and mode of acquisition
10. Know the indications for and limitations of antiviral therapy for HIV infection in children and adolescents
11. Identify the clinical manifestations and natural history of opportunistic infections in patients with HIV infection (eg, Pneumocystis, atypical mycobacteria, M. tuberculosis, CMV, intestinal protozoa, human papillomavirus
12. Recommend infection control measures and vaccinations for family members of a patient with HIV infection
13. Plan appropriate management of an infant whose mother has a positive HIV test
14. Recognize malignancies associated with HIV infection in children
15. Identify appropriate methods (diagnostic, pharmacologic and obstetric) for prevention of maternal transmission of HIV to her fetus
16. Know the indications for limitations of, and specific contraindications regarding antiretroviral therapy for pregnant HIV-infected adolescents and young adults
17. Plan a therapeutic regimen of combination antiretroviral therapy in an HIV-infected child or adolescent
18. Know the clinical manifestations of acute retroviral syndrome and appropriate diagnostic testing
19. Know the value of laboratory tests (eg. genotyping and quantitative HIV RNA PCR) in the treatment of HIV-infected children and adolescents
20. Know the appropriate methods of post-exposure prophylaxis and their indications after possible non-occupational exposure to HIV
21. Recognize comorbid conditions that impact successful treatment of HIV-infected adolescents (eg, mental illness, illicit drug use, limited social support)

H. Immunosuppressed patients
   1. Cancer
      a. Know the organisms to which the patient with cancer is most susceptible (frequency or severity of infection)
      b. Know the types of immunocompromise that contribute to susceptibility to infection in patients with cancer
      c. Identify the clinical manifestations, course, and prognosis of various infections in patients with cancer, and how they differ from the normal host
      d. Know the pathogens and empiric therapy for a patient with cancer who also has pneumonia (eg, diffuse, interstitial, localized)
      e. Plan evaluation of a patient with cancer who also has pneumonia
      f. Plan initial management of a neutropenic febrile cancer patient who has no focus of infection
      g. Plan management of a neutropenic febrile cancer patient after initial broad-spectrum antibiotic therapy, including when fever continues, when a specific organism is identified, and when neutropenia resolves
      h. Understand when specific antifungal therapy is required in a patient with cancer

i. Know specific measures, and their effectiveness for immuno- and chemoprophylaxis, of infection in patients with cancer

2. Transplantation
   a. Plan immunizations for a patient awaiting transplantation, and the patient's family
   b. Know the organisms to which a patient who has undergone transplantation is most susceptible according to period of time that has elapsed after organ transplantation and the site of infection (eg, pneumonia, cytomegalovirus disease)
   c. Know the causes of immunocompromise that contribute to susceptibility to infection in patients who have undergone transplantation
   d. Identify the clinical manifestations, course, and prognosis of various infections in patients who have undergone transplantation, and how they differ from the normal host
   e. Know the preferred empiric therapy for various infections in patients who have undergone transplantation, and how it differs from the normal host
   f. Know the treatment of choice for various infections in patients who have undergone transplantation, and how it differs from the normal host (eg, route and duration of therapy)
   g. Plan the initial evaluation and management of an immunocompromised transplant patient in whom fever or a particular focus of infection develops
   h. Know specific measures, and their effectiveness for antibacterial, antiviral, antifungal, immuno- and chemoprophylaxis, in patients during and following transplantation
   i. Understand the need to avoid antibiotics that suppress neutrophil production and maturation in patients who have recently undergone hemopoietic stem cell transplantation
   j. Understand the immunocompromised status of patients receiving therapy for graft versus host disease
3. Corticosteroid therapy
   a. Know the organisms to which a patient receiving corticosteroid therapy is most susceptible (frequency or severity of infection)
   b. Understand the relative risk of increased susceptibility to infection (eg, varicella) in a patient receiving corticosteroid therapy according to type, dose, mode, and duration
   c. Know the preferred empiric management for various infections in patients receiving corticosteroid therapy, and how it differs from the normal host
   d. Know specific measures, and their effectiveness, indications, and contraindications for immuno- and chemoprophylaxis, of infection in patients receiving corticosteroid therapy (eg, live-virus vaccine)
4. Acquired neutropenia
   a. Plan the diagnostic evaluation and management of a previously normal patient who has the acute onset of neutropenia and fever and/or a particular focus of infection
   b. Understand the relative risk of increased susceptibility to infection according to degree, duration, and cause of neutropenia (eg, suppression from viral, antibiotic, or cancer therapy or whether it is cyclic)
   c. Know specific measures and their effectiveness, indications, and contraindications for immuno- and chemoprophylaxis of infection in patients with neutropenia

