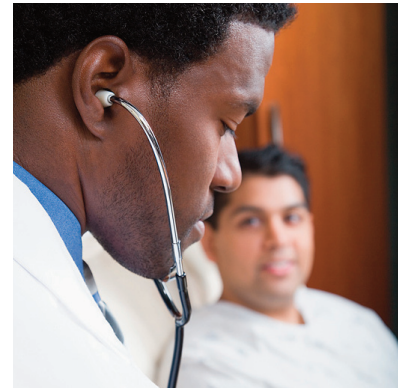




# USMLE<sup>®</sup> Content Outline



A Joint Program of the Federation of State Medical Boards  
of the United States, Inc., and the National Board of Medical Examiners<sup>®</sup>

This outline provides a common organization of content across all USMLE examinations. Each Step exam will emphasize certain parts of the outline, and no single examination will include questions on all topics in the outline. The examples listed within the outline are just examples. Questions may include diseases, symptoms, etc., that are not included in the outline. The USMLE program continually reviews its examinations to ensure their content is relevant to the practice of medicine. As practice guidelines evolve or are introduced, the content on USMLE is reviewed and modified as needed. At times, there is a change in emphasis on new content development that arises from our ongoing peer-review processes. For example, there has been an emphasis on new content developed assessing competencies related to geriatric medicine, and prescription drug use and abuse. USMLE has also focused recent efforts on the often unrecognized health care needs of recently returning servicemen and servicewomen (eg, traumatic brain injury and post-traumatic stress disorder), and the families of deployed servicemen and servicewomen. While many of the medical issues related to the health care of these special populations are not unique, certain medical illnesses or conditions are either more prevalent, have a different presentation, or are managed differently. Knowledge of foundational science and clinical science in these content areas will be assessed on the USMLE Step 1, Step 2 CK, and Step 3 examinations.

Examinees should refer to the test specifications for each examination for more information about which parts of the outline will be emphasized in the examination for which they are preparing. See the USMLE website ([www.usmle.org](http://www.usmle.org)) for more detail.

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## General Principles of Foundational Science

### Biochemistry and molecular biology

Gene expression: DNA structure, replication, exchange, and epigenetics (eg, imprinting, X-activation, DNA methylation)

Gene expression: transcription

Gene expression: translation, post-translational processing, modifications, and disposition of proteins (degradation), including protein/glycoprotein synthesis, intra-extracellular sorting, and processes/functions related to Golgi complex and rough endoplasmic reticulum

Structure and function of proteins and enzymes (eg, enzyme kinetics and structural/regulatory proteins)

Energy metabolism (eg, ATP generation, transport chain)

### Biology of cells

Adaptive cell responses and cellular homeostasis (eg, hypertrophy)

Mechanisms of injury and necrosis, including pathologic processes (eg, liquefactive necrosis, free radical formation)

Apoptosis

Cell cycle and cell cycle regulation (eg, mitosis)

Mechanisms of dysregulation

cell biology of cancer (eg, role of p53, proto-oncogenes)

general principles of invasion and metastasis, including cancer staging

Cell/tissue structure, regulation, and function, including cytoskeleton, organelles, glycolipids, channels, gap junctions, extracellular matrix, and receptors

### Human development and genetics

Principles of pedigree analysis  
inheritance patterns

occurrence and recurrence risk determination

Population genetics: Hardy-Weinberg law, founder effects, mutation-selection equilibrium

Principles of gene therapy

Genetic testing and counseling

Genetic mechanisms (eg, penetrance, genetic heterogeneity)

### Biology of tissue response to disease

Acute inflammatory responses (patterns of response)

acute inflammation and mediator systems (eg, histamine, prostaglandins, bradykinins, eosinophilic basic protein, nitric oxide)

vascular response to injury, including mediators

principles of cell adherence and migration (eg, ECAMs, selectins, leukocytic diapedesis, and rolling)

microbicidal mechanisms and tissue injury (eg, defensins)

clinical manifestations (eg, pain, fever, leukocytosis, leukemoid reaction, chills)

Chronic inflammatory responses (eg, tumor necrosis factor)

Reparative processes

wound healing, repair: thrombosis, granulation tissue, angiogenesis, fibrosis, scar/keloid formation

regenerative process

### Pharmacodynamic and pharmacokinetic processes: general principles

Pharmacokinetics: absorption, distribution, metabolism, excretion, dosage intervals

Mechanisms of drug action, structure-activity relationships (eg, anticancer drugs)

Concentration and dose-effect relationships (eg, efficacy, potency), types of agonists (eg, full, partial, inverse) and antagonists and their actions  
Individual factors altering pharmacokinetics and pharmacodynamics (eg, age, gender, disease, tolerance, compliance, body weight, metabolic proficiency, pharmacogenetics)  
Mechanisms of drug adverse effects, overdose, toxicology  
Mechanisms of drug interactions  
Signal transduction, including structure/function of all components of signal transduction pathways such as receptors, ligands (eg, general principles of nitric oxide, autocrine and paracrine signaling)

## **Microbial biology**

### **Microbial identification and classification, including principles, microorganism identification, and non-immunologic laboratory diagnosis**

#### **Bacteria**

structure (eg, cell walls, composition, appendages, virulence factors, extracellular products, toxins, mechanism of action of toxins)  
processes, replication, and genetics (eg, metabolism, growth, and regulation)  
oncogenesis  
antibacterial agents (eg, mechanisms of action on organism, toxicity to humans, and mechanisms of resistance)

#### **Viruses**

structure (eg, physical and chemical properties, virulence factors)  
processes, replication, and genetics (eg, life cycles, location of virus in latent infection)  
oncogenesis  
antiviral agents (eg, mechanisms of action on virus, toxicity to humans, and mechanisms of resistance)

#### **Fungi**

structure (eg, cell wall, composition, appendages, virulence factors, extracellular products, toxins, mechanisms of action of toxins)  
processes, replication, and genetics (eg, asexual vs. sexual, metabolism, growth)  
antifungal agents (eg, mechanisms of action on fungus, toxicity to humans, and mechanisms of resistance)

#### **Parasites**

structure (eg, appendages, macroscopic features, and virulence factors)  
processes, replication, and genetics (eg, life cycles, metabolism, and growth)  
oncogenesis  
antiparasitic agents (eg, mechanisms of action on parasite, toxicity to humans, and mechanisms of resistance)

#### **Prions**

## **Normal age-related findings and care of the well patient**

### **Infancy and childhood (0-12 years)**

**Normal physical changes:** linear growth, variations in linear growth, including constitutional delay; weight; head circumference; micturition, defecation, primary incontinence/bedwetting; normal physical examination; screening; sleep

**Developmental stages:** motor; speech; cognitive; psychosocial; anticipatory guidance

**Lifestyle and routine preventive health care:** nutrition; exercise (eg, benefits of exercise); preventive/travel medicine; risk factors and prevention (eg, guns, swimming, motor vehicles, car seats); routine vaccinations

### **Adolescence (13-17 years)**

**Normal physical changes:** linear growth, variations in linear growth including constitutional delay; weight; puberty; normal physical examination; gynecomastia; autonomy/self-identity; sleep

**Developmental stages:** cognitive (eg, abstract thought); psychosocial (eg, autonomy, role confusion, sexual identity); anticipatory guidance

**Lifestyle and routine preventive health care:** nutrition; exercise (eg, benefits of exercise); preventive/travel medicine; risk factors and prevention (eg, risk-taking behavior, helmets, safe sex, motor vehicles, seat belts, distractions); routine vaccinations

#### **Adulthood (18-64 years)**

**Normal physical changes:** weight; normal physical examination; screening; sleep

**Developmental stages:** cognitive; intimacy vs isolation; anticipatory guidance

**Lifestyle and routine preventive health care:** nutrition; exercise (eg, benefits of exercise); preventive/travel medicine; risk factors and prevention; routine vaccinations

#### **Senescence (65 years and older)**

**Normal physical changes, including normal physical exam for age:** weight, height (spinal compression), skin, bruising; normal physical examination; response to temperature; micturition, defecation; sleep

**Developmental stages:** motor; cognitive (eg, benign senescent forgetfulness); psychosocial; integrity vs despair; retrospection; anticipatory guidance

**Lifestyle and routine preventive health care:** nutrition; exercise (eg, benefits of exercise); preventive/travel medicine; risk factors and prevention (eg, falls, general medical condition; polypharmacy, driving, caregiver stress); routine vaccinations

## **Immune System**

### **Normal processes**

**Development of cells of the adaptive immune response, including positive and negative selection during immune development**

**Structure, production, and function**

granulocytes, natural killer cells, macrophages, mast cells, dendritic cells, cell receptors (eg, complement receptors and toll-like receptors), cytokines, chemokines

T lymphocytes, including T-lymphocyte receptors, accessory molecules (eg, CD3, CD4, CD8, B7), cell activation and proliferation, cytotoxic T lymphocytes, and memory T lymphocytes

B lymphocytes and plasma cells, including B-lymphocyte receptors, immunoglobulins, cell activation and proliferation, including development of antibodies and memory B lymphocytes

host defense mechanisms, host barriers to infection, mucosal immunity (eg, gut-associated lymphoid tissue and bronchus-associated lymphoid tissue), anatomical locations of T and B lymphocytes

**Cellular basis of the immune response and immunologic mediators**

antigen processing and presentation in the context of MHC I and MHC II molecules (eg, TAP, beta-2 microglobulin), intracellular pathways, mechanisms by which MHC is expressed on the surface; including distribution of MHC I and MHC II on different cells, mechanisms of MHC I and MHC II deficiencies, and the genetics of MHC

regulation of the adaptive immune response (eg, peripheral tolerance, anergy, regulatory T lymphocytes, termination of immune response, and B-T

lymphocyte interactions)

activation, function, and molecular biology of complement (eg, anaphylatoxins)

functional and molecular biology of cytokines (eg, IL 1-15)

**Basis of immunologic diagnostics (eg, antigen-antibody reactions used for diagnostic purposes, ELISA, immunoblotting, antigen-antibody changes over time, ABO typing)**

**Principles of immunologic protection**

vaccine production and mechanisms of vaccine action

biologically active antibodies (eg, monoclonal antibodies, polyclonal antibodies including IVIG, VZIG, rabies immunoglobulin)

**Effect of age on the function of components of the immune system**

**Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis**

**Disorders associated with immunodeficiency**

**deficiency primarily of humoral immunity:** common variable immunodeficiency; hyper IgM syndrome; hypogammaglobulinemia/agammaglobulinemia, X-linked (Bruton); selective immunodeficiency (eg, IgA, IgM, IgE)

**deficiency/dysfunction primarily of cell-mediated immunity:** adenosine deaminase deficiency; DiGeorge syndrome; severe combined immunodeficiency disease (SCID); Wiskott-Aldrich syndrome; granulomatosis; allergic reactions (insect bites)

**complement deficiency:** alternative pathway component deficiency (C2, C3b, C3bB, C36B6); classical pathway component deficiency (C1q, C1r, C1-C5); terminal component deficiency (C5b-C9; terminal complement complex); C1 esterase inhibitor deficiency, hereditary angioedema; mannose-binding lectin (MBL) deficiency; membrane attack complex deficiency

