

CHAPTER 3

HEALTHCARE ISSUES IN THE CHILD

HEALTHCARE TRENDS

- ▶ Causes of infant mortality have changed from primarily infectious and nutritional to noninfectious causes such as congenital anomalies and perinatal events (see Table 3-1).
- ▶ A resurgence of previously controlled infections such as tuberculosis and measles, and the emergence of newer infections such as human metapneumovirus (hMPV) and Middle East respiratory syndrome (MERS), coupled with antibiotic resistance and an increasingly global environment, make infectious diseases a persistent threat to child health.
- ▶ Environmental hazards such as environmental tobacco smoke exposure, asbestos, carbon monoxide, radon, and toxigenic molds are being increasingly recognized as important antecedents to health problems in children.
- ▶ Psychosocial issues are now playing a predominant role in child health, particularly issues such as alcohol and drug use and abuse, child neglect and maltreatment, violence, teen pregnancy, depression, anxiety, and behavior and school problems.
- ▶ Family functioning is increasingly being recognized as a major contributing factor in the health and well-being of children. Utilization of community resources to support families has increased.
- ▶ Changes in healthcare delivery include decreased use of hospitals and increased use of outpatient facilities, home health care, specialists, managed care, and an increasingly larger focus on cost containment.
- ▶ Current healthcare trends support greater emphasis on disease prevention and promotion than exclusively disease management.

TABLE 3-1.
LEADING CAUSES OF DEATH BY AGE GROUP

AGE	CAUSE OF DEATH
Under 1 year	Unintentional injuries* Congenital malformations Short gestation Sudden infant death syndrome Maternal pregnancy complications
1 to 4 years	Unintentional injuries* Congenital anomalies Homicide Malignant neoplasms Conditions of the heart
5 to 9 years	Unintentional injuries* Malignant neoplasms Congenital anomalies Homicide Conditions of the heart
10 to 14 years	Unintentional injuries* Malignant neoplasms Suicide Homicide Congenital anomalies
15 to 24 years	Unintentional injuries* Homicide Suicide Malignant neoplasms Heart disease

*Includes motor vehicle accidents, drowning, firearms.

Data adapted from *10 Leading Causes of Death by Age Group, United States, 2010*, by the Office of Statistics and Programming, National Center for Injury Prevention and Control, & Centers for Disease Control and Prevention, 2015. http://www.cdc.gov/injury/wisqars/pdf/10LCID_All_Deaths_By_Age_Group_2010-a.pdf

EPIDEMIOLOGY

General Disease Concepts

Natural History of Disease

Refers to the course of a disease in a person over time.

- ▶ Stage of susceptibility (prepathological)
- ▶ Stage of presymptomatic disease (subclinical)
- ▶ Stage of clinical disease
- ▶ Stage of disability (or death)

Prevention of Disease

The goal is to intervene as early as possible to prevent disease or disability.

Primary Prevention

- ▶ Interventions are directed at the stage of susceptibility to prevent the disease from occurring.
- ▶ Examples: Nutrition, exercise, education, water fluoridation, immunizations, wearing protective equipment during sports.

Secondary Prevention

- ▶ Interventions are directed toward the subclinical stage for early detection of the illness or problem to reduce the severity of the disease.
- ▶ Examples: Genetic testing in newborns, lead screening, vision and hearing screening, smoking cessation programs.

Tertiary Prevention

- ▶ Interventions are directed at the clinical stage of disease for treatment and rehabilitation of the illness to prevent or minimize progression of the disease or its sequelae.
- ▶ Examples: Use of inhaled steroids to manage asthma, penicillin prophylaxis in children with sickle cell disease.

Disease Etiology (Causation or Causal Web)

Any factors (direct or indirect) that increase the likelihood of disease. The development of a disease (e.g., tuberculosis) is likely due to a combination of factors (e.g., nutritional, living conditions), rather than exclusively one factor (e.g., tubercle bacillus). Lillienfeld and Stolley (1994, p. 37) outlined a causal web of disease that takes into account agent factors, host factors, and environmental factors.

- ▶ Agent factors include aspects related to etiology, such as infectious causes (viral, bacterial, protozoan); nutritional influences (excess, lack); and chemical elements (allergens, poisons, alcohol, smoke).
- ▶ Host factors include such determinants as age (newborn, premature, adolescent); sex; genetics (sickle cell disease); and physiologic state (general nutrition, general health, immune status).
- ▶ Environmental factors include the physical environment (climate, altitude, air pollution); socioeconomic environment (occupation, urban crowding); biologic environment (food and water sources).

Communicable or Infectious Disease Concepts

- ▶ Patterns in which organisms attack and invade vulnerable persons
- ▶ Involves identification of causative agents
- ▶ Relies on microbiology principles in understanding the life cycle of organisms
- ▶ Focuses on intervention at vulnerable phases in the course of disease or life cycle of the organism to limit or eradicate disease

General Definitions

- ▶ Infection: Colonization and multiplication of an organism in the host, typically producing an immune response but no signs or symptoms.
- ▶ Disease: Signs and symptoms (including pathologic changes) produced by infection. Certain organisms, such as influenza, are capable of infection with or without producing disease; other organisms, such as measles, typically produce disease in susceptible persons. Disease may vary in severity.
- ▶ Colonization: The organism invades the host at a particular site, multiplies, and acts as a parasite but does not produce infection, disease, or an immune response.
- ▶ Carrier state: Persistence of an organism in a host; may have followed infection, disease, or colonization and may be infective to others.

Agent (Organism) Properties

- ▶ Infectivity: Ability of an organism to invade and multiply in a susceptible host. For example, varicella is highly infective, rhinovirus is intermediate, and tubercle bacilli are of low infectivity.
- ▶ Pathogenicity: Ability of an organism to produce disease. Rabies, rhinovirus, and varicella are highly pathogenic organisms; adenovirus and rubella are intermediate; and tubercle bacillus is low.
- ▶ Virulence: Severity of disease an organism can produce; it can be measured by criteria such as number of days in bed or the frequency of serious sequelae, including death (fatality rate). Rabies virus is highly virulent (nearly 100% fatality rate); poliovirus is moderately virulent; varicella and rhinovirus are of low virulence (almost zero fatality rate).
- ▶ Immunogenicity: Ability to produce a lasting and effective immunity. Rhinovirus, which primarily acts locally, results in a poor systemic immune response, that is, low immunogenicity. Systemic viral infections such as measles produce lasting immunity, that is, high immunogenicity.

Agent–Host Relations

- ▶ Latent infection: The organism is not shedding or obtainable, but likely hidden in host cells.
- ▶ Patent infection: The organism is shedding or obtainable from feces, urine, blood, or the respiratory tract. Certain infections may remain permanently patent (some cases of hepatitis B), or be intermittently patent (herpes virus), or reactivate and produce disease after being latent for a long time (tuberculosis and herpes zoster).
- ▶ Period of communicability: The time when sufficient numbers of organisms are shed to cause transmission; usually concurrent with disease but not always.
- ▶ Incubation period: The time from exposure to the onset of disease.

Reservoirs of Infection

- ▶ Cases and carriers
 - ▷ Animal carriers: Lower vertebrate animals.
 - ▷ Invertebrate hosts: Insects.

- ▷ Inanimate objects: Some organisms such as influenza or *Staphylococcus aureus* can live for a period of time on inanimate objects such as doorknobs, toys, or counters. Some infectious agents are free-living in the environment, multiplying on inanimate objects (salmonella in food, legionellosis in pools of water, histoplasmosis in soil).

Transmission Mechanisms

- ▶ Direct: Through touching, kissing, sexual intercourse, transplacentally, childbearing, breastfeeding, transfusions, etc.
- ▶ Indirect: Through air, vector (insect, animals), or vehicle (food, water, towels).

Control Measures

- ▶ Measures directed against the reservoir: Isolation, quarantine, insect spraying, etc.
- ▶ Measures meant to interrupt transmission: Water purification, pasteurization of milk, barrier protection during sexual intercourse, and so on.
- ▶ Reducing host susceptibility or enhancing host resistance: Immunizations, appropriate use of antibiotics, improved nutrition, and so on.

Concepts of Endemic vs. Epidemic vs. Pandemic Infection

- ▶ Endemic: A condition that is regularly found in a certain area or in a certain group of people.
- ▶ Epidemic: A widespread occurrence of an infectious disease in a community at a particular time.
- ▶ Pandemic: An epidemic of infectious disease that has spread across a large region (such as multiple continents).
- ▶ Herd immunity: Resistance of a group to invasion and spread of an infectious agent when a large portion of the group is immune; decreases the likelihood of an epidemic in an area.
- ▶ Generation time: Time interval between receipt of infection and the maximal communicability of the host; applies to both subclinical and clinical infections (incubation period applies only to clinical cases); used to describe and analyze the spread of infectious diseases (e.g., common vehicle, single exposure epidemic, the incubation or generation time).

HEALTH MAINTENANCE

Healthy People 2020

Healthy People 2020 is the prevention agenda for the nation as outlined by the federal government. It is a statement of national health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats and began with the 1979 Surgeon General's Report, *Healthy People*, which laid the foundation for a national prevention agenda. It defines leading health indicators necessary to measure health over the next 10 years. As a group, Healthy People 2020 indicators reflect the major health concerns in the United States at the beginning of 2010. Leading health indicators were selected on the basis

of their ability to motivate action, availability of data to measure progress, and importance as public health issues. They are:

- ▶ Access to health services
- ▶ Clinical preventive services
- ▶ Environmental quality
- ▶ Injury and violence
- ▶ Maternal, infant, and child health
- ▶ Mental health
- ▶ Nutrition, physical activity, and obesity
- ▶ Oral health
- ▶ Reproductive and sexual health
- ▶ Social determinants
- ▶ Substance abuse
- ▶ Tobacco use and exposure

Nutrition

- ▶ Goal: Maintain or achieve ideal body weight and supply all essential body nutrients to maintain or regain health.
- ▶ Normal growth requires appropriate intakes of protein, fat, carbohydrates, water, vitamins, minerals, and trace elements.
- ▶ Recommended dietary allowances (RDAs) are estimates of safe and adequate amounts of nutrients recommended to be consumed daily to maintain health. The RDA is the amount of nutrient needed to meet the known nutrient requirements of the average person, and it works for approximately 97% of the population.