d. Know the increased risk of streptococcus viridans infection in children with neutropenia following chemotherapy with cytosine arabinoside

I. Malnutrition
1. Know the organisms to which patients with malnutrition are most susceptible with regard to frequency or severity of infection, and that outcome is worse
2. Know that specific nutritional deficiencies (eg, vitamin A, zinc) contribute to increased severity of respiratory and gastrointestinal tract infections
3. Recognize the immunologic deficits associated with malnutrition (eg, cell-mediated immunity)
4. Identify the effects of infection on the nutritional status (eg, nitrogen loss with typhoid fever and tuberculosis)

J. Metabolic and liver disease
1. Identify the organisms to which patients with chronic liver disease are most susceptible
2. Identify the organisms to which patients with metabolic disease (eg, galactosemia) are most susceptible

10. **Epidemiology and Principles of Epidemiologic Research/Biostatistics**

A. Principles of outbreak investigations
1. Evaluate disease outbreaks (eg, in a newborn nursery, child-care center, school) to determine likely source, cause, mode of acquisition, and resulting recommendations
2. Calculate an incidence (attack) rate, secondary attack rate, and case fatality rate in an outbreak
3. Recognize the epidemiologic characteristics indicative of a common source outbreak (eg, contaminated vehicle)
4. Differentiate rates of infection, disease, and colonization

B. Modes of transmission
1. Know the major routes of transmission/acquisition of micro-organism (eg, type of contact, common vehicle, airborne, vectorborne)
2. Know major sources and reservoirs of different microorganisms, including sites of colonization and shedding

C. Infection control in hospitalized children
1. Differentiate sterilization, disinfection, cleaning, and decontamination in hospital infection control procedures
2. Know the predisposing factors for hospital-acquired infection by organ system, including lung, urinary tract, skin, blood, CNS, and GI tract
3. Develop a policy for immunizing health-care professionals in a hospital as well as a plan for how to implement the policy (eg, to ensure that all persons who have contact with patients are immune to rubella and/or varicella)
4. Formulate a visitation policy for the siblings and/or pets of hospitalized children
5. Make recommendations for control of an epidemic/outbreak of hospital-acquired infection

D. Surveillance
1. Know diseases that should be reported to the relevant public health department, and the procedures to be used
2. Understand the limitations of results reported to VAERS

11. **Core Knowledge in Scholarly Activities**

A. Principles of use of biostatistics in research
   1. Types of variables
      a. Distinguish types of variables (eg, continuous, categorical, ordinal, nominal)
      b. Understand how the type of variable (eg, continuous, categorical, nominal) affects the choice of statistical test
   2. Distribution of data
      a. Understand how distribution of data affects the choice of statistical test
      b. Differentiate normal from skewed distribution of data
      c. Understand the appropriate use of the mean, median, and mode
      d. Understand the appropriate use of standard deviation
      e. Understand the appropriate use of standard error of the mean
   3. Hypothesis testing
      a. Distinguish the null hypothesis from an alternative hypothesis
      b. Interpret the results of hypothesis testing
   4. Statistical tests
      a. Understand when to use and how to interpret the chi square test
      b. Understand when to use and how to interpret tests comparing continuous variables between two groups (eg, t test, Mann Whitney U)
      c. Understand when to use and how to interpret tests comparing continuous variables between three or more groups (eg, ANOVA, Kruskal-Wallis)
      d. Understand when to use paired tests
      e. Understand the appropriate use of parametric versus nonparametric tests
      f. Interpret a p value
      g. Interpret a p value when multiple comparisons have been made
      h. Interpret a confidence interval
      i. Identify a type I error
      j. Identify a type II error
   5. Measurement of association and effect
      a. Understand how to interpret relative risk and absolute risk
      b. Understand how to interpret odds ratio
      c. Understand how to interpret number needed to treat or harm
      d. Understand how to interpret hazard ratio
      e. Understand when to use and how to interpret correlation coefficient
   6. Regression
      a. Understand when to use and how to interpret regression analysis (eg, linear, logistic)
      b. Understand when to use and how to interpret survival analysis (eg, Kaplan Meier)
   7. Diagnostic tests
      a. Recognize the importance of an independent "gold standard" in evaluating a diagnostic test
      b. Interpret sensitivity and specificity
      c. Interpret positive and negative predictive values
      d. Understand how disease prevalence affects the positive and negative predictive value of a test
      e. Interpret a receiver operating characteristic curve
   8. Systematic reviews and meta-analysis