**deficiency of phagocytic cells and natural killer cells:** Chediak-Higashi disease; chronic granulomatous disease and other disorders of phagocytosis; leukocyte adhesion deficiency

**HIV/AIDS:** HIV1 and HIV2; AIDS; AIDS complications (eg, neuropathy, dementia, renal insufficiency); immunology of AIDS; immune reconstitution syndrome (IRS); secondary infections; noninfectious complications

**Immunologically mediated disorders**

**hypersensitivity reactions:** type 1, 2, 3, including anaphylaxis; type 4; drug reactions; serum sickness

**transplantation:** rejection; graft-vs-host disease

**Adverse effects of drugs on the immune system:** Jarisch-Herxheimer reaction; drugs affecting the immune system (eg, prednisone, azathioprine, cyclosporine, methotrexate, monoclonal antibody drugs [eg, abciximab, adalimumab; bevacizumab, infliximab, omalizumab, rituximab]); vaccine adverse effects

## Blood & Lymphoreticular System

**Normal Processes**

**Embryonic development, fetal maturation, and perinatal changes**

**Organ structure and function**

**Cell/tissue structure and function**

production and function of erythrocytes, including heme and hemoglobin synthesis;

hemoglobin O<sub>2</sub> and CO<sub>2</sub> transport, transport proteins, erythropoietin

production and function of platelets

production and function of coagulation and fibrinolytic factors; hemostasis

**Repair, regeneration, and changes associated with stage of life**

**Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis**

**Infectious and immunologic**

**infectious disorders**

**bacteria**

**viral:** hemorrhagic fever (Ebola virus, Marburg virus); chikungunya; dengue fever

**parasitic:** malaria (*Plasmodium* spp); babesiosis (*Babesia* species)

**primary infections of lymphoid tissue:** lymphadenitis (viral, bacterial, fungal, parasitic); lymphangitis; buboes, bubonic plague (*Yersinia pestis*); cat scratch disease (*Bartonella henselae*)

**immunologic and inflammatory disorders:** cryoglobulinemia, essential mixed cryoglobulinemia; autoimmune hemolytic anemia; paroxysmal nocturnal hemoglobinuria; thrombotic thrombocytopenic purpura; hemolytic uremic syndrome

**Neoplasms:** leukemia, acute (ALL, AML); leukemia, chronic (CLL, CML); lymphomas, Hodgkin disease, non-Hodgkin lymphoma, Burkitt lymphoma, T-cell lymphoma; multiple myeloma, dysproteinemias, monoclonal gammopathy of unknown significance (MGUS); myelofibrosis; myelodysplastic syndrome, myelodysplasias; other immunoproliferative neoplasms (eg, Waldenstrom macroglobulinemia)

**Anemia, cytopenias, and polycythemia anemias**

**decreased production:** anemia of chronic disease

**hemolysis:** glucose-6-phosphate dehydrogenase deficiency; pyruvate kinase deficiency

**disorders of hemoglobin, heme, or membrane:** disorders of red cell membranes; hereditary spherocytosis, elliptocytosis; methemoglobinemia, congenital; sickle cell disease; sideroblastic anemia; thalassemias

**other causes of anemia:** blood loss, acute and chronic as a cause of anemia

**cytopenias:** aplastic anemia; leukopenia; neutropenia, cyclic neutropenia, agranulocytosis; pancytopenia; thrombocytopenia, quantitative; immune thrombocytopenic purpura (ITP)

**cythemias:** leukocytosis; polycythemia vera; secondary polycythemia

**Coagulation disorders (hypocoagulable and hypercoagulable conditions)**

**hypocoagulable:** disseminated intravascular coagulation; hemophilia, congenital factor VIII [hemophilia A] and IX [hemophilia B]; hypofibrinogenemia; von Willebrand disease; platelet dysfunction, qualitative

**hypercoagulable:** heparin-induced thrombocytopenia; other coagulopathies (eg, homocysteinemia, hypoplasminogenemia, antithrombin III, protein C/protein S deficiency, Factor V Leiden, anticardiolipin antibodies, lupus anticoagulant, prothrombin G20210A mutation)

**reactions to blood components:** ABO incompatibility/anaphylaxis; Rh incompatibility/anaphylaxis; hemolysis, delayed; transfusion reaction; transfusion contaminated with bacteria; transfusion-related acute lung injury (TRALI); anaphylactoid reaction (IgA deficiency)

**Traumatic, mechanical, and vascular disorders:** mechanical injury to erythrocytes (eg, cardiac valve hemolysis); disorders of the spleen; splenic rupture/laceration; splenic infarct; splenic abscess; effects/complications of splenectomy (eg, sepsis due to encapsulated bacteria); hypersplenism

**Congenital disorders**



**Adverse effects of drugs on the hematologic and lymphoreticular systems:** antiplatelet drugs, antithrombin drugs (eg, dabigatran); chemotherapeutic agents; inhibitors of coagulation factors; methemoglobinemia, acquired; propylthiouracil; tumor lysis syndrome; warfarin

## Behavioral Health

### Normal Processes

**Psychodynamic and behavioral factors, related past experience (eg, transference, personality traits)**

**Adaptive behavioral responses to stress and illness (eg, coping mechanisms)**

**Maladaptive behavioral responses to stress and illness (eg, drug-seeking behavior, sleep deprivation)**

**Patient adherence:** general adherence; adolescent adherence

### Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis,

#### Management, Risks, Prognosis

**Psychotic disorders:** brief psychotic disorder; delusional disorder; psychotic disorder due to a general medical condition; schizophrenia; schizoaffective disorder; substance-induced psychotic disorder

**Anxiety disorders:** acute stress disorder; anxiety due to a general medical condition; generalized anxiety disorder; hyperventilation syndrome; obsessive-compulsive disorder; panic disorder with and without agoraphobia; phobic disorders; anxiety disorder (social phobia); post-traumatic stress disorder; separation anxiety disorder; substance-induced anxiety disorder

**Mood disorders:** major depressive disorder with and without psychotic features, including seasonal affective disorder; major depressive disorder, postpartum, with and without psychotic features, including screening; cyclothymic disorder; dysthymic disorder; bipolar disorder, manic/depressed/mixed; premenstrual syndrome, premenstrual dysphoric disorder; mood disorder due to a general medical condition; substance-induced mood disorder (illegal or prescribed); suicidal ideation/attempt

**Somatoform disorders:** body dysmorphic disorder; conversion disorder, including psychogenic seizures; dissociative disorders; hypochondriasis; malingering; pain disorder; somatization disorder, somatoform disorder NOS

**Factitious disorders:** factitious disorder

**Eating disorders and impulse control disorders:** anorexia nervosa; binge-eating disorder; bulimia nervosa; eating disorder; disorders of impulse control (eg, gambling, shoplifting, pyromania, trichotillomania)

**Disorders originating in infancy/childhood:** attachment disorder; attention-deficit/hyperactivity disorder; developmental speech or language disorder; learning disability/dyslexia; mental retardation and developmental delay, undefined, including school problems, fetal alcohol syndrome; oppositional defiant disorder, conduct disturbance disorder, disruptive behavior disorder; pervasive developmental disorder, including autistic disorder, Asperger syndrome, Rett syndrome; psychoses with origin specific to childhood; elimination disorders (incontinence, encopresis); tic disorders/Tourette disorder

**Personality disorders:** antisocial personality disorder; avoidant personality disorder; borderline personality disorder; dependent personality disorder; histrionic personality disorder; narcissistic personality disorder; obsessive-compulsive personality disorder; paranoid personality disorder; schizoid personality disorder

**Psychosocial disorders/behaviors:** adjustment disorder; grief response/bereavement, normal

and abnormal; parent-child relational problems other than physical or emotional abuse; other psychosocial stress

**Sexual and gender identity disorders:** gender identity disorder; psychosexual dysfunction

**Substance abuse disorders:** alcohol abuse/intoxication/dependence/withdrawal; tobacco/nicotine abuse/dependence/withdrawal; cannabis abuse/intoxication/dependence; hallucinogen abuse/intoxication/dependence/withdrawal; inhalant abuse/intoxication/dependence/withdrawal; opioids, heroin, including prescription drugs, abuse/intoxication/dependence/withdrawal; sedatives, hypnotics, including benzodiazepines and barbiturates abuse/intoxication/dependence/withdrawal; stimulants, cocaine, methamphetamine abuse/intoxication/dependence/withdrawal; other drugs of abuse (eg, ecstasy, PCP, bath salts) abuse/intoxication/dependence/withdrawal; polysubstance abuse/intoxication/dependence/withdrawal

**Adverse effects of drugs:** steroid-induced psychosis; varenicline and suicide; drug-induced psychogenic polydipsia

## Nervous System & Special Senses

### Normal Processes

**Embryonic development, fetal maturation, and perinatal changes, including neural tube derivatives, cerebral ventricles, and neural crest derivatives**

### Organ structure and function

spinal cord

gross anatomy and blood supply

spinal reflexes

brain stem (eg, cranial nerves and nuclei, reticular formation, anatomy and blood supply, control of eye movements)

brain

gross anatomy and blood supply

higher function: cognition, language, memory, executive function

hypothalamic function

limbic system and emotional behavior

circadian rhythms and sleep

sensory systems

general sensory modalities, including sharp, dull, temperature, vibratory, and proprioception

special sensory modalities, including vision, hearing, taste, olfaction, and balance

motor systems

brain and spinal cord (upper motoneuron)

basal ganglia and cerebellum

autonomic nervous system

peripheral nerves

### Cell/tissue structure and function, including neuronal cellular and molecular biology

axonal transport

excitable properties of neurons, axons, and dendrites, including channels

synthesis, storage, release, reuptake, and degradation of neurotransmitters and neuromodulators

presynaptic and postsynaptic receptor interactions, trophic and growth factors

brain metabolism

glia, myelin

brain homeostasis: blood-brain barrier, cerebrospinal fluid formation and flow, choroid plexus

### **Repair, regeneration, and changes associated with stage of life**

## **Abnormal Processes: Health and Health Maintenance, Screening,**

### **Diagnosis, Management, Risks, Prognosis**

#### **Infectious, immunologic, and inflammatory disorders**

**infectious disorders:** meningitis: bacterial (*Actinomyces israelii*; *Haemophilus influenzae*; *Listeria monocytogenes*; *Mycobacterium tuberculosis*; *Neisseria meningitidis*; *Staphylococcus aureus*, epidermidis; *Streptococcus agalactiae*; *Streptococcus pneumoniae*); viral (adenovirus, arboviruses, echovirus and coxsackie A & B viruses, polioviruses, herpes simplex virus, varicella zoster, human immunodeficiency virus, lymphocytic choriomeningitis virus, measles virus, mumps virus, St. Louis encephalitis virus, California encephalitis virus, Western equine encephalitis virus); fungal (*Blastomycosis dermatitidis*, *Cryptococcus neoformans/gattii*); spirochetal (*Borrelia burgdorferi*; *Leptospira*; *Treponema pallidum*, including neurosyphilis); protozoal/helminths (*Acanthamoeba*, *Naegleria fowleri*, *Strongyloides stercoralis*, *Angiostrongylus cantonensis*, *Baylisascaris procyonis*); encephalitis (herpesvirus [HSV-1], varicella-zoster virus, Epstein-Barr virus, cytomegalovirus, mumps virus, enterovirus, West Nile virus, St. Louis encephalitis virus, rabies virus, Eastern and Western equine encephalitis virus, poliovirus, *Taenia*, *Toxoplasma gondii*); prion disease (eg, Creutzfeldt-Jakob disease); botulism (*Clostridium botulinum*), tetanus (*Clostridium tetani*); CNS disorders associated with AIDS (eg, progressive multifocal leukoencephalopathy)