Diet Planning

- ▶ Energy requirements can be determined using charts or the calculations in Table 3-2.
- ▶ Energy requirements vary greatly based on physical activity level. For example: A 9-month-old infant weighing 8 kg requires approximately 800 calories/day ($8 \text{ kg} \times 100 \text{ kcal/kg/day} = 800$).
- ▶ Adolescents who have completed growth and need to lose weight must reduce calorie intake by 500 calories per day for each pound they wish to lose each week. Maximum recommended weight loss is 2 lbs/week.
- ▶ Weight loss is not recommended for growing children except under special circumstances and with close supervision.
- ▶ For children older than 2 years, recommendations are that 55%–60% of calories come from carbohydrates, 10%–15% from protein, and no more than 20%–35% from fat (with 10% or less saturated fat, less than 1% trans fat, and less than 300 mg of cholesterol per day).
- ▶ Fat and cholesterol should not be restricted in the first 2 years of life.
- ▶ Recommended fiber intake is 0.5 g/kg per day to a maximum of 35 g per day.

TABLE 3-2.
ESTIMATED ENERGY REQUIREMENTS BY STAGE OF LIFE

AGE	AVERAGE KCAL/KG/DAY*	RANGE OF KCAL/KG/DAY*
Birth–6 months	110–120	80–120
7–12 months	90–105	80–120
1–10 years	80	70–90
Adolescence	30–55	35–55

*The range of kcal allows for differences in growth patterns, activity level, and gender.

Recommended Nutritional Supplements

- ▶ Vitamin K 1 mg IM is given at birth to all newborns to prevent hemorrhagic disease of the newborn.
- ▶ Vitamin D 400 units/day is recommended for all breast-fed infants until they are ingesting a minimum of 1000 mL/day (1 quart) of vitamin D–fortified formula or milk. Vitamin D 400 units/day, either in foods or supplements, is recommended for children and adolescents.
- ▶ Ferrous sulfate 2–3 mg/kg/day (max 15 mg/day) is recommended for breast-fed pre-term infants by 2 months old.
- ▶ Iron-fortified cereals should be started by 6 months of age in all infants to replace iron stores, which are depleted by the time the infant doubles birth-weight at approximately age 4–5 months.
- ▶ Fluoride supplements may be recommended to reduce susceptibility to dental caries. Daily recommended doses of fluoride are determined by the child's age and the fluoride ion level of the drinking water. Current recommended doses of fluoride can be found in the *Guideline on Fluoride Therapy*, which can be found at http://www.aapd.org/media/policies_guidelines/g_fluoridetherapy.pdf (American Academy of Pediatric Dentistry, 2014).
- ▶ No routine daily administration of a vitamin, mineral supplement, or both is recommended except as noted above.

Infant Nutrition

- ▶ Breast milk, formulas, or both are sufficient to meet nutrient needs of infants up to 6 months of age (see Table 3-3).
- ▶ All infant formulas have 20 calories/oz except for those specifically labeled as higher in calories (e.g., Enfamil 24) (see Table 3-4).
- ▶ Ross Nutritionals markets a human milk–fortified formula (Similac Natural Care) that contains DHA and ARA and may be added to breast milk or fed alternatively with breast milk.
- ▶ Many companies now market products for older infants and toddlers (e.g., Enfamil Next Step) with calcium levels equivalent to cow's milk, fortified with DHA and ARA.
- ▶ Evaporated milk should not be recommended.

**TABLE 3-3.
BREAST MILK**

BREASTFEEDING	
<p>ADVANTAGES</p> <ul style="list-style-type: none"> • Nutritionally balanced. • Contains antibodies and macrophages; free of bacteria. • Allergic reactions are rare. • Economic benefits, both in savings on purchase of formula and in lower expenses for health care. 	<p>POSSIBLE PROBLEMS</p> <ul style="list-style-type: none"> • Milk supply may be insufficient. • Physical or mechanical difficulties such as inverted nipples may occur. • Medications and infectious organisms may pass to infant. • Nutritional deficiencies in the mother may affect infant.
CONTRAINDICATIONS OR CAUTIONS WITH BREASTFEEDING	
<p>MATERNAL CONDITIONS</p> <ul style="list-style-type: none"> • Human immunodeficiency virus (HIV) and active tuberculosis are definite contraindications in the United States. • Active skin lesions of the breast such as herpes or syphilis preclude nursing until treated or resolved. • Other viruses such as cytomegalovirus and hepatitis B pass into breast milk but each person can be evaluated individually. 	<p>INFANT CONDITIONS</p> <ul style="list-style-type: none"> • Certain inborn errors such as galactosemia, phenylketonuria, and tyrosinemia of metabolism prevent breastfeeding. • Premature infants <2,000 g (4½ pounds) may not be able to thrive on breast milk alone.
MEDICATIONS*	
<p>CONTRAINDICATED</p> <p>Anticancer drugs Cisplatin Cyclophosphamide Cyclosporine Doxorubicin Immunosuppressants Methotrexate</p> <p>DRUGS OF ABUSE</p> <p>All (such as amphetamines, PCP, cocaine, heroin), including nicotine</p> <p>OTHER</p> <p>Bromocriptine Ergotamine Lithium Phenindione Radioactive compounds (temporarily suspend nursing until cleared from system)</p>	<p>EFFECTS UNKNOWN BUT MAY BE A CONCERN</p> <p>Antianxiety, antidepressant, and antipsychotic agents Chloramphenicol Metoclopramide Metronidazole</p> <p>USE WITH CAUTION</p> <p>Aspirin Clemastine Phenobarbital Primidone Sulfasalazine</p>

MEDICATIONS USUALLY COMPATIBLE WITH BREASTFEEDING

Analgesics: Acetaminophen, ibuprofen, codeine; aspirin with caution

Anticoagulants: Warfarin

Antiepileptics: Carbamazepine, ethosuximide, phenytoin, valproic acid; phenobarbital with caution

Antihistamines and decongestants

Antihypertensive and cardiovascular medications: Captopril, digoxin, methyldopa, minoxidil, propranolol, verapamil

Antibiotics (except chloramphenicol and sulfa drugs in first 3 months of life and in infants with G-6-PD deficiency; tetracycline has not been found to cause mottling of the teeth)

Antithyroid: Thiouracil

Diuretics (may suppress lactation)

Hormones: Contraceptives, short-term prednisone (if taken in large doses over time can suppress growth)

Other: Caffeine (in moderate amounts), cisapride, metoclopramide

*Most commonly used medications are safe while a woman is breastfeeding. All new medications prescribed to breastfeeding mothers should be evaluated for safety in the infant. All drugs appear in breast milk usually at 1%–2% of the maternal dose. All medications need to be evaluated individually. A more complete list of medications may be found in the Pediatric Nutrition Handbook (noted below).

From *Medications and Mother's Milk* 2014, by T. Hale and H. Rowe, 2014, Amarillo, TX: Hale Publishing; "Chemotherapy in Pregnancy," by T. B. Buekers and T. A. Lallas, 1998, *Obstetrics and Gynecology Clinics of North America*, 25, pp. 323–329; and *Pediatric Nutrition Handbook* (6th ed., pp. 633–641), by American Academy of Pediatrics, 2009, Elk Grove Village, IL: Author.

Food Introduction

- ▶ Historically guidelines have been directed more by tradition than scientific fact.
- ▶ Foods may be introduced when infant is able to sit with support and has good neuromuscular control of head and neck, typically around 4–6 months of age.
- ▶ The use of cereals mixed in formula bottles is discouraged.
- ▶ Order of food introduction is not critical but infant cereals are fortified with iron that is usually needed in the growing infant between 4 and 6 months of age. Cereals, particularly rice, which is gluten-free, are a good first food. Green or yellow vegetables are often recommended as a second choice before fruits, which are sweeter.
- ▶ Start with single-ingredient foods, add one new food at a time, wait up to 4–7 days between foods to identify intolerances.

Food and Formula Cautions

- ▶ Low-iron formula preparations are never recommended.
- ▶ No cow's milk in the first year of life; rice milk and almond milk are also not appropriate for babies during the first year of life.
- ▶ No honey before age 1 year because of possible development of infantile botulism.
- ▶ Foods high in salt or sugar such as canned or processed foods should be avoided. RDA for sodium for infants is 17.6 mg/kg/day.

TABLE 3-4.
INFANT FORMULAS

	COW'S MILK-BASED	SOY PROTEIN ISOLATE	PROTEIN HYDROLYSATES
<i>Examples</i>	Enfamil, Similac, Good Start, Enfamil Lipid	Isomil, ProSobee	Nutramigen, Pregestimil, Alimentum
<i>Composition Comments</i>	<p>Casein/whey ratio varies with manufacturer.</p> <p>Lactose is usual carbohydrate (CHO) source; lactose-free formulas now widely available and use corn syrup, sucrose, or both.</p> <p>Available in iron-fortified and low-iron preparation; low-iron formulas are never recommended.</p> <p>Many formulas are now fortified with DHA (docosahexaenoic acid) and ARA (arachidonic acid), which are nutrients also found in breast milk that support brain and eye development (e.g., LIPIL, a Mead Johnson nutritionals product).</p>	<p>CHO – sucrose, glucose, or both.</p> <p>Methionine is added to all soy formulas to correct deficiencies.</p> <p>All are fortified with iron.</p>	<p>Partially hydrolyzed protein that results in peptides that do not elicit an immunologic response.</p> <p>Most are lactose-free.</p>
<i>Uses</i>	Routine use in well infants	<p>Infants with lactose intolerance.</p> <p>Infants with cow's milk-protein sensitivity (up to 20% of infants allergic to cow's milk are also allergic to soy).</p>	Infants with cow's milk and soy sensitivity.
<i>Contraindications</i>	<p>Milk protein sensitivity</p> <p>Lactose intolerance</p> <p>Galactosemia</p> <p>Phenylketonuria</p>	<p>Soy protein allergy.</p> <p>Preterm infants: The CHO, protein, and mineral absorption of soy formulas in preterm infants is not adequately documented and AAP does not recommend their use; soy formulas specifically developed for preterm infants are available.</p> <p>Infants with renal disease.</p>	Formulas are more expensive but used when infants are unable to tolerate either cows' milk-based formula or soy formula.