a. Understand the purpose of a systematic review
b. Understand the advantages of adding a meta-analysis to a systematic review
c. Interpret the results of a meta-analysis

B. Principles of epidemiology and clinical research design
1. Assessment of study design, performance and analysis (internal validity)
a. Recognize and understand the strengths and limitations of a cohort study, case control study, and randomized controlled clinical trial
b. Recognize the use and limitations of surrogate endpoints
c. Understand the use of intent-to-treat analysis
d. Understand how sample size affects the power of a study
2. Assessment of generalizability (external validity)
a. Understand how nonrepresentative samples can bias results
b. Assess how the data source (eg, diaries, billing data, discharge diagnostic code) may affect study results
3. Bias and confounding
a. Identify common strategies in study design to avoid or reduce bias
b. Identify common strategies in study design to avoid or reduce confounding
4. Causation
a. Understand the difference between association and causation
5. Incidence and prevalence
a. Distinguish disease incidence from disease prevalence
6. Screening
a. Understand factors that affect the rationale for screening for a condition or disease (eg, prevalence, test accuracy, risk benefit, disease burden, presence of a presymptomatic state)
7. Cost benefit, cost effectiveness, and outcomes
a. Interpret cost-effectiveness ratios
b. Distinguish costs from charges
c. Understand quality-adjusted life years
8. Measurement
a. Understand the types of validity that relate to measurement (eg, face, construct, criterion, predictive, content)
b. Distinguish accuracy from precision
c. Understand when to use and how to interpret a kappa coefficient

C. Ethics in research
1. Professionalism and misconduct in research
a. Identify and manage potential conflicts of interest in the funding, design, and/or execution of a research study
b. Identify various forms of research misconduct (eg, plagiarism, fabrication, falsification)
c. Know how, and to whom, to report concerns of research misconduct
2. Principles of research with human subjects
a. Understand and contrast the functions of an Institutional Review Board and a Data Safety Monitoring Board
b. Recognize the types of protections in designing research that might be afforded to children and other vulnerable populations

c. Understand the federal regulatory definitions regarding which activities are considered research and what constitutes human subjects research
d. Understand the federal regulatory definition of minimal risk and apply this to research involving children
e. Understand the ethical considerations of study design (eg, placebo, harm of intervention, deception, flawed design)

3. Principles of consent and assent
   a. Understand what constitutes informed consent in research
   b. Distinguish between consent and assent in research involving children

D. Quality improvement

1. Design of a Project
   a. Understand various models of quality improvement and recognize that all utilize a data-informed, iterative process using tests of change to achieve a stated aim
   b. Understand that the aim of any quality improvement project should be specific, measurable, achievable, realistic, and time-limited
   c. Understand strategies to optimize identification of key drivers and interventions to achieve a specific aim
   d. Understand tools to facilitate completion of quality improvement work, including key driver diagrams and process maps
   e. Understand each phase of a Plan-Do-Study-Act (PDSA) cycle
2. Data and Measurement
   a. Differentiate between process, outcome, and balancing measures
   b. Interpret a run chart and identify shifts, trends, and outliers in data
   c. Differentiate between a run chart and a control chart
   d. Differentiate between common cause and special cause variation