**immunologic and inflammatory disorders:** myasthenia gravis, including thymoma; multiple sclerosis; transverse myelitis

**Neoplasms (cerebral, spinal, and peripheral):** benign (meningioma, neurofibromatosis); malignant (glioblastoma multiforme, astrocytoma, medulloblastoma, primary CNS lymphoma); metastatic (eg, breast, lung, pancreatic, testicular, melanoma)

**Cerebrovascular disease:** arteriovenous malformations, ectatic cerebral vessels; transient ischemic attack; stroke, thrombotic: cerebral artery occlusion/cerebral infarction; stroke, embolic: cerebral embolism; stroke: intracerebral hemorrhage, including subarachnoid hemorrhage, traumatic intracranial hemorrhage; cerebral artery aneurysm; carotid artery stenosis/atherosclerosis/occlusion/dissection; vertebral artery deficiency/dissection; subclavian steal syndrome; vascular dementia; hypertensive encephalopathy; posterior reversible encephalopathy syndrome; venous sinus thrombosis

**Disorders relating to the spine, spinal cord, and spinal nerve roots:** cauda equina syndrome; spinal artery thrombosis/embolus/infarct; spinal cord compression; spinal cord transection, paraplegia and quadriplegia, acute and chronic effects (eg, autonomic dysreflexia); spinal stenosis (cervical, lumbar)

#### **Cranial and peripheral nerve disorders**

**cranial nerve injury/disorders:** cranial nerve injury; Bell palsy; anisocoria, miosis, mydriasis; internuclear ophthalmoplegia; nystagmus and other irregular eye movements; vestibular neuritis, labyrinthitis; ptosis of the eyelid; Horner syndrome

**peripheral nerve/plexus injury/disorders:** peripheral nerve injury, including brachial plexus; carpal/cubital/tarsal/peroneal tunnel syndrome; mononeuritis, Guillain-Barré syndrome; Miller Fisher syndrome; neuropathy (eg, Charcot-Marie-Tooth disease); herpes zoster

**Neurologic pain syndromes:** complex regional pain syndrome (reflex sympathetic dystrophy, causalgia); fibromyalgia; postherpetic neuralgia; phantom limb pain; thalamic pain syndrome; trigeminal neuralgia

**Degenerative disorders/amnestic syndromes:** Alzheimer disease; frontotemporal dementia, including Pick disease, progressive supranuclear palsy, Lewy body disease

**Global cerebral dysfunction:** altered states of consciousness; delirium; coma/brain death

**Neuromuscular disorders:** amyotrophic lateral sclerosis/spinal muscular atrophy; muscular dystrophy; muscle channelopathies

**Movement disorders:** acute dystonia; adult tic disease; essential tremor; Huntington disease; Parkinson disease, including Parkinson dementia

**Metabolic disorders:** adrenoleukodystrophy; metabolic encephalopathy

**Paroxysmal disorders:** headache, including migraine, mixed, tension, ice-pick, cluster, medication withdrawal, caffeine withdrawal; seizure disorders, including generalized tonic-clonic, partial, absence, febrile

**Sleep disorders:** cataplexy and narcolepsy; circadian rhythm disorders; insomnia, primary; sleep terror disorder and sleepwalking; REM sleep behavior disorder; restless legs syndrome

**Traumatic and mechanical disorders and disorders of increased intracranial pressure:** anoxic brain damage, cerebral hypoxia; epidural, subdural hematoma (cerebral and spinal); intraparenchymal hemorrhage, traumatic subarachnoid hemorrhage; cerebral edema; pseudotumor cerebri (idiopathic intracranial hypertension); torticollis/cervical dystonia; hydrocephalus, including normal-pressure; traumatic brain injury (concussion)/postconcussion syndrome (dementia pugilistica); traumatic brain syndrome

**Congenital disorders:** Friedreich ataxia; neural tube defects (eg, spina bifida, holoprosencephaly, anencephaly); microcephaly; Sturge-Weber syndrome; tuberous sclerosis, von Hippel-Lindau disease; hydrocephalus, obstructive (Arnold-Chiari)

**Adverse effects of drugs on the nervous system:** acute dystonic reaction; drug-induced meningitis (eg, NSAIDs, sulfa drugs); drug-induced neuropathy (eg, vincristine, isoniazid, metronidazole); extrapyramidal adverse effects (eg, akathisia, dystonia, drug-induced parkinsonism); neuroleptic malignant syndrome; poisoning by psychotropic agents, including antidepressants; serotonin syndrome; tardive dyskinesia

**Disorders of the eye and eyelid**

**infectious and inflammatory disorders of the eye:** blepharitis/eyelid inflammation; chalazion; chorioretinitis; conjunctivitis (adenovirus)/keratoconjunctivitis; dacryocystitis; endophthalmitis; hordeolum; iridocyclitis; optic neuritis; periorbital cellulitis; uveitis

**neoplasms of the eye:** melanoma; retinoblastoma

**disorders of the eye and eyelid, structural:** cataract; glaucoma; lacrimal system disorders; pterygium; refractive disorders (presbyopia, myopia, hyperopia, astigmatism)

**disorders of the pupil, iris, muscles (extraocular):** amblyopia; strabismus

**disorders of the retina:** hypertensive retinopathy; macular degeneration; papilledema; retinal detachment; retinitis pigmentosa; vascular disorders affecting the retina, including central retinal artery embolus, retinal hemorrhage, amaurosis fugax, embolus, carotid artery stenosis, central retinal vein occlusion; visual impairment/blindness, night blindness

**traumatic and mechanical disorders:** black eye; burn of the eye and adnexa; corneal

abrasion, ulcer; dislocated lens; foreign body in eye; hyphema; injury to optic nerve and pathways; laceration of the eye and eyelid; ocular open wounds; orbital fracture; subconjunctival hemorrhage

**adverse effects of drugs on the eyes:** ethambutol; hydroxychloroquine; prednisone

#### **Disorders of the ear**

**infectious and inflammatory disorders of the ear:** chondritis; mastoiditis; otitis, externa, media, interna, serous, suppurative, malignant otitis externa

**neoplasms:** acoustic neuroma, neurofibromatosis type 2; cholesteatoma

**hearing loss/deafness:** hearing loss, including noise induced; otosclerosis; tinnitus

**disorders of balance and spatial orientation:** Ménière disease; motion sickness; vertigo, including benign positional vertigo

**traumatic and mechanical disorders:** barotrauma; foreign body in ear; impacted cerumen; laceration, avulsion; perforation of tympanic membrane; eustachian tube disorders

**adverse effects of drugs on the ear:** antineoplastic agents, including cisplatin; aminoglycosides; furosemide; salicylates

## **Skin & Subcutaneous Tissue**

### **Normal Processes**

**Embryonic development, fetal maturation, and neonatal changes**

**Organ structure and function, including barrier function, thermal regulation**

**Cell/tissue structure and function, eccrine function**

**Repair, regeneration, and changes associated with stage of life (eg, senile purpura, male pattern baldness, postmenopausal hair changes)**

**Skin defense mechanisms and normal flora**

### **Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis,**

#### **Management, Risks, Prognosis**

#### **Infectious, immunologic, and inflammatory disorders**

##### **infectious disorders and infestations**

**bacterial:** cellulitis, erysipelas, impetigo, staphylococcal scalded skin syndrome; abscess, cutaneous, including septic abscess; anthrax (*Bacillus anthracis*); carbuncle; folliculitis; pilonidal cyst, infected; pyoderma gangrenosum; MSSA and MRSA skin infections; mycobacterial infections (eg, leprosy, draining sinus); scarlet fever (group A streptococcus)

**viral:** herpes simplex type 1 & type 2, herpes zoster, Ramsay-Hunt syndrome; molluscum contagiosum; hand-foot-and-mouth disease; herpangina; parvovirus; chickenpox, erythema infectiosum (fifth disease), rubella, measles, roseola (exanthema subitum); verrucae vulgaris

**fungal (deep and superficial):** candidiasis, skin; dermatophytosis, tinea corporis; dermatomycoses; diaper rash; onychomycosis

**parasitic:** cutaneous larva migrans; cutaneous leishmaniasis

**infestations, nonvenomous bites, stings:** scabies; lice; insect bites, including bed bugs

##### **immunologic and inflammatory disorders**

**papulosquamous and eczematous dermatoses:** psoriasis; lichen planus and lichenoid dermatoses; allergic/irritant contact dermatitis (eg, nickel); dermatoses caused by plants (poison ivy, poison oak)

**vesiculobullous disorders:** epidermolysis bullosa; dermatitis herpetiformis;

pemphigus; pemphigoid

**urticaria, erythema, exanthema, and purpura:** erythema nodosum; atopic dermatitis; pityriasis rosea; urticaria; Stevens-Johnson syndrome, erythema multiforme, toxic epidermal necrolysis

**autoimmune disorders:** vitiligo

### **Neoplasms**

**benign neoplasms, cysts and other skin lesions:** actinic keratoses; cysts, including epidermal; hemangiomas; lipoma; pigmented nevi; seborrheic keratosis; xanthomas

**malignant neoplasms:** basal cell carcinoma; squamous cell carcinoma; melanoma, including genital; Kaposi sarcoma; cutaneous T-cell lymphoma, mycosis fungoides

### **Adnexal disorders (hair and hair follicles, nails, sweat glands, sebaceous glands, oral mucous membranes)**

**disorders of the hair and hair follicles:** alopecia; seborrhea capitis/seborrheic dermatitis; tinea barbae and capitis

**disorders of the nails (including ingrowing nail)**

**disorders of sweat and sebaceous glands:** acne vulgaris; hidradenitis suppurativa; hyperhidrosis; ichthyosis; rosacea

**Oral disease:** aphthous ulcers (stomatitis, canker sores); leukoplakia

**Disorders of pigmentation:** albinism; lentigo

**Traumatic and mechanical disorders:** animal bites (dogs, cats, etc); burns or wounds affecting the skin or subcutaneous tissue (eg, sunburn, other including blast injuries and burns); cauliflower ear; effects of ultraviolet light; keloids; tattoo; thermal injury, perniosis, frostbite; ulcers, decubitus

**Congenital disorders:** xeroderma pigmentosum; benign lesions in neonates, infants, children (eg, congenital nevi)

**Adverse effects of drugs on skin and subcutaneous tissue:** drug reactions, eruptions, including local reaction to vaccine