- ▶ Avoid foods that are easily choked on such as grapes, popcorn, hot dogs, raisins, and peanut butter.
- ▶ Late introduction of solid foods has been associated with an increased risk of allergic sensitization to food allergens.

Immunizations

Immunization Guidelines

- ▶ Infants and children are routinely immunized against multiple infectious diseases (Table 3-5). In addition, influenza vaccination is encouraged for all children older than 6 months.
- ▶ Children entering school and licensed day care are required in all states to be immunized. To check individual state laws regarding exemptions, refer to the Immunization Action Coalition at <http://www.immunize.org/laws/>.
- ▶ Many children, particularly under 2 years of age, are not fully immunized and therefore at risk for infections.
- ▶ Immunizations not begun in early infancy or interrupted will need modifications using the “catch-up” immunization schedule (Table 3-6); however, if interrupted, previously given vaccines do not need repeating.
- ▶ If the vaccine status is unknown, the child is considered unimmunized and begun on an appropriate schedule.
- ▶ Preterm infants should be immunized with regular doses according to their postnatal chronological age.
- ▶ Side effects (SEs) common to almost all the vaccines are mild and transient injection-site reactions such as pain, tenderness, and erythema, and mild to moderate fevers for 24 to 48 hours.
- ▶ General contraindications to vaccinations include hypersensitivity and reactions (urticaria, shock, wheezing), immunocompromised states in the individual or pregnancy (for live virus vaccines), undefined illnesses where administering vaccines may confuse the diagnosis, and prior severe reactions where administering the vaccine would be more harmful than withholding.
- ▶ Noncontraindications: Minor illnesses; presence of a pregnant woman in the household; family history of seizure disorders, sudden infant death syndrome (SIDS), and adverse reactions to vaccines.
- ▶ There is no contraindication to simultaneous administration of the routine vaccines.
- ▶ Informed consent must be obtained before vaccination with information provided regarding the disease to be prevented, risks and benefits of the vaccine, and potential side effects. Current CDC Vaccine Information Statements (VISs) on each vaccine administered must be given each time the vaccine is given. Manufacturer, lot number, site of immunization, person administering, and address of clinic must be recorded each time a vaccine is administered.
- ▶ Additional vaccines may be indicated or recommended for specific illnesses or disorders, travel, geographical area, or special circumstances (Table 3-5).

TABLE 3-5. RECOMMENDED IMMUNIZATION SCHEDULE FOR PERSONS AGED 0 THROUGH 18 YEARS

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16-18 yrs
Hepatitis B ¹ (HepB)	1 st dose	2 nd dose					3 rd dose									
Rotavirus ² (RV) RV1 (2-dose series); RV5 (3-dose series)		1 st dose	2 nd dose	2 nd dose	3 rd dose				4 th dose			5 th dose				
Diphtheria, tetanus, & acellular pertussis ³ (DTaP; <7 yrs)		1 st dose	2 nd dose	2 nd dose	3 rd dose		3 rd or 4 th dose. See footnote 4	4 th dose								
<i>Haemophilus influenzae</i> type b ⁴ (Hib)		1 st dose	2 nd dose	2 nd dose	3 rd dose		4 th dose									
Pneumococcal conjugate ⁵ (PCV13)		1 st dose	2 nd dose	2 nd dose	3 rd dose		3 rd dose					4 th dose				
Inactivated poliovirus ⁶ (IPV; <18 yrs)		1 st dose					3 rd dose									
Influenza ⁷ (IV; LAIV)						Annual vaccination (IV only) 1 or 2 doses						Annual vaccination (LAIV or IV) 1 or 2 doses		Annual vaccination (LAIV or IV) 1 dose only		
Measles, mumps, rubella ⁸ (MMR)						See footnote 8	1 st dose					2 nd dose				
Varicella ⁹ (VAR)							1 st dose					2 nd dose				
Hepatitis A ¹⁰ (HepA)																
Meningococcal ¹¹ (Hib-MenCY ≥ 6 weeks; MenACWY-D ≥ 9 mos; MenACWY-CRM ≥ 2 mos)						See footnote 11								1 st dose		
Tetanus, diphtheria, & acellular pertussis ¹² (Tdap; ≥ 7 yrs)														(Tdap)		
Human papillomavirus ¹³ (2HPV; females only; 4HPV, 9HPV; males and females)																
Meningococcal B ¹																
Pneumococcal polysaccharide ⁵ (PPSV23)																

Range of recommended ages for all children
 Range of recommended ages for catch-up immunization
 Range of recommended ages for certain high-risk groups
 Range of recommended ages for non-high-risk groups that may receive vaccine, subject to individual clinical decision making
 No recommendation

From *Recommended Immunization Schedule for Persons Aged 0 Through 18 Years: United States, 2016*, by CDC, 2016. Retrieved from <http://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html>

- ▶ Free vaccines are available through the Vaccines for Children (VFC) program to children with Medicaid, who are uninsured, whose health insurance does not cover vaccines, or who are Native Americans or Alaskan natives.

This schedule (Table 3-5) includes recommendations in effect as of 2016. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations (<http://www.cdc.gov/vaccines/hcp/acip-recs/>). Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS) at <http://www.vaers.hhs.gov> or by telephone, 1.800.822.7967.

The *Recommended Immunization Schedule for Persons Aged 0 through 18 Years* is approved by the Advisory Committee on Immunization Practices, the American Academy of Pediatrics (<http://www.aap.org>), the American Academy of Family Physicians (<http://www.aafp.org>), and the American College of Obstetricians and Gynecologists.

Footnotes to Table 3-5

1. Hepatitis B vaccine (HepB) (Minimum age: birth)

At birth

- ▶ Administer monovalent HepB to all newborns before hospital discharge.
- ▶ If mother is hepatitis B surface antigen (HBsAg)-positive, administer HepB and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth.
- ▶ If mother's HBsAg status is unknown, administer HepB within 12 hours of birth. Determine mother's HBsAg status as soon as possible and, if HBsAg-positive, administer HBIG (no later than age 1 week).

After the birth dose

- ▶ The HepB series should be completed with either monovalent HepB or a combination vaccine containing HepB. The second dose should be administered at age 1 or 2 months. Monovalent HepB vaccine should be used for doses administered before age 6 weeks. The final dose should be administered no earlier than age 24 weeks.
- ▶ Infants born to HBsAg-positive mothers should be tested for HBsAg and antibody to HBsAg 1 to 2 months after completion of at least 3 doses of the HepB series, at age 9 through 18 months (generally at the next well child visit).
- ▶ Administration of four doses of HepB to infants is permissible when a combination vaccine containing HepB is administered after the birth dose. The fourth dose should be administered no earlier than age 24 weeks.
- ▶ A two-dose series (separated by at least 4 months) of adult formulation Recombivax HB is licensed for children aged 11 through 15 years.

2. Rotavirus vaccine (RV) (Minimum age: 6 weeks)

- ▶ Administer the first dose at age 6 through 14 weeks (maximum age: 14 weeks 6 days). Vaccination should not be initiated for infants age 15 weeks 0 days or older.
- ▶ The maximum age for the final dose in the series is 8 months 0 days
- ▶ Rotateq is administered in three doses at 2, 4, and 6 months of age
- ▶ If Rotarix is administered in two doses at ages 2 and 4 months, a dose at 6 months is not indicated.

3. Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP) (Minimum age: 6 weeks)
 - ▶ The fourth dose may be administered as early as age 12 months provided at least 6 months have elapsed since the third dose.
 - ▶ Administer the final dose in the series at age 4 through 6 years.
4. Haemophilus influenzae type b conjugate vaccine (Hib) (Minimum age: 6 weeks)
 - ▶ The primary series with ActHIB, MenHibrix, or Pentacel is administered at 2, 4, and 6 months of age.
 - ▶ If PRP-OMP (PedvaxHIB or Comvax [HepB-Hib]) is administered at ages 2 and 4 months, a dose at age 6 months is not indicated.
 - ▶ Not routinely recommended for children 5 years or older but one dose should be administered to unimmunized children 5 years and older who have functional or anatomic asplenia and persons 5 through 18 years with HIV infection.
5. Pneumococcal vaccine (Minimum age: 6 weeks for pneumococcal conjugate vaccine [PCV]; 2 years for pneumococcal polysaccharide vaccine [PPSV])
 - ▶ PCV13 is recommended for all children younger than 5 years old. Administer one dose of PCV to all healthy children ages 24 through 59 months who are not completely vaccinated for their age.
 - ▶ All recommended doses of PCV13 should be administered before PPSV23 vaccination if possible. Administer PPSV23 2 or more months after last dose of PCV to children aged 2 years or older with cochlear implants and those with certain underlying medical conditions (sickle cell disease, diabetes mellitus, functional or anatomic asplenia, HIV infection, chronic lung or heart disease).
6. Inactivated poliovirus vaccine (IPV) (Minimum age: 6 weeks)
 - ▶ The final dose in the series should be administered on or after the fourth birthday and at least 6 months after the previous dose.
 - ▶ If four doses are administered before age 4 years, a fifth dose should be administered at age 4 through 6 years.
7. Influenza vaccine (seasonal) (Minimum age: 6 months for inactivated influenza vaccine [IIV]; 2 years for live, attenuated influenza vaccine [LAIV])
 - ▶ Administer annually to children ages 6 months through 18 years who do not have contraindications.
 - ▶ For healthy children ages 2 through 18 years who have no contraindications or precautions, either LAIV or IIV may be used. LAIV should not be given to children ages 2 through 4 years who have had wheezing in the past 12 months. Children of any age with asthma may be at increased risk for wheezing after receiving LAIV.
 - ▶ LAIV should not be administered to children 2–17 years receiving aspirin or aspirin-containing products; persons allergic to eggs; immunosuppressed persons; or persons who have taken influenza antiviral medications in the previous 48 hours.
 - ▶ Children receiving IIV should receive 0.25 mL if age 6 through 35 months or 0.5 mL if 3 years or older.
 - ▶ Administer two doses (separated by at least 4 weeks) to children ages 6 months through 8 years who are receiving influenza vaccine for the first time or who were vaccinated for the first time during a previous influenza season but only received one

dose. The two previous doses need not have been given during the same season or consecutive seasons.