## **Musculoskeletal System**

### **Normal processes**

**Embryonic development, fetal maturation, and perinatal changes**

**Organ structure and function**

**Cell/tissue structure and function**

biology of bones, joints, tendons, skeletal muscle, cartilage

exercise and physical conditioning/deconditioning

**Repair, regeneration, and changes associated with stage of life**

### **Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis,**

**Management, Risks, Prognosis**

**Infectious, inflammatory, and immunologic disorders**

**infectious disorders:** gangrene, dry and wet, clostridial myonecrosis (*Clostridium perfringens*); discitis; myositis, infective; necrotizing fasciitis; osteomyelitis; septic arthritis; spondylitis, tuberculous

**immunologic disorders:** ankylosing spondylitis; dermatomyositis/polymyositis; juvenile idiopathic arthritis; rheumatoid arthritis, Felty syndrome; psoriatic arthropathy

**inflammatory disorders:** adhesive capsulitis of shoulder (frozen shoulder syndrome); ankylosis/spondylopathy (inflammatory); bursitis; fasciitis; osteochondritis,

osteochondritis dissecans; tendinitis, supraspinatus syndrome, enthesopathy of spine, elbow, ankle; temporomandibular joint disorders; fibrositis, myofascial pain syndrome; synovitis; tenosynovitis; myositis

**Neoplasms:** benign neoplasms (e.g., ganglion cyst); malignant neoplasms of bone (eg, osteosarcoma, sarcoma, leiomyosarcoma, rhabdosarcoma); metastases to bone, secondary malignant neoplasm of bone

**Degenerative and metabolic disorders**

**degenerative/metabolic disorders of bone, tendon, and cartilage:** chondromalacia; disc degeneration, herniated disc; Legg-Calvé-Perthes disease; Osgood-Schlatter disease; osteodystrophy; osteomalacia; osteonecrosis (avascular), bone infarct; osteoporosis; osteopenia; osteitis deformans (Paget disease of bone); pathologic fracture; spondylolisthesis/spondylosis (degenerative)

**degenerative/metabolic disorders of joints:** gout, gouty arthritis, pseudogout; joint effusion; osteoarthritis

**degenerative/metabolic disorders of muscles, ligaments, fascia:** Dupuytren contracture; muscle calcification and ossification; muscle wasting and diffuse atrophy; rhabdomyolysis

**Traumatic and mechanical disorders:** amputation and care of amputees; backache, including low back pain; blast injuries; contractures, hospital-acquired; contusions; dislocations; fractures; sprains, strains; kyphoscoliosis, scoliosis; rotator cuff syndrome; slipped capital femoral epiphysis; dislocation of hip

**Congenital disorders:** achondroplasia/dwarfism; disorders of limb development (HOX gene mutation, phocomelia); developmental dysplasia of the hip; dislocation of hip in infantile spinal muscular atrophy; genu valgum or varum; foot deformities (flat foot, valgus/varus deformities); osteogenesis imperfecta; McArdle disease; mitochondrial myopathies

**Adverse effects of drugs on the musculoskeletal system:** drug-induced myopathy (eg, steroids, statins, cocaine, AZT); malignant hyperthermia

## Cardiovascular System

### Normal Processes

**Embryonic development, fetal maturation, and perinatal transitional changes**

**Organ structure and function**

chambers, valves

cardiac cycle, mechanics, heart sounds, cardiac conduction

hemodynamics, including blood volume and systemic vascular resistance

circulation in specific vascular beds, including pulmonary and coronary

**Cell/tissue structure and function**

heart muscle, metabolism, oxygen consumption, biochemistry, and secretory function (eg, atrial natriuretic peptide)

endothelium and secretory function, vascular smooth muscle, microcirculation, and lymph flow

neural and hormonal regulation of the heart, blood vessels, and blood volume, including responses to change in posture, exercise, and tissue metabolism, and autonomic responses

**Repair, regeneration, and changes associated with stage of life**

**Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis**

**Infectious, immunologic, and inflammatory disorders**

**infectious disorders:** infective endocarditis, myocarditis

**immunologic and inflammatory disorders**

**Neoplasms:** myxoma, metastases

**Dysrhythmias:** premature beats (PACs, PVCs); atrial flutter/fibrillation; multifocal atrial tachycardia; paroxysmal tachycardias; ventricular tachycardia/fibrillation; wide complex tachycardia; torsades des pointes; bradycardias; atrioventricular block (first-, second-, third-degree); conduction disorder (LBBB, RBBB); cardiac arrest; sick sinus syndrome; prolonged QT syndrome; Wolff-Parkinson-White syndrome; carotid sinus hypersensitivity; pacemaker dysfunction, including failure to sense, capture

**Heart failure:** chordae tendineae rupture; congestive heart failure; cor pulmonale; diastolic dysfunction; systolic dysfunction; mitral valve dysfunction; heart failure secondary to myocardial infarction; high-output heart failure, including thyrotoxicosis-induced, anemia-induced; tachycardia, induced; cardiogenic pulmonary edema

**Ischemic heart disease:** acute coronary syndrome, acute myocardial infarction; angina pectoris, stable and unstable/coronary artery disease/coronary insufficiency; coronary artery spasm

**Diseases of the myocardium:** cardiomyopathy, dilated, including alcoholic, viral, takotsubo; cardiomyopathy, obstructive hypertrophic; cardiomyopathy, familial dilated; cardiomyopathy, restrictive; hypertensive heart disease, left ventricular hypertrophy; complications of myocardial infarction; traumatic tamponade post-myocardial infarction; papillary muscle rupture/dysfunction; ventricular free wall rupture; myocarditis

**Diseases of the pericardium:** chronic constrictive pericardiopathy; pericardial effusion; pericardial tamponade; acute pericarditis; pericarditis, following myocardial infarction, surgery, trauma

**Valvular heart disease:** valve disorders, mitral/aortic/tricuspid/pulmonic; mitral valve prolapse; functional murmurs; rheumatic heart disease; complications of artificial valves

**Hypotension:** orthostatic hypotension

**Hypertension:** elevated blood pressure reading without diagnosis of hypertension; essential hypertension; malignant hypertension; secondary hypertension

**Dyslipidemia:** hypercholesterolemia; hyperlipidemia; hypertriglyceridemia; lipoproteins/lipoprotein lipase deficiency

**Vascular disorders**

**disorders of the great vessels:** aneurysm, aortic (abdominal/thoracic), dissection, ruptured; aneurysm, iliac, other peripheral vascular, ruptured; aortoiliac disease

**peripheral arterial vascular disease:** arterial embolus/thrombosis; arteriovenous fistula; atheroembolic disease; claudication; compartment syndrome; cholesterol emboli; hypertensive vascular disease; peripheral arterial disease; thromboangiitis obliterans

**diseases of the veins:** deep venous thrombosis, venous thromboembolism; phlebitis/thrombophlebitis; varicose veins; venous insufficiency; stasis ulcers, stasis dermatitis

**Traumatic and mechanical disorders:** ventricular puncture; myocardial contusion; lymphedema; myocardial rupture; traumatic aortic dissection

**Congenital disorders, including disease in adults:** anomalous left coronary artery; atrial septal defect; coarctation of the aorta; endocardial cushion defect; patent foramen ovale; patent ductus arteriosus; tetralogy of Fallot; transposition of the great vessels; ventricular septal defect



**Adverse effects of drugs on the cardiovascular system:** adriamycin; cocaine, amphetamine, PCP; ACE inhibitors, calcium channel blockers, alpha blockers, minoxidil

## Respiratory System

### Normal Processes

**Embryonic development, fetal maturation, and perinatal changes**

**Organ structure and function**

airways, including mechanics and regulation of breathing  
lung parenchyma, including ventilation, perfusion, gas exchange  
pleura  
nasopharynx, sinuses

**Cell/tissue structure and function, including surfactant formation, and alveolar structure**

**Repair, regeneration, and changes associated with stage of life**

**Pulmonary defense mechanisms and normal flora**

### Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis,

**Management, Risks, Prognosis**

**Infectious, immunologic, and inflammatory disorders**

**infectious, immunologic, and inflammatory disorders of the upper airways:** acute upper respiratory infection; viral infections (adenovirus, coronaviruses, coxsackievirus, influenza virus, parainfluenza virus, rhinoviruses); sinusitis; nasopharyngitis; epiglottitis; croup; acute laryngitis; acute laryngotracheitis; tracheitis; pharyngitis; streptococcal throat infections; tonsillitis; peritonsillar abscess; rhinitis, allergic, chronic; ulcers of nasal cavity/sinuses

**infectious, immunologic, and inflammatory disorders of the lower airways:** hospital-acquired pneumonia; ventilator-associated pneumonia, community-acquired pneumonia, acute bronchiolitis; bronchiolitis obliterans with organizing pneumonia (BOOP); anthrax, pulmonary (Bacillus anthracis); aspiration pneumonia, pneumonitis; bronchitis, acute; bronchopneumonia; pneumonia (Bordetella pertussis, Burkholderia pseudomallei, Chlamydomphila pneumoniae, Coxiella burnetii, Francisella tularensis, Haemophilus influenzae, Klebsiella pneumoniae, Legionella, Moraxella catarrhalis, Mycoplasma pneumoniae, Pseudomonas aeruginosa, pulmonary tuberculosis, Streptococcus, MSSA, MRSA, other gram-negative bacteria); viral infection (eg, influenza A, B, adenovirus, H1N1, respiratory syncytial virus, parainfluenza virus); fungal infection (aspergillosis, including allergic bronchopulmonary aspergillosis and aspergilloma, histoplasmosis, coccidioidomycosis, Pneumocystis); lung abscess; viral infection (eg, influenza A, B, adenovirus, respiratory syncytial virus, parainfluenza virus, avian influenza virus); fungal infection (aspergillosis, including allergic bronchopulmonary aspergillosis and aspergilloma, histoplasmosis, coccidioidomycosis, Pneumocystis)

**Neoplasms**

**benign neoplasms:** upper airways (eg, vocal cord polyps, nasal polyps, juvenile papillomatosis); lungs and pleura (eg, solitary pulmonary nodule, bronchial carcinoid tumors)

**malignant neoplasms**

**upper airways:** lip, oral cavity, and pharynx; head and neck cancer; larynx; trachea

**lower airways and pleura:** malignant neoplasms of bronchus and/or lung (squamous

cell, adenocarcinoma, large cell, small cell); malignant neoplasms of pleura (mesothelioma); secondary malignant neoplasms of lung; secondary malignant neoplasms of pleura

**metastatic neoplasms including pleural**

**Obstructive airway disease:** asthma, reactive airway disease; bronchiectasis; chronic airway obstruction; chronic obstructive pulmonary disease (COPD), chronic bronchitis, emphysema

**Pneumoconiosis/fibrosing/restrictive pulmonary disorders/interstitial lung disease:**

pneumoconiosis; asbestosis; silicosis; silo-filler's lung, byssinosis, bagassosis, berylliosis; hypersensitivity pneumonitis; hypereosinophilic syndromes, Loeffler syndrome; interstitial pneumonia, usual (UIP), desquamative (DIP), nonspecific

**Respiratory failure/respiratory arrest and pulmonary vascular disorders:** acute respiratory distress syndrome (ARDS); pulmonary hypertension; pulmonary vascular disorders, arteriovenous fistula; pulmonary edema, pulmonary cause and unspecified; pulmonary embolism; air and fat embolism; respiratory failure due to enteral feeding

**Metabolic, regulatory, and structural disorders:** disorders of gas exchange; hypoventilation; hypoxia; pulmonary alveolar proteinosis; ventilation-perfusion imbalance

**Disorders of the pleura, mediastinum, and chest wall:** chylothorax; costochondritis; empyema; hemothorax; mediastinitis; pleural effusion; pleuritis; pneumomediastinum; pneumothorax

**Traumatic and mechanical disorders**

**upper airways:** epistaxis; barotrauma, sinus; laryngeal/pharyngeal obstruction; tracheoesophageal fistula; tracheal stenosis; tracheomalacia; trauma (eg, tracheal injury); foreign body (nose, pharynx, larynx, trachea); traumatic/mechanical disorders of the nasal cavity/sinuses (eg, septal perforation)

**lower airways and pleura:** atelectasis; diaphragm/chest wall injury; drowning and near-drowning; foreign body, upper and lower respiratory tract; penetrating chest wounds; pulmonary contusion; sleep apnea, obstructive and central; hypoventilation syndrome, obesity-hypoventilation syndrome

**Congenital disorders:** bronchogenic cysts; congenital cysts; congenital diaphragmatic hernia; pulmonary sequestration; immotile cilia syndrome

**Adverse effects of drugs on the respiratory system:** bleomycin, amiodarone; adverse effects of 100% oxygen; tobacco, inhalants, cocaine

## Gastrointestinal System

### Normal Processes

**Embryonic development, fetal maturation, and perinatal changes**

**Organ structure and function**

anatomy of the alimentary canal, including mouth, pharynx, esophagus, stomach, small intestine, large intestine, anus, peritoneal cavity

liver and biliary system, including enterohepatic circulation

salivary glands and exocrine pancreas

gastrointestinal motility, including defecation digestion and absorption

**Cell/tissue structure and function**

endocrine and neural regulatory functions, including GI hormones (eg, gastrin)

salivary, gastrointestinal, pancreatic, hepatic secretory products, including enzymes, proteins, bile salts, and processes

synthetic and metabolic functions of hepatocytes

**Repair, regeneration, and changes associated with stage of life**

**Gastrointestinal defense mechanisms and normal flora**

**Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis**

**Infectious, immunologic, and inflammatory disorders**

**infectious disorders**

**bacterial:** pseudomembranous colitis (*Clostridium difficile*); enteritis/enteric infections (includes gastroenteritis) (eg, *Staphylococcus aureus*, *Escherichia coli*, *Listeria monocytogenes*, *Yersinia enterocolitica*, *Campylobacter* species, *Vibrio cholerae*, *Salmonella* species, *Shigella* species, traveler's/infectious diarrhea); hepatic abscess, subhepatic abscess, subphrenic abscess; peritonitis, primary and secondary; Whipple disease

**viral:** infectious esophagitis (eg, CMV, herpes); hepatitis A, B, C, D, E; coxsackievirus enteritis/colitis; Echovirus enteritis/colitis; rotavirus enteritis; mumps; gingivostomatitis, herpetic

**fungal:** thrush

**parasitic:** *Cryptosporidium*, *Cyclospora*, *Entamoeba histolytica*, *Giardia*, *Isospora belli*, *Strongyloides stercoralis*

**immunologic and inflammatory disorders:** autoimmune hepatitis; celiac disease; eosinophilic esophagitis; granulomatous enteritis; inflammatory bowel disease, including Crohn disease, regional enteritis, microscopic colitis (collagenous and lymphocytic colitis), ulcerative colitis, toxic megacolon

**Neoplasms**

**benign neoplasms, including polyps, cysts:** stomach; small intestine; colon, rectum, and anus, including polyps

**malignant neoplasms and pre-malignant conditions:** oral cancer (eg, lips, mouth, tongue, salivary glands); esophageal, squamous and adenocarcinoma; Barrett esophagus; gastrinoma, Zollinger-Ellison syndrome; gastrointestinal carcinoid tumors; gastrointestinal stromal tumors; small intestine; stomach, adenocarcinoma, lymphoma, MALT; colon, rectum, anus; hereditary colon cancer syndromes, familial adenomatous polyposis (eg, Peutz-Jeghers syndrome, Gardner syndrome, Turcot syndrome, ); MUTYH-associated polyposis; gallbladder, cholangiocarcinoma, adenocarcinoma of the ampulla of Vater; liver, including hepatoma; peritoneal cancer, including metastatic studding with cancer; pancreas

**metastatic neoplasms**

**Signs, symptoms, and ill-defined disorders:** upper gastrointestinal bleeding; lower gastrointestinal bleeding; constipation; diarrhea; hematochezia; bright red rectal bleeding; melena; nausea, vomiting, rumination

**Disorders of the oral cavity, salivary glands, and esophagus**

**oral cavity and salivary glands:** abscessed tooth; dental caries; malocclusion; disorders of the salivary glands (eg, stones, sialadenitis, parotitis); teething syndrome

**esophagus:** achalasia and cardiospasm; dysphagia; diverticulum (eg, Zenker); esophageal periapical abscess without sinus; esophagitis/esophageal reflux (GERD); esophagitis, pill; Mallory-Weiss syndrome; paraesophageal (hiatal) hernia; stricture and stenosis of esophagus

**Disorders of the stomach, small intestine, colon, rectum, anus**

**stomach:** dyspepsia/hyperacidity; gastric ulcer; gastritis; peptic ulcer; peptic ulcer perforation; gastroparesis

**small intestine, colon:** appendicitis; angiodysplasia; diverticula; duodenitis, duodenal ulcer, peptic ulcer; gastroenteritis and colitis (noninfectious); granulomatous enterocolitis; Hirschsprung disease; impaction of intestine; intestinal obstruction/stricture; intussusception; irritable colon/irritable bowel syndrome; ischemic bowel; necrotizing enterocolitis; paralytic ileus; volvulus; malnutrition and malabsorption, including lactose intolerance, short bowel syndrome

**rectum and anus:** abscess of anal and rectal regions; anal fissure; anal fistula; ulcer; fecal incontinence; hemorrhage (rectum, anus); proctitis; hemorrhoids; rectal prolapse

#### **Disorders of the liver and biliary system, noninfectious**

**liver:** cirrhosis; Dubin-Johnson, Rotor syndromes; end-stage liver disease, including indications for transplantation; Gilbert syndrome, Crigler-Najjar syndrome; hepatic coma/hepatic encephalopathy; hepatitis, noninfectious; hepatitis, fatty liver, alcoholic; hepatorenal syndrome; hepatopulmonary syndrome; jaundice; non-alcoholic fatty liver disease; portal hypertension/esophageal varices

**biliary system:** bile duct obstruction/cholestasis; cholangitis, including ascending; choledocholithiasis; cholelithiasis/cholecystitis; cholestasis due to parenteral nutrition; gallstone ileus; Mirizzi syndrome; primary biliary cirrhosis; primary sclerosing cholangitis

**Disorders of the pancreas:** pancreatitis, acute; pancreatitis, chronic; pancreatitis, hereditary; pancreatic cyst/pseudocyst; pancreatic duct obstruction; pancreatic insufficiency

**Disorders of the peritoneal cavity:** ascites

**Traumatic and mechanical disorders:** abdominal wall defects; adhesions, postsurgical; digestive system complications of surgery; post-gastric surgery syndromes (eg, blind loop syndrome, adhesions); duodenal tear; foreign body in digestive system; inguinal, femoral, and abdominal wall hernias; open wound, abdominal; perforation of hollow viscus and blunt trauma; perforation/rupture of esophagus (Boerhaave syndrome); umbilical hernia

**Congenital disorders:** annular pancreas; biliary atresia; cleft lip and palate; esophageal atresia; malrotation without volvulus; Meckel diverticulum; pyloric stenosis, gastric outlet obstruction; tracheoesophageal fistula

**Adverse effects of drugs on the gastrointestinal system:** drug-induced changes in motility (chronic laxative abuse, opioids); drug-induced gastritis, duodenitis, peptic ulcer disease (NSAIDs); drug-induced hepatitis (eg, acetaminophen, isoniazid); drug-induced pancreatitis (eg, thiazide diuretics)

## **Renal & Urinary System**

### **Normal Processes**

**Embryonic development, fetal maturation, and perinatal changes**

#### **Organ structure and function**

kidneys, ureters, bladder, urethra  
glomerular filtration and hemodynamics  
urine concentration and dilution  
renal mechanisms in acid-base balance  
renal mechanisms in body fluid homeostasis  
micturition

#### **Cell/tissue structure and function**

renal metabolism and oxygen consumption

tubular reabsorption and secretion, including transport processes and proteins  
hormones produced by or acting on the kidney (eg, renin, aldosterone, angiotensin II, vasopressin)

**Repair, regeneration, and changes associated with stage of life**

**Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis**

**Infectious, immunologic, and inflammatory disorders**

**infectious disorders**

**upper urinary tract:** granulomatous pyelonephritis; perinephric abscess; pyelonephritis; pyonephrosis; renal abscess; renal tuberculosis

**lower urinary tract and urinary tract infections of unspecified location:** cystitis; urethritis, chlamydial and nonchlamydial

**immunologic and inflammatory disorders**

**upper urinary tract**

**glomerular disorders:** Alport syndrome; glomerular disease due to hepatitis B, C; glomerulonephritis, including poststreptococcal; IgA nephropathy; lupus nephritis; minimal change disease; nephrotic syndrome; thin basement membrane disease

**tubular interstitial disease:** acute tubular necrosis (ATN); acute interstitial nephritis; papillary necrosis; HIV nephropathy

**lower urinary tract:** interstitial cystitis

**Neoplasms**

**benign neoplasms and cysts**

**malignant neoplasms:** renal (eg, Wilms tumor/nephroblastoma, renal cell carcinoma, renal tumors associated with congenital/hereditary conditions); urinary bladder and collecting system

**Signs, symptoms, and ill-defined disorders:** dysuria; hematuria; oliguria, anuria; proteinuria

**Metabolic and regulatory disorders:** acute kidney injury; renal insufficiency; azotemia, uremic syndrome; chronic kidney disease, including end-stage renal disease; cystinuria; Fanconi syndrome; hypertensive renal disease (renal complications of hypertension); renal calculi, ureteral calculi, nephrolithiasis; renal tubular acidosis

**Vascular disorders:** renal artery stenosis (atherosclerosis, fibromuscular dysplasia, nephrosclerosis); renal vein thrombosis; renal infarction

**Traumatic and mechanical disorders:** bladder rupture; neurogenic bladder; obstructive uropathy; posterior urethral valves; renal laceration; renal vascular injury; ureteral laceration/avulsion/disruption; urethral diverticulum; urethral/ureteral obstruction/stricture/prolapse; urinary incontinence, including secondary enuresis; vesicoureteral reflux