8. Measles, mumps, and rubella vaccine (MMR) (Minimum age: 12 months)
 - ▶ Administer the second dose routinely at age 4 through 6 years. However, the second dose may be administered before age 4, provided at least 28 days have elapsed since the first dose.
 - ▶ Administer 1 dose of MMR vaccine to infants ages 6 through 11 months before departure from the United States for international travel. Children should then be revaccinated, starting at 12 months of age with 2 doses of MMR, if following the current immunization schedule.
 - ▶ Administer 2 doses of MMR vaccine to children 12 months and older before departure from the United States for international travel. The first dose should be administered on or after 12 months of age and the second dose at least four weeks later.
9. Varicella vaccine (Minimum age: 12 months)
 - ▶ Administer the second dose routinely at age 4 through 6 years.
 - ▶ The second dose may be administered before age 4 years, provided that at least 3 months have elapsed since the first dose.
 - ▶ For children ages 12 months through 12 years, the minimum interval between doses is 3 months. However, if the second dose was administered at least 28 days after the first dose, it can be accepted as valid.
10. Hepatitis A vaccine (HepA) (Minimum age: 12 months)
 - ▶ Administer to all children aged 1 year (i.e., 12 through 23 months). Administer two doses at least 6 months apart.
 - ▶ Children not fully vaccinated by age 2 years can be vaccinated at subsequent visits.
 - ▶ HepA also is recommended for older children who live in areas where vaccination programs target older children, who are at increased risk for infection, or for whom immunity against hepatitis A is desired. This includes persons with clotting factor disorders; persons with chronic liver disease; and persons who anticipate close personal contact with an international adoptee during the first 60 days after arrival in the United States from a country with high or intermediate endemicity. The first dose should be administered as soon as the adoption is planned, ideally 2 or more weeks before the arrival of the adoptee.
11. Meningococcal vaccine (MCV4) (Minimum age: 6 weeks for Hib-MenCY [MenHibrix], 9 months for MenACWY-D [Menactra], 2 months for MenACWY-CRM [Menveo])
 - ▶ Routine vaccination against meningococcal disease is not recommended for children ages 2 months through 10 years.
 - ▶ For children aged 2 to 23 months, vaccination with the age-appropriate meningococcal conjugate formulation should be administered to those children who are at increased risk for meningococcal disease. Those considered at increased risk are those with complement deficiency, those with functional or anatomic asplenia (including sickle cell disease), healthy infants in an area with an outbreak, or those traveling to an area where the disease is hyperendemic or there is an epidemic.
 - ▶ Recommended for routine use in 11- to 12-year-old children with a booster dose recommended at 16 years of age.

- ▶ If the first dose is administered at age 16 years or older, a booster dose is not needed.
 - ▶ Adolescents ages 11–18 years with human immunodeficiency virus (HIV) infection should receive a two-dose primary dose series with at least 8 weeks between doses.
- Meningococcal B vaccine (MenB-4C or MenB-FHbp) (Minimum age: 10 years)
- ▶ Administer to persons 10 years of age or older who are at increased risk for meningococcal disease, such as those with complement component deficiencies, those with anatomic or functional asplenia, and those identified as being at increased risk because of a serogroup B meningococcal disease outbreak.
 - ▶ Should be administered as a two-dose series (MenB-4C Bexsero) or three-dose series of MenB-FHbp (Trumenba). The same vaccine product should be used for all doses. The two MenB vaccines are not interchangeable. May be administered at the same time as MenACWY vaccines but at a different anatomical site.
 - ▶ Not currently recommended for children ages 2 months to 9 years who are at increased risk for serogroup B meningococcal disease.
12. Tetanus and diphtheria toxoids and acellular pertussis vaccine (Tdap) (Minimum age: 10 years for Boostrix and 11 years for Adacel)
- ▶ Administer one dose of Tdap at age 11 or 12 years.
 - ▶ Tdap may be administered regardless of the interval since the last tetanus and diphtheria toxoid-containing vaccine (Td).
 - ▶ Administer 1 dose of Tdap vaccine to pregnant adolescents during each pregnancy (preferably between 27 and 36 weeks gestation) regardless of the time since the previous dose of Td or Tdap.
13. Human papillomavirus vaccine (HPV) (Minimum age: 9 years)
- ▶ Three HPV vaccines are currently licensed: A quadrivalent vaccine (4vHPV; Gardasil); a nine-valent vaccine (9vHPV; Gardasil 9[®]) for the prevention of cervical, vaginal, and vulvar cancers (in females) and genital warts (in females and males); and a bivalent vaccine (2vHPV; Cervarix) for the prevention of cervical cancers in females.
 - ▶ HPV vaccines are most effective for both males and females when given before exposure to HPV through sexual contact.
 - ▶ 4vHPV, 9vHPV, or 2vHPV is recommended for the prevention of cervical precancers and cancers in females.
 - ▶ 4vHPV4 and 9vHPV are recommended for the prevention of cervical, vaginal, and vulvar precancers, and cancers and genital warts in females.
 - ▶ It is best to administer the first dose to females at age 11 or 12 years, but the vaccination series can be started as young as 9 years of age.
 - ▶ Administer HPV vaccine beginning at age 9 years to children and youth with any history of sexual abuse or assault who have not initiated or completed the three-dose series.
 - ▶ Administer the second dose 1 to 2 months after the first dose and the third dose 6 months after the first dose (at least 24 weeks after the first dose).
 - ▶ Administer the series to females at age 13 through 26 years if not previously vaccinated.

- ▶ Only 4vHPV and 9vHPV are to be administered in a three-dose series to males ages 9 through 26 years to reduce their likelihood of acquiring anogenital warts.
- ▶ Any available HPV vaccine product may be used to continue or complete the vaccination series in females and either 4vHPV or 9vHPV can be used to continue or complete the vaccination series in males.
- ▶ Contraindicated for anyone with an immediate hypersensitivity to any vaccine component. 4vHPV and 9vHPV are contraindicated for anyone with an immediate hypersensitivity to yeast. 2vHPV should not be administered to persons with anaphylactic latex reactions.
- ▶ Not recommended for use in pregnant women but pregnancy testing is not needed before the vaccination.

Catch-Up Immunizations

Table 3-6 provides catch-up schedules and minimum intervals between doses for children whose vaccinations have been delayed. A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Use the section appropriate for the child's age.

Hepatitis B Vaccine (HepB)

- ▶ Administer the three-dose series to those not previously vaccinated
- ▶ A two-dose series (separated by at least 4 months) of adult formulation Recombivax HB is licensed for children ages 11 through 15 years.

Rotavirus Vaccine (RV)

- ▶ The maximum age for the first dose is 14 weeks 6 days. Vaccination should not be initiated for infants 15 weeks 0 days or older.
- ▶ The maximum age for the final dose in the series is 8 months 0 days.

Diphtheria and Tetanus Toxoids and Acellular Pertussis Vaccine (DTaP)

- ▶ The fifth dose is not necessary if the fourth dose was administered at 4 years or older.

Tetanus and Diphtheria Toxoids and Acellular Pertussis Vaccine (Tdap) (Minimum age: 10 years for both Boostrix and Adacel)

- ▶ Persons 7 years and older who are not fully immunized with DTaP vaccine should receive Tdap vaccine as one dose (preferably the first) in the catch-up series; if additional doses are needed, use Td vaccine. For children 7 through 10 years who receive a dose of Tdap as part of the catch-up series, an adolescent Tdap vaccine dose at age 11 through 12 years should *not* be administered. Td should be administered instead, 10 years after the Tdap dose.
- ▶ Persons age 11 through 18 years who have not received Tdap vaccine should receive a dose followed by Td booster doses every 10 years thereafter.
- ▶ Inadvertent doses of DTaP vaccine: If administered inadvertently to a child age 7 through 10 years, an inadvertent dose may count as part of the catch-up series. This dose may count as the adolescent Tdap dose, or the child can later receive a Tdap booster dose at age 11 through 12 years. If administered inadvertently to an adolescent age 11 through 18 years, the dose should be counted as the adolescent Tdap booster.

TABLE 3-6. CATCH-UP IMMUNIZATION SCHEDULE FOR PERSONS AGES 4 MONTHS THROUGH 18 YEARS WHO START LATE OR WHO ARE MORE THAN 1 MONTH BEHIND — UNITED STATES, 2016

Vaccine	Minimum Age for Dose 1	Minimum Interval Between Doses			
		Dose 1 to Dose 2	Dose 2 to Dose 3	Dose 3 to Dose 4	Dose 4 to Dose 5
Hepatitis B	Birth	4 weeks	8 weeks (And at least 16 weeks after first dose)		
Rotavirus	6 weeks	4 weeks	4 weeks		
Diphtheria, Tetanus, Pertussis	6 weeks	4 weeks	4 weeks	6 months	6 months
Haemophilus influenzae type b	6 weeks	4 weeks	4 weeks	8 weeks (as final dose) This dose only necessary for children ages 12 months through 59 months who received three doses before the first birthday.	