**Congenital disorders:** double ureters/ureteral duplication/double collecting system; horseshoe kidney; hydronephrosis/reflux; renal agenesis, renal hypoplasia, renal dysplasia; single kidney

**Adverse effects of drugs on the renal and urinary system:** ACE inhibitors; aminoglycosides; amphotericin B; cisplatin; furosemide; gadolinium (nephrogenic systemic fibrosis); heroin; iodinated contrast dye; lithium; NSAIDs; penicillins; sulfa drugs; tenofovir; drug-induced urinary retention

## Pregnancy, Childbirth, & the Puerperium

### Normal Processes

**Organ structure and function:** pregnancy, including fertilization, implantation, development of embryo, labor and delivery, the puerperium, lactation, gestational uterus, placenta

### Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis

#### Prenatal care

**preconception counseling and care:** folate deficiency prevention; immunizations; nutritional assessment, including vitamins; Rh screening

**prenatal risk assessment/prevention:** adolescent pregnancy; antepartum fetal evaluation, including biophysical profile; genetic screening;  $\alpha$ -fetoprotein; diabetes mellitus; neural tube defects; Rh isoimmunization

**supervision of normal pregnancy:** assessment of gestational age; iron deficiency prevention; nutrition, including weight management; surveillance, including ultrasonography and assessment of fetal growth; vitamin deficiency prevention; infections, maternal, fetal, newborn (focus on prevention and screening): cytomegalovirus, coxsackievirus, hepatitis B virus, herpes simplex viruses, HIV, influenza virus, parvovirus B19 virus, rubella virus, varicella-zoster virus, Chlamydia trachomatis, Treponema pallidum, Streptococcus agalactiae, Toxoplasma gondii, amnionitis; urinary tract infection

**Obstetric complications:** abortion, induced, septic, missed, spontaneous, threatened; acute fatty liver of pregnancy; anemia of pregnancy, sickle cell disease, thalassemia in pregnancy; antepartum hemorrhage, including third-trimester bleeding; cardiomyopathy of pregnancy; cervical incompetence, cervical shortening; cholestasis of pregnancy, intrahepatic; congenital abnormalities, maternal (eg, bicornuate uterus); ectopic pregnancy; fetal abnormality affecting management of mother (eg, hydrocephalus, spina bifida); gestational diabetes; intrauterine growth restriction; maternal mortality; multiple gestation; placental abnormalities (abruptio placentae, placenta previa, premature separation of placenta); polyhydramnios, oligohydramnios; preeclampsia, eclampsia, HELLP syndrome, gestational hypertension; prolonged pregnancy; Rh isoimmunization affecting management of mother; vomiting in pregnancy (morning sickness, hyperemesis gravidarum); trauma in pregnancy; infections complicating pregnancy

**Labor and delivery:** labor and delivery, uncomplicated; labor and delivery, complicated, including shoulder dystocia; cesarean delivery, including complications; cord compression, cord prolapse; fetal malpresentations (eg, breech); intrapartum fetal evaluation, including fetal heart tones; intrapartum prophylaxis (eg, HIV, Chlamydia, gonococcal prophylaxis); premature rupture of membranes; preterm (before 37 weeks' gestation) and postdates labor and delivery; threatened preterm labor

**Puerperium, including complications:** lactation problems; breast-feeding problems; lochia; postpartum cardiomyopathy; postpartum blues; postpartum hemorrhage; postpartum sepsis; retained placenta, products of conception (eg, placenta accreta); uterine atony

#### Newborn (birth to 4 weeks of age)

##### normal newborn

examination of liveborn at admission to hospital  
screening, newborn

**disorders of the newborn:** screening, newborn; ABO incompatibility in newborn; hemolytic disease due to Rh incompatibility; birth asphyxia syndrome (liveborn neonate); birth trauma (eg, cord compression, brachial palsy, lacerations); drug

withdrawal syndrome in newborn; feeding problems in newborn; fetal growth and development abnormalities, including fetal growth restriction; gastrointestinal obstruction; hypocalcemia of newborn; infections, congenital or peripartum (cytomegalovirus, herpes simplex viruses, HIV, hepatitis B, rubella virus, parvovirus B19 virus, varicella zoster virus, Chlamydia trachomatis, Streptococcus agalactiae, Treponema pallidum, Toxoplasma gondii); intrapartum fetal distress/death including stillborn; jaundice, fetal/neonatal/perinatal; laryngomalacia; macrosomia (large for gestational age); meconium aspiration syndrome; neonatal acne; neonatal Candida infection (thrush); neonatal hypoglycemia; neonatal conjunctivitis and dacryocystitis; ophthalmic gonorrhoea; phenylketonuria; premature infant; post-term infant; pseudomembranous colitis of infancy; respiratory distress syndrome (hyaline membrane disease); respiratory problems after birth (eg, bronchopulmonary dysplasia, tracheomalacia; tracheoesophageal fistula in neonates); retinitis of prematurity; seizures in newborn; sudden infant death syndrome (SIDS), apparent life-threatening event (ALTE); tetanus neonatorum

**Congenital disorders, neonatal:** congenital malformations and anomalies; neonatal hydrocele

**Adverse effects of drugs on pregnancy, childbirth, and the puerperium:** alcohol, tobacco, and other drugs (ATOD); prenatal radiation exposure; teratology (eg, ACE inhibitors, SSRIs, warfarin, infections, toxins)

**Systemic disorders affecting pregnancy, labor and delivery, and puerperium:** appendicitis; asthma; carpal tunnel syndrome in pregnancy; cirrhosis; deep venous thrombosis (DVT); diabetes mellitus; heart failure, valvular heart disease; hypertension; myasthenia gravis; obesity; pancreatitis; psychiatric disorders; renal failure/renal disease, including SLE; seizure disorders; thyroid disorders, hypothyroidism, hyperthyroidism

## Female Reproductive System & Breast

### Normal Processes

**Embryonic development, fetal maturation, and perinatal changes, gametogenesis**

#### Organ structure and function

female structure, including breast

female function (eg, ovulation, menstrual cycle, puberty)

intercourse, sexual response

**Cell/tissue structure and function:** hypothalamic-pituitary-gonadal axis, sex steroids, and gestational hormones

**Reproductive system defense mechanisms and normal flora**

### Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis,

#### Management, Risks, Prognosis

##### Breast

**infectious, immunologic, and inflammatory disorders:** breast abscess; inflammatory disease of breast, fat necrosis; mastitis; nipple discharge

##### neoplasms

**benign and undefined neoplasms:** breast cyst, solitary; fibrocystic changes; fibroadenoma; hypertrophy of breast; intraductal papilloma

**malignant neoplasms (including screening):** breast cancer; intraductal carcinoma; Paget disease of breast; phyllodes tumors

### Female reproductive system

**infectious, immunologic, and inflammatory disorders:** bacterial vaginosis, including during pregnancy; Bartholin gland abscess; cellulitis, pelvic; candidiasis of the vulva or vagina; lichen sclerosus; sexually transmitted infections and exposure; cervicitis and endocervicitis; chancroid (*Haemophilus ducreyi*); genital herpes; gonorrhea (*Neisseria gonorrhoeae*); human papillomavirus infection, genital/venereal/anal warts, condylomata acuminata; lymphogranuloma venereum (*Chlamydia trachomatis*), non-lymphogranuloma venereum; pelvic inflammatory disease; Fitz-Hugh–Curtis syndrome; salpingitis and oophoritis; syphilis (*Treponema pallidum*); trichomoniasis (*Trichomonas vaginalis*); urethritis; vaginitis; vulvovaginitis

**Neoplasms of the cervix, ovary, uterus, vagina, and vulva**

**benign neoplasms and cysts:** abnormal Pap smear; benign neoplasm of ovary; endocervical and endometrial polyps; leiomyomata uteri; ovarian cyst

**malignant and precancerous neoplasms:** cervical cancer; HPV causing cancer; cervical dysplasia, HPV causing dysplasia; endometrial hyperplasia; endometrial/uterine cancer; gestational trophoblastic disease (hydatidiform mole); ovarian cancer; vulvar dysplasia and cancer

**Fertility and infertility:** assisted reproductive techniques (ART); contraception (eg, oral contraceptives, IUD, vaginal cap, cervical sponge, diaphragm, implant, morning-after pill, male and female condoms); female infertility; gonadal dysgenesis 45,X (Turner syndrome); sterilization; tubal factors; infertility

**Menopause:** ovarian failure, premature menopause; perimenopause; premenopausal menorrhagia; postmenopausal atrophic vaginitis; postmenopausal bleeding; vasomotor symptoms

**Menstrual and endocrine disorders:** abnormal uterine bleeding, including perimenopausal; absence of menstruation (primary amenorrhea, secondary amenorrhea including undiagnosed pregnancy); anovulation; dysmenorrhea; endometriosis; hirsutism, virilization; mittelschmerz; pelvic pain; polycystic ovarian syndrome; postcoital bleeding; premenstrual syndrome

**Sexual dysfunction:** dyspareunia; orgasmic dysfunction; sexual desire/arousal syndrome; vaginismus

**Traumatic and mechanical disorders:** Asherman syndrome; chronic inversion of uterus; chronic pelvic pain syndrome; cystocele; imperforate hymen; injuries, wounds, and burns affecting the female reproductive system and injuries, wounds, burns, and blast injuries; ovarian torsion; pelvic relaxation; prolapse, vaginal walls, uterine, uterovaginal; rectocele; urethrocele

**Congenital disorders:** müllerian agenesis; uterus didelphys, bicornuate uterus; short cervix

**Adverse effects of drugs on the female reproductive system and breast:** antihistamines, H<sub>2</sub>-receptor blockers; benzodiazepines; beta-adrenergic blockers; hormone replacement; opioids; spironolactone; selective serotonin reuptake inhibitors; tricyclic antidepressants

## Male Reproductive System

### Normal Processes

**Embryonic development, fetal maturation, and neonatal changes, gametogenesis**

#### Organ structure and function

structure, male genitalia and prostate

function, male genitalia and prostate (eg, spermatogenesis, puberty)

intercourse, orgasm, erection



**Cell/tissue structure and function, including hypothalamic-pituitary-gonadal axis, sex steroids, and gestational hormones**

**Reproductive system defense mechanisms and normal flora**

**Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis**

**Infectious, immunologic, and inflammatory disorders**

**infectious disorders:** balanitis; epididymitis; orchitis; prostatitis; sexually transmitted infections and exposure; chancroid (*Haemophilus ducreyi*); genital herpes; gonorrhea (*Neisseria gonorrhoeae*); human papillomavirus infection, genital/venereal/anal warts, condylomata acuminata; lymphogranuloma venereum (*Chlamydia trachomatis*); syphilis (*Treponema pallidum*); trichomoniasis (*Trichomonas vaginalis*); urethritis, chlamydial and nonchlamydial, nongonococcal

**immunologic and inflammatory disorders:** autoimmune hypogonadism

**Neoplasms:** malignant neoplasms, penile, prostate, testicular, breast

**Metabolic and regulatory disorders, including sexual dysfunction:** erectile dysfunction, impotence; infertility, male factor; male sexual dysfunction; premature ejaculation