<p>Haemophilus influenzae type b (continued)</p> <p><i>or</i></p> <p>If both doses were PRP-OMP (PedvaxHIB; Comvax) and were administered before the first birthday.</p> <p>No further doses needed</p> <p>If previous dose was administered at age 15 months or older.</p>			
	<p>6 weeks</p> <p>4 weeks</p> <p>If first dose was administered before the first birthday.</p> <p>8 weeks (as final dose for healthy children)</p> <p>If first dose administered at the first birthday or after.</p> <p>No further doses needed</p> <p>For healthy children if first dose was administered at age 24 months or older.</p>	<p>4 weeks</p> <p>If current age is younger than 12 months and previous dose was given at <7 months of age.</p> <p>8 weeks (as final dose for healthy children)</p> <p>If previous dose was given between 7–11 months (wait until at least 12 months old);</p> <p><i>or</i></p> <p>If current age is 12 months or older and at least one dose was given before age 12 months.</p> <p>No further doses needed</p> <p>For healthy children if previous dose was administered at age 24 months or older.</p>	<p>8 weeks (as final dose)</p> <p>This dose only necessary for children ages 12 months through 59 months who received three doses before age 12 months or for high-risk children who received three doses at any age.</p>
<p>Inactivated Poliovirus</p>	<p>6 weeks</p> <p>4 weeks</p>	<p>4 weeks</p>	<p>6 months (minimum age 4 years for final dose)</p>

CONTINUED

PERSONS AGES 4 MONTHS THROUGH 6 YEARS

Meningococcal	6 weeks	8 weeks
Hib-MenCY ≥6 weeks; MenACWY-D ≥9 mos; MenACWY- CRM ≥2 mos)		
Measles, Mumps, Rubella	12 months	4 weeks
Varicella	12 months	3 months
Hepatitis A	12 months	6 months

CHILDREN AND ADOLESCENTS AGES 7 THROUGH 18 YEARS

Meningococcal (Hib-MenCY ≥ 6 weeks; MenACWY-D ≥9 mos; MenACWY- CRM ≥ 2 mos)	Not Applicable (N/A)	8 week
Tetanus, Diphtheria/ Tetanus, Diphtheria, Acellular Pertussis	7 years	4 weeks
	4 weeks	6 months
	If first dose of DTaP/DT was administered before the first birthday.	If first dose of DTaP/DT was administered before the first birthday.
	6 months (as final dose)	
	If first dose of DTaP/DT or Tdap/Td was administered at or after the first birthday.	
Human Papillomavirus	9 years	Routine dosing intervals are recommended

Hepatitis A	N/A	6 months	
Hepatitis B	N/A	4 weeks	8 weeks (And at least 16 weeks after first dose)
Inactivated Poliovirus	N/A	4 weeks	4 weeks 6 months
Measles, Mumps, Rubella	N/A	4 weeks	
Varicella	N/A	3 months If younger than age 13 years. 4 weeks If age 13 years or older.	

From "Advisory Committee on Immunization Practices Recommended Immunization Schedules for Persons Aged 0 Through 18 Years—United States, 2016," by C. L. Robinson and Advisory Committee on Immunization Practices (ACIP), ACIP Child/Adolescent Immunization Work Group, *MMWR*, 65(4), pp. 86–87. <http://dx.doi.org/10.15585/mmwr.mm6504a4>

Haemophilus Influenzae Type B Conjugate Vaccine (Hib)

- ▶ If dose 1 was administered at ages 12 through 14 months, administer a second (final) dose at least 8 weeks after dose 1, regardless of Hib vaccine used in the primary series.
- ▶ If both doses were PRP-OMP (PedvaxHIB or COMVAX), and were administered before the first birthday, the third (and final) dose should be administered at age 12 through 59 months and at least 8 weeks after the second dose.
- ▶ If the first dose was administered at age 7 through 11 months, administer the second dose at least 4 weeks later and a third (and final) dose at age 12 through 15 months or 8 weeks after second dose, whichever is later.
- ▶ If the first dose is administered before the first birthday and the second dose is administered at younger than 15 months, a third (and final) dose should be given 8 weeks later.
- ▶ For unvaccinated children 15 months or older, administer only one dose.

Pneumococcal Vaccine

- ▶ Administer one dose of pneumococcal conjugate vaccine (PCV) to all healthy children 24 through 59 months who are not completely vaccinated for their age.

Inactivated Poliovirus Vaccine (IPV)

- ▶ In the first 6 months of life, minimum age and minimum intervals are only recommended if the person is at risk of imminent exposure to circulating poliovirus (i.e., travel to a polio-endemic region or during an outbreak).
- ▶ If four or more doses are administered before age 4 years, an additional dose should be administered at age 4 through 6 years and at least 6 months after the previous dose.
- ▶ A fourth dose is not necessary if the third dose was administered at age 4 years or older and at least 6 months after the previous dose.
- ▶ If both oral polio vaccine (OPV) and IPV were administered as part of a series, a total of four doses should be administered, regardless of the child's current age.
- ▶ If only OPV was administered, and all doses were given before 4 years of age, one dose of IPV should be given at 4 years or older, at least 4 weeks after the last OPV dose.
- ▶ IPV is not routinely recommended for U.S. residents 18 years or older.

Measles, Mumps, and Rubella Vaccine (MMR)

- ▶ Ensure that all school-aged children and adolescents have had two doses of MMR vaccine; the minimum interval between the two doses is 4 weeks.

Varicella Vaccine

- ▶ Ensure that all persons ages 7 through 18 years without evidence of immunity (see Centers for Disease Control [CDC], 2007) have two doses of varicella vaccine.
- ▶ For children ages 7 through 12 years, the recommended minimum interval between doses is 3 months (if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid).
- ▶ For persons 13 years and older, the minimum interval between doses is 4 weeks.

Hepatitis A Vaccine (HepA)

- ▶ The minimum interval between the two doses is 6 months.
- ▶ Administer two doses of HepA vaccine at least 6 months apart to previously unvaccinated persons who live in areas where vaccination programs target older children, or who are at increased risk for infection. This includes persons with clotting factor disorders and persons with chronic liver disease.
- ▶ This also includes persons who anticipate close personal contact (e.g., household or regular babysitting) with an international adoptee during the first 60 days after arrival in the United States from a country with high or intermediate endemicity. The first dose should be administered as soon as the adoption is planned, ideally 2 or more weeks before the arrival of the adoptee.

Human Papillomavirus Vaccine (HPV)

- ▶ Administer the vaccine series to females (either 2vHPV, 4vHPV, or 9vHPV) and males (4vHPV) at age 13 through 18 years if not previously vaccinated.
- ▶ Use recommended routine dosing intervals for series catch-up (i.e., the second and third doses should be administered at 1 to 2 and 6 months after the first dose). The minimum interval between the first and second doses is 4 weeks. The minimum interval between the second and third doses is 12 weeks, and the third dose should be administered at least 24 weeks after the first dose.

Vaccinations

DTaP (Diphtheria, Tetanus, and Acellular Toxoids)

- ▶ Initial doses at 2, 4, and 6 months, with fourth dose given 6 to 12 months after the third (usually at 15 to 18 months) and fifth dose at 4 to 6 years (unless fourth dose was given after the fourth birthday, in which case a fifth dose is not necessary).
- ▶ DTaP is not given after the age of 7 years. From ages 7 to 10 years, Td (tetanus and diphtheria toxoid) should be administered if an additional dose is needed. Because of an increased incidence of pertussis infection in older adolescents and adults, one dose of Tdap is now recommended for children 11 to 18 years of age and for adults ages 19 to 64. If pertussis vaccine is contraindicated, an infant or child is immunized with DT until age 7 years.
- ▶ Split doses of DTaP should not be used.
- ▶ When possible, the same brand of DTaP should be used for the entire series.
- ▶ PEDIARIX (GlaxoSmithKline) is a combined DTaP, HepB recombinant, and IPV vaccine. May be used for three-dose primary series. May not be used in infants under 6 weeks of age, nor in children older than 7 years.
- ▶ PENTACEL (Sanofi Pasteur) is a combined DTaP, IPV, and Hib vaccine. It is administered in a four-dose series: 2, 4, 6, and 15 to 18 months.

IPV (Inactivated Polio Vaccine)

- ▶ An all-IPV schedule is used in the United States to eliminate vaccine-associated paralytic polio (VAPP).
- ▶ Given at 2 months, 4 months, 6 to 18 months, and 4 to 6 years.

- ▶ Four doses are required for school entry (unless the third dose was given after the fourth birthday, in which case the fourth dose is unnecessary).
- ▶ OPV, a live attenuated vaccine, can be given under special circumstances, such as travel to endemic areas or for outbreaks.

Hib (Haemophilus Influenzae Type B)

- ▶ Three vaccines are licensed for use. All are conjugated vaccines bound to a protein carrier. The difference in the vaccines is in the type of protein carrier used, which affects the scheduling (either a three- or four-dose schedule). Four-dose schedule (HibTITER, Wyeth; ActHIB, Aventis) is given at 2, 4, 6, and 12 to 15 months. Three-dose schedule (PedvaxHIB, Merck) is given at 2, 4, and 12 to 15 months. Hiberix (GlaxoSmithKline) is indicated as a booster dose and is approved for children 15 months to 4 years of age. Comvax (Merck, Hib/hepatitis B combination vaccine) was discontinued. Because immune response to Hib vaccine increases with age, fewer doses are required at older ages. After 15 months of age, one dose of any of the licensed vaccines is sufficient.
- ▶ After age 5 years, Hib immunization is indicated only for children with a chronic condition associated with an increased risk of Hib disease such as sickle cell disease, asplenia, or antibody deficiency.
- ▶ Children younger than 2 years with a history of documented Hib infection should still be vaccinated.

HepB Vaccine (Hepatitis B Vaccine)

- ▶ HepB vaccine may be given at any age, but is recommended to start at birth. The recommended schedule is at birth, 1 to 2 months later, and 4 to 6 months after the first dose. This schedule may be shortened if necessary.
- ▶ Infants born to HBsAg-positive mothers should receive hepatitis B immune globin (HBIG) and HBV within 12 hours of birth.
- ▶ Infants born to hepatitis B–positive mothers should have their immune status to hepatitis B checked at 9 to 12 months.

MMR (Measles, Mumps, Rubella Vaccine)

- ▶ Composed of three attenuated live vaccines
- ▶ First dose is recommended at 12 to 15 months of age and the second dose at 4 to 6 years of age. When administering catch-up immunizations for children older than 4 years old, the second dose of MMR can be given any time after 4 weeks has elapsed since the first dose.
- ▶ After exposure to measles infection, vaccination within 72 hours may provide protection or alter the clinical course of the disease.
- ▶ Measles vaccine may suppress PPD reactions for 4 to 6 weeks; give PPD tests on the day of the MMR vaccine or wait 6 weeks.
- ▶ SEs (5 to 12 days after vaccination): Fever, rash, transient arthritis, thrombocytopenia, and, rarely, encephalopathy.
- ▶ MMRV (measles, mumps, rubella, and varicella) combination vaccine now available.

Varivax (Varicella Zoster Vaccine)

- ▶ Attenuated live vaccine.
- ▶ First dose given at 12 to 15 months and second administered before kindergarten entry (4 to 6 years).
- ▶ Give vaccine within 3 to 5 days after exposure, if unimmunized.
- ▶ SEs may include local injection site reaction consisting of approximately 2 to 3 papules (vesicles are rare with this type of reaction) and/or 2 weeks post-vaccine, a generalized varicella-like rash, typically on the trunk. This generalized rash carries a slight risk of infection to others through direct contact with the rash. Airborne transmission has not been known to occur.