**Traumatic and mechanical disorders:** benign prostatic hyperplasia/hypertrophy; circumcision, including complications; epididymal cyst; hydrocele; injuries, wounds, and burns to male genitalia, including blast injuries; penile laceration, penile fracture, Peyronie disease; phimosis; scrotal laceration; spermatocele; testicular rupture/avulsion/laceration; torsion of testis; urethral laceration/disruption; varicocele

**Congenital disorders of the male reproductive system:** hypospadias; Klinefelter syndrome; undescended testicle

**Adverse effects of drugs on the male reproductive system:** alcohol; androgens, testosterone; antipsychotics, antidepressants including selective serotonin reuptake inhibitors; beta-adrenergic blockers; diuretic including thiazides; drug-induced priapism (eg, trazodone); finasteride, dutasteride; sildenafil, tadalafil, vardenafil; marijuana; nitric oxide reductase inhibitors

## Endocrine System

**Normal Processes**

**Embryonic development, fetal maturation, and perinatal changes**

**Organ structure and function**

hypothalamus, posterior and anterior pituitary gland  
thyroid gland  
parathyroid gland  
adrenal cortex, adrenal medulla  
pancreatic islets  
ovary and testis  
adipose tissue

**Cell/tissue/structure and function, including hormone synthesis, secretion, action, metabolism**

peptide hormones  
steroid hormones, including vitamin D  
thyroid hormones  
catecholamine hormones  
renin-angiotensin system

**Repair, regeneration, and changes associated with stage of life**

## **Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis, Management, Risks, Prognosis**

### **Diabetes mellitus and other disorders of the endocrine pancreas**

**diabetes mellitus:** diabetes mellitus, type 1; diabetes mellitus, type 1.5; diabetes mellitus, type 2; diabetes mellitus, acute complications: hyperosmolar coma, hypoglycemic shock, ketoacidosis, including cerebral edema, associated electrolyte abnormalities; diabetes mellitus, chronic complications: gastrointestinal/gastroparesis, neurologic/neuropathy, ophthalmologic/retinopathy, peripheral vascular, renal/nephropathy, metabolic syndrome

**hypoglycemia and islet cell disorders:** hypoglycemia (secondary to insulinoma, surreptitious insulin use, sepsis, liver failure); hyperglycemia (secondary to glucagonoma); hyperinsulinism; islet cell tumors/insulinoma/somatostatinoma; pancreatic neuroendocrine tumors

**Thyroid disorders:** cyst, nodule; euthyroid sick syndrome; goiter (euthyroid-normal thyroid function with goiter); hypothyroidism; hyperthyroidism, including thyrotoxicosis and thyroid storm; thyroiditis, including Hashimoto; Graves disease; neoplasms (benign cysts and nodules, thyroid cancer including papillary, follicular, medullary, and anaplastic); thyroid deficiency from pituitary disorder; infertility due to thyroid disease; secondary hypothyroidism and hyperthyroidism

**Parathyroid disorders:** hyperparathyroidism; hypoparathyroidism; metabolic bone disease

**Adrenal disorders:** corticoadrenal insufficiency (Addison disease); adrenal insufficiency, secondary; hypocortisolism; Cushing disease, Cushing syndrome; hyperaldosteronism; neoplasms, benign and malignant (adrenal neuroblastoma, pheochromocytoma, adrenal carcinoma, adrenal adenoma, aldosteronoma, adrenal incidentaloma); delayed and precocious puberty; hypertensive endocrine disease

**Pituitary disorders:** acromegaly/gigantism; diabetes insipidus; galactorrhea not associated with childbirth; panhypopituitarism from any cause; pituitary apoplexy (eg, Sheehan syndrome); growth hormone deficiency; short stature; SIADH (inappropriate secretion of ADH [vasopressin]); neoplasm, benign and malignant (pituitary adenomas, craniopharyngioma, metastatic disease); prolactinoma and hyperprolactinemia, including infertility due to these disorders; hypogonadism, primary and secondary

### **Hypothalamic endocrine disorders**

#### **Multiple endocrine neoplasia (MEN1, MEN2)**

**Congenital disorders:** disorders of sexual differentiation; congenital adrenal hyperplasia; androgen insensitivity/resistance syndrome; congenital hypothyroidism

**Adverse effects of drugs on the endocrine system:** drug, medicinal, and biologic substance effects; exogenous steroid suppression of adrenal glands, anabolic steroids

## **Multisystem Processes & Disorders**

### **Normal Processes**

#### **Principles of nutrition**

generation, expenditure, and storage of energy at the whole-body level  
functions of nutrients (eg, essential, trans-fatty acids, cholesterol)

#### **Electrolyte and water metabolism**

electrolyte metabolism (calcium, potassium, phosphorus)  
water metabolism

**Intracellular accumulations (eg, pigments, fats, proteins, carbohydrates, minerals, inclusions, vacuoles, lysosomal/glycogen storage disease and structures related to**

storage diseases, glycogen phosphorylase deficiency, Zellweger syndrome)  
**Abnormal Processes: Health and Health Maintenance, Screening, Diagnosis,  
Management, Risks, Prognosis**

**Infectious, immunologic, and inflammatory disorders**

**infectious disorders**

**bacterial:** brucellosis (*Brucella* spp); leptospirosis (*Leptospira interrogans*); Lyme disease (*Borrelia burgdorferi*); melioidosis (*Burkholderia pseudomallei*); miliary (disseminated) tuberculosis (*Mycobacterium tuberculosis*); tularemia (*Francisella tularensis*); toxic shock syndrome; Q fever (*Coxiella burnetii*); anaplasmosis and ehrlichiosis (*Anaplasma* and *Ehrlichia* species); rickettsiosis (Rocky Mountain spotted fever [*Rickettsia rickettsii*])

**viral:** infectious mononucleosis (Epstein-Barr virus); cytomegalovirus infection; yellow fever; human herpesvirus 8 (HHV-8)

**fungal:** blastomycosis (*Blastomyces dermatitidis*); candidiasis (*Candida albicans*); coccidioidomycosis (*Coccidioides immitis/posadasii*); histoplasmosis (*Histoplasma capsulatum*)

**parasitic:** schistosomiasis (*Schistosoma*); leishmaniasis (*Leishmania* spp), visceral (kala-azar); trypanosomiasis/Chagas disease, acute and chronic (*Trypanosoma*)

**immunologic and inflammatory disorders:** acute rheumatic fever; autoimmune arteritis/vasculitis; Behçet syndrome; Churg-Strauss syndrome; eosinophilic granuloma, histiocytosis, Langerhans cell histiocytosis; Goodpasture syndrome; Henoch-Schönlein purpura; Kawasaki disease; mixed connective tissue disease; polyangiitis; polyarteritis nodosa; polymyalgia rheumatica, temporal arteritis; Raynaud disease/Raynaud syndrome; reactive arthritis, formerly Reiter disease, including Reiter arthritis; scleroderma (systemic sclerosis); Sjögren syndrome; systemic lupus erythematosus; Takayasu arteritis; Wegener granulomatosis; familial Mediterranean fever; sarcoidosis, Lofgren syndrome

**Neoplasms and related disorders**

**paraneoplastic syndromes:** endocrine (eg, SIADH, Cushing syndrome, hypercalcemia of malignancy [PTHrP]); hematologic (polycythemia, nonbacterial thrombotic endocarditis); neurologic (myasthenic syndrome, paraneoplastic cerebellar degeneration, limbic encephalitis, pure sensory neuropathy); mucocutaneous (eg, acanthosis nigricans); musculoskeletal (eg, pulmonary osteoarthropathy, polymyositis); other (membranous glomerulonephritis)

**inherited cancer syndromes:** DNA repair abnormalities (eg, Fanconi anemia); Lynch syndrome (gastrointestinal and female reproductive)

**Signs, symptoms, and ill-defined disorders:** arthralgias; abdominal pain; chest pain; cough; dizziness, light-headedness, syncope, including breath-holding spells with syncope; dyspnea, shortness of breath; edema, anasarca; fatigue; fever of unknown origin; Gulf War syndrome; hemoptysis; joint pain; palpitations; pruritus; unexpected weight gain/weight loss

**Nutrition**

**protein-calorie malnutrition (kwashiorkor, marasmus)**

**vitamin deficiencies and/or toxicities:** vitamin A; vitamin B; vitamin B1, thiamine (eg, Wernicke-Korsakoff syndrome, beriberi); vitamin B3, niacin; vitamin B6, pyridoxine; vitamin B9, folic acid; vitamin B12, cobalamins (pernicious anemia); vitamin C (scurvy); vitamin D (rickets); vitamin E; vitamin K

**mineral deficiencies and/or toxicities**

**obesity**

## **enteral/parenteral nutrition (TPN)**

### **Toxins and environmental extremes**

physical and associated disorders

temperature (eg, hypothermia, hyperthermia, heat stroke)

radiation (eg, radon, uranium mining, imaging studies)

thermal injury, burns, electrocution, lightning

decreased atmospheric pressure, high-altitude sickness

increased water pressure

chemical including Gulf War illness/syndrome

gases, vapors, smoke inhalation

agricultural hazards (eg, pesticides, green tobacco poisoning, anhydrous ammonia, Agent Orange)

volatile organic solvents

heavy metals

other chemical agents (eg, ethylene glycol, carbon tetrachloride, methanol; BPA)

principles of poisoning and therapy (eg, ASA, acetaminophen)

**Venomous bites and stings:** hymenoptera bites and stings; scorpion bites; snake bites; spider bites; jellyfish stings

### **Fluid, electrolyte, and acid-base balance disorders**

**fluid volume and electrolyte/ion disorders:** fluid volume disorders; dehydration;

hypovolemia; volume overload; electrolyte disorders; hyponatremia, hypernatremia;

hypokalemia, hyperkalemia; hypocalcemia, hypercalcemia; hypophosphatemia,

hyperphosphatemia; hypomagnesemia

**acid-base disorders:** metabolic acidosis; metabolic alkalosis; respiratory acidosis;

respiratory alkalosis; mixed acid-base disturbances

### **Abuse**

**child, nonaccidental trauma/inflicted head trauma/factitious disorder by proxy intimate partner abuse, sexual, emotional, and physical including injuries (eg, rib fractures) related to abuse**

**elder abuse, sexual, emotional, and physical including injuries (eg, rib fractures) related to abuse**

**sexual assault**

**Multiple trauma (eg, prioritization, blast injury involving more than one organ system)**

**Shock, cardiogenic, hypovolemic, neurogenic, septic, sepsis, bacteremia, systemic inflammatory response syndrome (SIRS), refractory, multiorgan dysfunction syndrome: meningococemia**

### **Genetic metabolic and developmental disorders**

**multifactorial:** VATER syndrome, association syndromes

**large genomic changes:** Beckwith-Wiedemann syndrome; Down syndrome; Prader-Willi syndrome

**enzymatic/metabolic:** alpha-1 antitrypsin deficiency; porphyria; inborn errors of metabolism (eg, maple syrup urine disease, diseases involving urea cycle); storage diseases (eg, Fabry disease, Tay-Sachs disease, glycogen storage disease, mucopolysaccharidoses)