Pneumococcal Vaccines: Pneumococcal Polysaccharide (PPSV) and Pneumococcal 13 Valent Conjugate Vaccine (Prennar)

- ▶ Pathogenesis: An important characteristic of the pneumococcal organism (*Streptococcus pneumoniae*) is the presence of a polysaccharide capsule that protects the pneumococcus from phagocytosis by neutrophils. The human immune system is able to produce antibodies against the capsule of the pneumococcus, which attach to the surface of the capsule and facilitate phagocytosis by neutrophils. The goal of pneumococcal vaccines is to induce antibodies to the pneumococcal polysaccharide capsule. There are more than 80 different pneumococcal capsules. On the basis of these capsules, pneumococci are classified into serogroups and given numbers (1, 2, 3, etc.) and subdivided into serogroups assigned letters (6A, 6B, etc.). Immunity developed to one serogroup does not protect against infection in another serogroup. Although more than 80 serotypes exist, certain groups are more responsible for causing disease than others. It is against these serogroups that vaccines are directed.
- ▶ Indications: The original pneumococcal vaccine (PPSV or Pneumovax) is effective against 23 serotypes but not immunogenic in children younger than 2 years. It is indicated for children older than 2 years with risk factors for the development of severe pneumococcal disease, such as children with sickle cell disease, asplenia, HIV or other immunodeficiency disorders, and nephrotic syndrome. Prennar is effective against 13 serotypes most often associated with serious infections in children, is linked to a protein carrier enabling immunogenicity in the under-2 age group, and is now routinely administered (Table 3–6). The number of vaccines will depend on the age (four injections if vaccine series is begun before 7 months of age, three if begun at 7 to 11 months, two if begun at 12 to 23 months, and one if begun at 2 years or older).

Rotavirus (Rota)

- ▶ Administer two-dose oral series (Rotarix®) at 2 and 4 months.
- ▶ Give three-dose oral series (Rotateq®) at 2, 4, and 6 months; give final dose no later than age 32 weeks.
- ▶ Do not begin series in infants older than 15 weeks.
- ▶ Contraindications: Previous anaphylaxis to any component of vaccine, history of intussusception, or severe combined immune deficiency (SCID).

Hepatitis A

- ▶ Give two doses 6 months apart to all children starting at age 12 months.
- ▶ Vaccinate all children and adolescents age 2 years and older who will be traveling to endemic areas, have chronic liver disease, or wish to be immunized.

Meningococcal Conjugate (MCV4)

- ▶ Give single dose of MCV4 to 11- to 12-year-olds. A booster dose is recommended at 16 years of age.
- ▶ Effective against serotypes A, C, Y, and W-135, but not type B strain, the most epidemic variety.
- ▶ Vaccinate all children 2 years and older who have anatomic or functional asplenia, terminal complement component deficiencies, or are traveling to or residing in countries with endemic meningitis.

Meningococcal B Vaccine

- ▶ Two serogroup B meningococcal vaccines have been licensed by the Food and Drug Administration.
- ▶ The preferred ages for vaccination are 16 through 18 years.
- ▶ Bexsero is given as two doses, at least 1 month apart.
- ▶ Trumenba is given as three doses, with the second dose 2 months after the first and the third dose 6 months after the first.

Human Papilloma Virus (HPV)

- ▶ Give three-dose series of either bivalent, quadrivalent, or nine-valent HPV vaccine to girls at age 11 to 12 years on a 0-, 2-, 6-month schedule; may be started at age 9 years.
- ▶ Vaccinate all older girls and women (through age 26 years) who were not previously vaccinated.
- ▶ A three-dose series of quadrivalent or nine-valent HPV vaccine may be given to males 9 to 26 years of age.

Flu Vaccine (Influenza)

- ▶ Injected vaccines are inactivated and recommended for routine use. They are not approved for children younger than 6 months.
- ▶ FluMist (Wyeth) is a live attenuated nasal vaccine that may be given to healthy children older than 2 years.
- ▶ Vaccines are developed annually based on expected strains for the coming winter.
- ▶ Immunizations are administered in the fall before influenza season and immunity lasts up to 1 year.
- ▶ Infants and young children 6 to 35 months old receive 0.25 mL of vaccine and children older than 35 months receive 0.5 mL.
- ▶ Recommended yearly for persons 6 months of age and older, for household contacts and out-of-home caregivers of all children, all adults, and children with chronic conditions.

- ▶ Children younger than 9 years old receive two vaccines 1 month apart the first time they are vaccinated; every year thereafter, only one vaccine is given.
- ▶ Children older than 9 years and adults receive only one vaccine yearly, including the first year.

Preventive Medications for Specific Uses

Respiratory Syncytial Virus (RSV) Immune Globin (Synagis)

- ▶ Provides temporary, passive immunity for high-risk infants against RSV.
- ▶ Synagis (palivizumab) is given at 15 mg/kg IM once per month starting the month before RSV season (October or November) and continuing throughout the RSV season.
- ▶ Currently indicated for children younger than 2 years of age with congenital heart disease, chronic lung disease, and premature infants (fewer than 29 weeks' gestation). The American Academy of Pediatrics sets the administration criteria for Synagis (palivizumab).
- ▶ No alterations in routine vaccines with (Synagis) palivizumab.

Disease Prevention

- ▶ Chemoprophylaxis may be used to prevent disease in various ways (see Table 3-7).

Injuries

- ▶ See Tables 3-8 and 3-9.
- ▶ Injuries cause approximately half of all deaths in children.
- ▶ Each year, about 16 million children receive care for injuries.
- ▶ More than 30,000 children become permanently disabled annually because of injuries.
- ▶ Injury rates vary with age, gender, ethnicity, socioeconomic status, and location.
- ▶ Highest rates of injury are in adolescents, infants, males, Native Americans, Black people, and low-income and rural areas.

Other Disease Prevention Programs

Back to Sleep Program

- ▶ Back to Sleep Program: Position infants solely on their backs for sleeping. Incidence of SIDS has decreased dramatically with changed sleeping positions. Some anecdotal studies have reported increased incidence of occipital molding (plagiocephaly) as a result, not associated with any long-term adverse sequelae. Can be ameliorated with "tummy time" for infant while awake and supervised.
- ▶ For the prevention of sudden unexpected infant death (SUID) and sudden infant death syndrome (SIDS), the most common cause of death under 1 year.
- ▶ Risk factors for SIDS: Sleep position, exposure to cigarette smoke, low birth-weight, and prematurity; highest incidence in Black people and Native Americans, lowest in Asians.

TABLE 3-7.
CHEMOPROPHYLAXIS FOR DISEASE PREVENTION

PREVENTING PRIMARY DISEASE		
CONDITION	RATIONALE	RECOMMENDATIONS
Respiratory Syncytial Virus (RSV)	Infants younger than 2 years with chronic lung disease or less than 29 weeks' gestation are susceptible to severe respiratory complications with RSV. Immunoprophylaxis reduces hospitalization and duration of illness.	Palivizumab (Synagis) administered once a month (15 mg/kg) from beginning to end of RSV season.
Neural Tube Defects	Neural tube defects encompass a number of disorders of the cranium, spine, and nervous system that occur when the neural tube fails to close. Folic acid supplementation has resulted in more than 50% reduction in these birth defects. The average North American diet includes less than half the recommended dietary intake of folic acid.	All women of childbearing years, whether pregnant or not, take 0.4 mg daily of folic acid either alone or as part of a multivitamin supplement. The dose is increased with pregnancy.
Hemorrhagic Disease of the Newborn	Newborn gut lacks the bacteria necessary to synthesize vitamin K, which is used for coagulation.	1 mg vitamin K (phytonadione) is administered once immediately after birth.
Ophthalmia Neonatorum Chemoprophylaxis	Primary purpose is the prevention of gonococcal and chlamydia conjunctivitis in the neonate.	A single application of 0.5% erythromycin ophthalmic ointment.
Group B Streptococcus (GBS) Prevention in the Newborn	In the early 1970s, GBS was a primary cause of neonatal sepsis and meningitis. Prevention strategies began to screen women for GBS and provide antibiotic prophylaxis for those women who were positive or had specific risk factors.	<p>Screen pregnant women for GBS in one of two ways:</p> <ol style="list-style-type: none"> 1. Obtain vaginal and rectal cultures at 35 to 37 weeks gestation. 2. If no culture results are available, the decision for chemoprophylaxis is based on the presence of one or more risk factors: delivery at 37 weeks' gestation or fewer, membranes ruptured for more than 18 hours, intrapartum fever of 38°C (100.4°F) or more, or if mother had a previous infant with GBS disease or she herself had GBS bacteriuria. <p>Penicillin remains the preferred treatment agent, with ampicillin as an acceptable alternative.</p>

Dental Caries	Reduction of dental caries can be accomplished with fluoride and sealants. Excess fluoride will cause fluorosis (mottling of the teeth).	Dose of fluoride is dependent on fluoride concentration in the water and age of the child (see section on nutrition). Sealants are plastic coverings applied by the dentist to secondary molars.
DISEASE PREVENTION IN HIGH-RISK PERSONS		
CONDITION	RATIONALE	RECOMMENDATIONS
Infective Endocarditis (IE) or Bacterial Endocarditis (BE) Prophylaxis	<p>BE prophylaxis with antibiotics is recommended for children with specific cardiac conditions who are undergoing procedures that may induce a transient bacteremia.</p> <p>High-risk conditions include prosthetic valves, repaired congenital heart disease with prosthetic material, a history of infective endocarditis, a heart transplant with abnormal valve function, certain congenital heart defects (CHD) including cyanotic CHD that has not been repaired, a CHD that has been completely repaired with prosthetic materials, and repaired CHD with residual defects.</p> <p>High-risk procedures include invasive respiratory procedures that involve incision or biopsy of the respiratory mucosa (e.g., tonsillectomy, adenoidectomy), gingival or periapical region of teeth manipulated, or oral mucosa perforated (tooth extractions, surgery).</p> <p>Antibiotics are not recommended for those undergoing genitourinary or gastrointestinal tract procedures.</p>	<p>Recommended prophylaxis (single dose to be administered 30–60 minutes before the procedure): oral amoxicillin 50 mg/kg (maximum 2 g).</p> <p>If allergic to amoxicillin, use clindamycin 20 mg/kg PO (not to exceed 600 mg); cephalexin (50 mg/kg, maximum 2 g); azithromycin or clarithromycin (15 mg/kg, maximum 500 mg).</p> <p>Postprocedural antibiotics are no longer recommended.</p>
Streptococcus pneumoniae (Pneumococcal disease)	Extended (possibly lifelong) antibiotic prophylaxis is recommended for those persons at risk for developing fulminant pneumococcal disease, particularly patients with sickle cell disease and asplenia. Currently, antibiotics are recommended even if the pneumococcal vaccine is given.	<p>Penicillin G or V, likely for life.</p> <p>If younger than 5 years of age: 125 mg BID.</p> <p>If older than 5 years of age: 250 mg BID.</p>