**structural protein disorders:** amyloidosis; Ehlers-Danlos syndrome; immotile cilia syndrome (Kartagener syndrome; primary ciliary dyskinesia); Marfan syndrome

**intracellular/extracellular transport receptors:** cystic fibrosis; hemochromatosis; Wilson disease

**triplet repeat/RNA disorders:** fragile X syndrome

**Adverse effects of drugs on multisystem disorders:** drug-induced electrolyte abnormalities and acid base-disorders (eg, albuterol, prednisone, diuretics, alcohol)

## **Biostatistics, Epidemiology/Population Health, & Interpretation of the Medical Literature**

### **Epidemiology/population health**

**Measures of disease frequency: incidence/prevalence**

**Measures of health status:** rates, crude and adjusted; reproductive rates (eg, maternal mortality, neonatal/infant/under-5 mortality); mortality, morbidity; standardization; life expectancy, health-adjusted life expectancy; population attributable risk (PAR), population attributable risk percent (PAR%); risk factors

**Survival analysis interpretation (eg, Kaplan-Meier curve)**

**Composite health status indicators, measures of population impact:** years of potential life lost; quality-adjusted life years; disability-adjusted life years; standardized mortality ratio

**Population pyramids and impact of demographic changes**

**Disease surveillance and outbreak investigation:** disease reporting; response to public health advisory, health promotion; recognition of clusters

**Communicable disease transmission:** attack rate; herd immunity; reportable diseases

**Points of intervention:** primary, tertiary; community level (eg, cigarette taxes, soda taxes, smoke-free cities, buildings: restaurants, public buildings); school policies; access, healthy food, transportation, clean air, safe environments

### **Study design, types and selection of studies (includes dependent/independent variables)**

**Descriptive studies (case report [one person]/case series [more than one])**

**Analytical studies: observational:** community surveys; cross-sectional (individuals); ecological (populations); case control; retrospective and prospective cohort

**Analytical studies: interventional:** clinical trial (randomized controlled trial; double-blind; placebo-controlled; noninferiority/equivalence trials); community intervention

**Systematic reviews and meta-analysis:** potential uses; estimation of effect sizes; heterogeneity; publication bias; forest plots, funnel diagrams; risk of bias, bias risk scale

**Obtaining and describing samples:** matching, inclusion/exclusion criteria, selecting appropriate controls for studies, lack of controls, concealed allocation, randomization, stratification

**Methods to handle noncompliance:** loss to follow-up; intention-to-treat analysis

**Qualitative analysis**

### **Measures of association**

**Relative risk**

**Odds ratio, hazard ratio**

**Other measures of association:** number needed to treat/harm; absolute risk (AR), absolute risk percent (AR%); population attributable risk (PAR), population attributable risk percent (PAR%)

**Distributions of data:** measures of central tendency; measures of variability; regression to mean; normal distribution; nominal measurement

**Correlation and regression, uses and interpretation:** correlation coefficients; multiple regression

### **Principles of testing and screening**

**Properties of a screening test:** validity, accuracy, reliability; criteria for a screening test; confirmatory testing; appropriateness; lead-time bias, length bias; screening vs diagnostic tests

**Sensitivity and specificity; predictive value, positive and negative**

**ROC curves**

**Probability:** theory (independence, product, addition rules); decision trees; likelihood ratios (application of Bayes theorem); post-test, pretest

**Study interpretation, drawing conclusions from data**

**Causation:** hypothesis-generating vs hypothesis-driven testing; causal criteria, temporality, temporal sequence, dose-response relationship; reverse causality

**Chance**

null hypothesis, Type I error and alpha level (multiple comparisons, random error/chance)

sample size and Type II error, beta, power

selection and interpretation of basic tests of statistical significance: chi-square; confidence intervals; p-values; t-test

a priori vs. post hoc analysis: subgroup analysis; error rate; affect types

**Interpretation of graphs/tables and text**

**Bias, confounding, and threats to validity (includes methods to address)**

selection, sampling bias

information bias: recall; ascertainment, ecologic fallacy, lack of blinding; loss to follow up

confounding variables, Hawthorne effect (includes methods to address)

other threats to validity (eg, placebo effect)

**Internal vs. external validity:** generalizability (external validity); efficacy vs effectiveness

**Statistical vs. clinical significance; clinical and surrogate outcome/end-point**

**Clinical decision making, interpretation and use of evidence-based data and**

**recommendations:** application of study results to patient care and practice, including patient preferences and individualization of risk profiles; risk/benefit analysis; synthesis of concepts with real data

**Research ethics**

**Informed consent for research**

**Privacy of patient data (HIPAA)**

**Roles of institutional review boards (IRBs)**

**Intervention analysis:** interim analysis; stopping analysis; safety monitoring

**Regulatory issues:** drug development, phases of approval; appropriateness of placebo;

appropriateness of randomized clinical trial; components of studies; ethics; scheduling; off-label use

**Other issues related to research ethics**

## Social Sciences

**Communication and interpersonal skills, including health literacy and numeracy, cultural competence**

**Patient interviewing, consultation, and interactions with the family (patient-centered communication skills)**

fostering the relationship (eg, expressing interest)

information gathering (eg, exploring patient's reaction to illness)

information provision (eg, providing information about working diagnosis)

making decisions (eg, eliciting patient's perspectives)

supporting emotions (eg, effective discussion with difficult patients)  
enabling patient behaviors (eg, education and counseling)

**Use of an interpreter**

**Medical ethics and jurisprudence, include issues related to death and dying and palliative care**

**Consent/informed consent to treatment, permission to treat (full disclosure, risks and benefits, placebos, alternative therapies, conflict of interest, and vulnerable populations)**

**Determination of medical decision-making capacity/informed refusal**

**Involuntary admission**

**Legal issues related to abuse (child, elder, and intimate partner)**

child protective services, foster care, immunizations

legal requirements for reporting

**Birth-related issues**

**Death and dying and palliative care**

life support

advance directive, health care proxy, advance care planning

euthanasia and physician-assisted suicide

diagnosing death/determination of brain death

pronouncing death

organ donation

hospice

pain management, including ethical issues related to death and dying

information sharing, counseling families

psychosocial and spiritual counseling, fear and loneliness

**Physician-patient relationship (boundaries, confidentiality including HIPAA, privacy, truth-telling, other principles of medical ethics, eg, autonomy, justice, beneficence)**

**Impaired physician, including duty to report impaired physician**

**Negligence/malpractice, including duty to report negligence and malpractice**

**Physician misconduct, including duty to report physician misconduct**

**Referrals**

**Cultural issues not otherwise coded**

**Systems-based practice (including health systems, public health, community, schools) and patient safety (including basic concepts and terminology)**

**Complexity/systems thinking**

**Characteristics of a complex system and factors leading to complexity:** how complexity leads to error

**Sociotechnical systems:** systems engineering; complexity theory; microsystems

**Health care/organizational behavior and culture:** environmental factors, workplace design and process; staffing; overcommitment, space, people, time, scheduling; standardization, reducing variance, simplification, metrics; safety culture; integration of care across settings; overutilization of resources (imaging studies, antibiotics, opioids); economic factors

**Quality improvement**

**Improvement science principles**

Variation and standardization: variation in process, practice; checklists, guidelines, and clinical pathways

Reliability

**Specific models of quality improvement:** model for improvement: plan-do-study-act (PDSA), plan-do-check-act (PDCA); Lean, including recognition and types of waste; Six Sigma

**Quality measurement**

Structure, process, outcome, and balancing measures

Measurement tools: run and control charts

Development and application of system and individual quality measures: core measures; physician quality report system (PQRS); event reporting system

**Strategies to improve quality**

Role of leadership

Principles of change management in quality improvement: specific strategies

**Attributes of high-quality health care**

High-value/cost-conscious care: overutilization of resources, including diagnostic testing, medications

Equitable care: access

Patient-centered care

Timely care

**Patient Safety**

**Patient safety principles**

Epidemiology of medical error

Error categorization/definition: active vs latent errors; Swiss cheese model of error; preventable vs non-preventable; near miss events/safety hazards

Causes of error

Patient factors: understanding of medication use; health literacy; economic status; cultural factors (eg, religion); failure to make appointments; socioeconomic status

Physician factors: deficiency of knowledge; judgment errors; diagnostic errors; fatigue, sleep deprivation; bias – cognitive, availability, heuristic, anchoring, framing

Human factors (eg, cognitive, physical, environmental)

High reliability of organization (HRO) principles: change management and improvement science; conceptual models of improvement

Reporting and monitoring for errors: event reporting systems

Communication with patients after adverse events (disclosure/transparency)

**Specific types of error**

Transitions of care errors (eg, handoff communication including shift-to-shift, transfer, and discharge): handoffs and related communication; discontinuities; gaps; discharge; transfers

Medication errors

Ordering, transcribing, dispensing, administration (wrong quantity, wrong route, wrong drug)

Medication reconciliation

Mathematical error

Procedural errors

Universal protocol (time out); wrong patient; wrong site; wrong procedure

Retained foreign bodies

Injury to structures: paracentesis; bowel perforation; thoracentesis; pneumothorax; central venous/arterial line injuries; arterial puncture and bleeding and venous thrombosis; lumbar puncture bleeding; paralysis

Other errors: anesthesia-related errors; mathematical errors



Health care-associated infections: nosocomial infection – eg, surgical site, ventilator associated, catheter-related; handwashing procedures or inadequate number of handwashing stations; central line-associated blood stream infections; surgical site infections; catheter-associated urinary tract infections; ventilator-associated pneumonia

Documentation errors: electronic medical record (including voice-recognition software errors); record keeping; incorrect documentation (eg, wrong patient, wrong date, copying and pasting, pre-labeling)

Patient identification errors

- Mislabeled: transfusion errors related to mislabeling

- Verification/two identifiers: lack of dual validation, including verbal verification of lab results

Diagnostic errors: errors in diagnostic studies; misinterpretation

Monitoring errors

- Cardiac monitoring/telemetry

- Drug monitoring (warfarin, antibiotics)

Device-related errors

- malfunction

- programming error

- incorrect use

### **Strategies to reduce error**

Human factors engineering

- Situational awareness

- Hierarchy of effective interventions: forcing function; visual cues

Error analysis tools: error/near miss analysis; failure modes and effect analysis; morbidity and mortality review; root cause analysis

Safety behavior and culture at the individual level: hierarchy of health care, flattening hierarchy, speak up to power; afraid to report, fear; psychological safety; closed-loop communication

Teamwork: principles of highly effective teams; case management; physician teams, physician-physician communication; interprofessional/intraprofessional teams; strategies for communication among teams, including system-provider communication, physician-physician communication (eg, consultations), interprofessional communication, provider-patient communication

### **Health care policy and economics**

#### **Health care policy**

Health care disparities: race/ethnicity; numeracy/literacy; socioeconomic status

Access to care: critical access systems or hospitals

Social justice

#### **Health care economics/Health care financing**

Types of insurance: Medicare, Medicaid, private insurance, self-pay

Navigating the insurance system: deductibles/co-pays; in-/out-of-network; preferred providers

Reimbursement issues affecting safety and quality: emergency services – EMTALA; pay-for-performance