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HOW TO PREVENT RECURRENCES OF DISEASE

Acute Rheumatic Fever (ARF) Prophylaxis	Long-term antibiotics effective against Group A streptococcus are given to persons who have a documented history of acute rheumatic fever. The purpose is to prevent recurrences of rheumatic fever. Antibiotic prophylaxis should begin as soon as the diagnosis of ARF is made and continue for years after the first attack; continue indefinitely in patients with established heart disease or in those frequently exposed to streptococci.	Benzathine penicillin IM every 4 weeks or daily oral antibiotics (which are less reliable): <ul style="list-style-type: none"> • Penicillin V 125–250 mg BID or • Sulfadiazine <ul style="list-style-type: none"> >60 pounds: 1 g daily <60 pounds: 0.5 g daily
Urinary Tract Infections (UTIs) Prophylaxis	Except for children with vesicoureteral reflux or other structural abnormalities of the urinary tract, the use of antibiotic prophylaxis is controversial.	Frequently used antibiotics for prophylaxis and treatment include trimethoprim (with or without sulfonamide) and nitrofurantoin, which are effective in 96% of children.

PREVENT DISEASE AFTER EXPOSURE

Meningitis (<i>Neisseria meningitidis</i> or <i>Haemophilus influenzae</i>)	Antibiotic prophylaxis is recommended for household members and childcare contacts of infected person.	Administer rifampin beginning within 24 hours of identifying the person at 10 mg/kg every 12 hours (maximum 1,200 mg/day) x 2 days for <i>Neisseria</i> , x 4 days for <i>Haemophilus</i> .
Pertussis	Household contacts of infected person should receive antibiotic prophylaxis.	Administer erythromycin estolate (some experts use azithromycin) at 40–50 mg/kg/day (maximum 2 g/day) for 14 days.
Sexually Transmitted Infections (STIs)	Symptomatic or asymptomatic persons exposed to partners with chlamydia, gonorrhea, or syphilis are treated with appropriate antibiotics.	Same treatment regimen is used for the infected and the exposed person (see Chapter 14: Sexually Transmitted Infections).

TABLE 3-8.
INJURY AND PREVENTION

TYPE OF INJURY	EPIDEMIOLOGY	PREVENTION
Motor Vehicle Accident (MVA)	<p>MVAs account for about one-half of all unintentional injury deaths; among infants and adolescents, usually the result of occupant injuries; among school-age children, predominantly from pedestrian injuries.</p>	<p>Use of child restraints and seat belts is the most effective way to prevent occupant injuries. There are four basic types of restraints:</p> <ol style="list-style-type: none"> 1. Rear-facing car seat should be used in the back seat until the child is age 2 years or until he or she exceeds the height or weight limit for the car seat. 2. Forward-facing car seats should be used in the back seat for toddlers greater than 2 years of age. 3. Booster seat (too big for a toddler seat but too small for a seat belt to fit properly). Used for children 40 to 80 pounds, preferably in the back seat. <p>Seat belt Children younger than 13 years should not sit in the front seat in vehicles.</p> <p>Safety seat adaptations are available for premature infants, patients in casts or on ventilators, and those who have special medical conditions such as spina bifida.</p> <p>Children can safely use adult seat belts when they are about 4'9" tall and typically starting at a time between 8 to 12 years of age. State laws vary on age and size for use of the adult seat belts.</p> <p>A safety seat fits if the child's ears are below the top of the safety seat back, and shoulders are below the safety seat strap slots.</p> <p>A shoulder strap should not be used if it goes across the face or throat.</p>
Drowning	<p>Drowning is the second leading cause of accidental death, with peak occurrences in the infant-to-toddler and adolescent years. Poor supervision plays a key role in drowning in the young child/infant years. Adolescent drownings are often associated with alcohol use. The majority of drownings occur in bodies of water that are part of the person's home, particularly bathtubs and pools. Infants can drown in inches of water and in unusual ways such as pails of water and toilet bowls.</p> <p>Approximately one-third of all survivors of drowning will suffer irreversible brain injury.</p>	<p>Supervision is the key to prevention.</p> <p>Leave no child unattended in or near water.</p> <p>Keep the bathroom door closed.</p> <p>Empty all pails of water.</p> <p>Teach children to swim and to behave safely around water (such as using life preservers).</p> <p>According to the AAP: Children are not developmentally ready for swimming lessons until after their fourth birthday. Aquatic programs for infants and toddlers have not been shown to decrease the risk of drowning.</p>

CONTINUED

Fire and Burns	<p>These injuries account for approximately 10% of all trauma deaths and more than 20% in children younger than 5 years of age. More than 1 million burn injuries occur each year and as many as 30,000 persons younger than 15 years old are hospitalized yearly for burns. Approximately 75% of all burns are scalds that occur in the kitchen.</p> <p>The majority of all deaths from fire are due to house fires, with death secondary to smoke inhalation. Bathtub water, if hotter than 120°F, can cause burns. Skin damage rarely occurs at temperatures below 110°F but a full thickness burn can occur in one second in water 160°F.</p>	<p>Keep smoke alarms on each floor of the house and check the batteries every month. There are two types of smoke alarms: photoelectric and ionization. Ionization smoke alarms are generally more responsive to flaming fires. Photoelectric smoke alarms are generally more responsive to fires that begin with a long period of smoldering. Keep pot handles turned in on the stove, out of toddlers' reach. Keep an ABC-rated fire extinguisher in the kitchen. Do not allow children to sit in laps of adults drinking hot liquids. Teach and practice fire escape route and rules. Keep the water temperature at 120°F. Discourage smoking in homes. Counsel families on safe use of heating elements in homes.</p>
Asphyxiation and Choking	<p>This type of injury accounts for approximately 40% of all unintentional deaths in children younger than 1 year old. Food items commonly choked on are hot dogs, candy, nuts, grapes, raisins, and raw vegetables. Nonfood items that children choke on include latex balloons, undersized infant pacifiers, and small toys such as balls and jacks, coins, beverage caps, and safety pins. Asphyxiation occurs from situations such as hanging from drapery cords or bibs tied around neck, crib strangulations (head entrapment), toy chest lids falling on a child's head and neck, or when nose and mouth are covered in a soft pillow, beanbag, or waterbed.</p>	<p>Do not feed small, round, hard foods to children younger than 2 to 3 years of age. Do not allow children to run with food. No latex balloons before age 3 years, monitor balloon use among older children. Encourage parents to learn the Heimlich maneuver. Keep small objects out of the reach of children. Evaluate all toys for safety. Tie up all cords above child's reach. Use bibs with Velcro instead of ties or snaps. Use cribs with slat spacing 2 3/8 inches or less. Do not place infants on any soft or enveloping surfaces.</p>
Poisoning	<p>American Association of Poison Control Centers estimates that there are 1.2 million poisonings in children younger than 6 years old annually. Although the number of pediatric poisonings is high, the fatality rate is low, much less than 0.1%. Toddlers are at the greatest risk. Children 6 to 12 years account for a very small percent. Adolescent exposures are usually intentional (suicide or abuse) or occupational. Over half of pediatric poisonings involve nondrug products, commonly cosmetics, personal care products (deodorants), cleaning substances, and plants. Pharmaceutical preparations comprise the remainder of ingestions with vitamins (particularly iron-containing products), analgesics, cold and cough medications, and antibiotics being the most common products.</p>	<p>Childproofing the home should include putting all medications and other poisonous substances out of reach or behind locked doors. Use child-resistant medication containers. Keep the phone number of Poison Control readily available: 1.800.222.1222 (nationwide 24-hour emergency service for poison exposures, epidemiology of poisoning, and education for poison prevention). It is no longer recommended that parents keep syrup of ipecac at home.</p>

TYPE OF INJURY	EPIDEMIOLOGY	PREVENTION
Falls	<p>Falls are a leading cause of death in children and result in enormous morbidity. Approximately 13,000 deaths occur annually due to falls.</p> <p>A disproportionately large number of injuries from falls occur in stairway falls in walkers and falls from bunk beds, playground equipment, skateboards, and trampolines.</p> <p>Falls in older children and adolescents are associated with sports, biking, skateboarding, and risk-taking behaviors.</p>	<p>Never leave infants or toddlers unattended on elevated surfaces.</p> <p>Keep crib rails up at all times.</p> <p>Avoid walker use. Gates should be placed in front of all staircases.</p> <p>Windowsills and bunk beds should never be used as play areas. Use window guards.</p> <p>Do not allow children to participate in activities beyond their physical abilities, such as skateboarding down steep hills.</p> <p>Discourage the use of any trampolines.</p> <p>Use protective gear (helmets, pads) for bike-riding, skateboarding, in-line skating, and sports.</p>

TABLE 3-9.
PREVENTION OF ENVIRONMENT-RELATED HEALTH PROBLEMS

SAFETY HAZARD	RISK	RECOMMENDATIONS
Environmental Tobacco Smoke Exposure	Increases risk of respiratory problems, otitis, SIDS, child becoming a smoker later.	No smoking in the home, car, or around children.
Carbon Monoxide Exposure	Effects range from chronic flu-like symptoms to death.	Use carbon monoxide detectors in the home. Properly use and maintain fuel-burning devices.
Radon	Increased risk of cancer.	Test home for radon with a home test kit and if level exceeds 4 pCi/L, identify basement leaks and seal. In high-risk areas, also have well water tested as radon can be aerosolized in steam and shower.
Lead	Lead poisoning can lead to neurological damage, and iron deficiency anemia.	Prevent and repair chipped indoor paint in older homes. Restoration of older homes may increase exposure to lead-based paint residue. Screen all children at 1 and 2 years of age and those children at risk when indicated. No use of lead-containing utensils for cooking or eating. Renovations done with proper precautions. Parents with employment in high-risk places (e.g. demolition sites, soldering plants, battery factories, gun ranges) should use precautions (e.g., change clothes and shoes and wash before coming home to reduce lead dust in the home).

Smoking Cessation

- ▶ More than 40% of U.S. children are exposed to environmental tobacco smoke in their own homes.
- ▶ National Cancer Institute recommends “5 As” for providers in assisting smokers to quit: anticipate, ask, advise, assist, and arrange. Encourage cessation of smoking first without pharmacologic interventions; if unsuccessful, you may educate regarding products available for assistance (see Table 3-10). They should not be used by adolescents with heart disease, especially arrhythmias, or during pregnancy (unless under supervision). Efficacy in teens has not been proven.

Exercise

- ▶ Recommendations are for 60 minutes of moderate physical activity of different types on most days of the week.
- ▶ Recommended to focus on fundamental fitness and not sport-specific skills.
- ▶ Age-specific guidelines are available in *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents* by Joseph F. Hagan Jr., Judith S. Shaw, and Paula Duncan.

Stress Management

- ▶ Stress is the emotional and physical response to an increase in the environmental demands beyond the resources of a person to cope with those demands.
- ▶ The goal is to find the right balance of positive and negative stress in life.
- ▶ People often seem to have vulnerability in one system to stress (e.g., hypertension, headaches, mental problems).
- ▶ Stress may be managed through various techniques.
 - ▷ Avoid unnecessary change during stressful times.
 - ▷ Manage time by keeping to predetermined goals and priorities.
 - ▷ Avoid stressful triggers when possible: certain persons, activities, and more.
 - ▷ Create habits or routines to decrease stress.
 - ▷ Develop alternative activities or friendships that increase pleasure.
 - ▷ Physical exercise often decreases stress.
 - ▷ Participate in religious, motivational, or service projects that increase self-esteem or change focus to helping others.
 - ▷ Use biofeedback, tension-relaxation exercise, yoga, imagery, or any combination of these practices to control stress reactions.

HEALTH SUPERVISION

- ▶ The general health of children can be greatly improved through the effective use of healthcare supervision (e.g., disease prevention, early detection and intervention of disorders, providing anticipatory guidance).

- ▶ Health supervision done at regularly scheduled well-child visits should include history and physical exam (PE), vital signs, evaluation of growth and development, and obtaining age-appropriate screening tests.
- ▶ The American Academy of Pediatrics recommends well-child visits at 3 to 5 days; 2 weeks; 1, 2, 4, 6, 9, 12, 15, 18, 24, and 30 months; annually at ages 3 to 21 years.
- ▶ Additional visits may be needed for children with chronic conditions, for sports physicals, and for presurgical procedures.

Assessments

Vital Signs

Heart Rate and Respirations

The normal ranges for resting heart rates and resting respiratory rates vary by age of the child. As the child grows older, the normal resting ranges for both the heart rate and respiratory rate decrease.

- ▶ An infant 12 months of age or younger typically has a heart rate between 80 and 160 beats per minute and a respiratory rate of 25–55 breaths per minute.
- ▶ During the toddler years (1 to 3 years of age), the heart rate is 80–130 beats per minute and the respiratory rate ranges from 20–30 breaths per minute.
- ▶ As a child reaches the preschool years (3 to 6 years of age), the heart rate ranges between 80 and 120 beats per minute and the respiratory rate varies from 20–25 breaths per minute.
- ▶ From 6 to 12 years of age, the heart rate is 70–110 beats per minute and the respiratory rate is 14–22 breaths per minute.
- ▶ During adolescence (13 years and older), the resting heart rate usually ranges from 55–110 beats per minute. The resting respiratory rate is between 12 and 18 breaths per minute.

Blood Pressure

- ▶ Birth: Systolic 60 to 85 and diastolic 40 to 55. Both pressures rise about 2–3 mm Hg per year throughout childhood, reaching adult levels at puberty.
- ▶ Pulse pressure: 20–50 mm Hg throughout childhood
- ▶ Leg pressures: Systolic pressure equal to arms until approximately 1 year of age; after age 1, leg pressure is 10–30 mm Hg higher than arms. Diastolic pressures are equal.
- ▶ In children and adolescents, hypertension is defined as blood pressure (BP) that is, on repeated measurement, at the 95th percentile or greater, adjusted for age, height, and gender.
- ▶ Systemic hypertension is uncommon in infants and younger children; when present, usually indicative of underlying disease process (secondary hypertension).
- ▶ Adolescents may acquire primary or essential hypertension (with no underlying cause); may track into adulthood.

TABLE 3-10.
PHARMACOLOGIC PREPARATIONS TO ASSIST IN SMOKING CESSATION

PHARMA-COTHERAPY	PRECAUTIONS AND CONTRAINDICATIONS	SIDE EFFECTS	DOSAGE	DURATION	AVAILABILITY
Bupropion SR	History of seizure History of eating disorders	Insomnia, dry mouth	150 mg every morning for 3 days, then 150 mg twice daily (begin treatment 1 to 2 weeks before quit date)	7 to 12 weeks Maintenance up to 6 months	Zyban (prescription only)
Varenicline	No documented contraindications Warnings: Advise patients and caregivers that the patient should stop taking varenicline and contact a healthcare provider immediately if agitation, hostility, depressed mood, or changes in behavior or thinking that are not typical for the patient are observed, or if the patient develops suicidal ideation or suicidal behavior.	Abnormal dreams, dry mouth, change in taste	Days 1 to 3: 0.5 mg orally once a day. Days 4 to 7: 0.5 mg orally twice a day. Days 8 to end of treatment: 1 mg orally twice a day. Max dose, 1 mg twice daily (begin treatment 1 to 2 weeks before quit date)	24 weeks	Chantix (prescription only)
Nicotine Gum/ Lozenges	None known	Mouth soreness, dyspepsia	1 to 24 cigs/day: 2 mg gum (up to 24 pcs/day) 25+ cigs/day: 4 mg gum (up to 24 pcs/day)	Up to 12 weeks	Nicorette, Nicorette Mint, Nicorette Orange (over the counter [OTC])

Nicotine Inhaler	Known hypersensitivity or allergy to nicotine or menthol	Local irritation of mouth, throat	6 to 16 cartridges/day	Up to 6 months	Nicotrol inhaler (prescription only)
Nicotine Nasal Spray (NS)	Allergy to any ingredient in Nicotrol NS; persistent nose problems (e.g., allergies, runny nose, nasal polyps, sinusitis) or severe asthma; recent heart attack; severe or worsening chest pain or a severely irregular heartbeat	Nasal irritation	8 to 40 doses/day	Up to 6 months	Nicotrol NS (prescription only)
Nicotine Patch	Allergy to any ingredient in Nicoderm CQ patch	Local skin reaction, insomnia	Tapering dose of 21 mg to 7 mg over a 10-week period	8–10 weeks	NicoDerm CQ, (OTC), generic patches (prescription and OTC), Nicotrol (OTC)

Data from *Explore Medications: Which Quit Smoking Medication is Right for You?* by Centers for Disease Control and Prevention, 2015b. <http://www.cdc.gov/tobacco/campaign/tips/quit-smoking/guide/explore-medications.html>

- ▶ Accurate blood pressure measurements should be part of the routine physical exam in all children older than 3 years and a complete family history of hypertension should be elicited.

Growth

- ▶ Assessment of growth is determined by routine monitoring of height, weight, head circumference (until age 2), dental development, and the appearance of secondary sex characteristics.
- ▶ Adequacy of growth is determined by comparison with normal growth guidelines or plotting the measurements of height, weight, and head circumference on a standard National Center for Health Statistics (NCHS) growth chart or World Health Organization (WHO) growth chart for children from birth to age 2 years.
- ▶ Most healthy infants will double their birth-weight between 4 to 6 months of age and will triple their birth-weight by 1 year of age.
- ▶ Between birth and 6 months of age, an infant's length increases approximately 1 inch per month. Between 6 and 12 months of age, the monthly gain of length is approximately 0.5 inches. Birth length increases by approximately 50% by 1 year of age.
- ▶ A newborn's head circumference ranges from 32 to 38 cm at birth. During the first 3 months of life, the head circumference increases 2 cm per month. From 4 to 6 months, the rate of growth decreases to 1 cm per month. Between 6 and 12 months of age, the head circumference increases 0.5 cm per month.
- ▶ Body mass index (BMI) is an assessment of weight for height and age that is gender specific and used to determine body fat. It is calculated by dividing weight in kilograms by height in meters squared. Standard BMI decreases during the preschool years, then increases into adulthood. Standard charts and BMI calculators are available at <http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-for-age.htm>.
- ▶ There are two periods of rapid growth, infancy and adolescence; in between, growth is steady but slower.
- ▶ Growth of most body tissues parallels physical growth with the exception of brain growth, which is most rapid in the first 2 years; lymph tissue growth, which is rapid in the preschool and early school-age years; and reproductive organ growth, which remains slow until puberty.

Adolescent Growth and Pubertal Changes

Male

- ▶ Average age of onset is 11 years.
- ▶ Precocious puberty is the development of secondary sex characteristics before age 9 and is often associated with a pathological etiology in males.
- ▶ Sexual maturity rating (SMR, or Tanner staging) in males describes the stages of genital development and pubic hair growth. The stages range from 1 to 5. When describing SMR, a preadolescent male with no pubertal genital development or pubic hair would be considered a stage 1 and adolescent with adult-like pubic hair and genital development would be considered Stage 5.

- ▶ Delayed puberty is defined as no secondary sexual maturation or any sign of puberty by the age of 13 years in girls and 14 years in boys.
- ▶ First change is testicular enlargement; testicular size greater than 2 to 2.5 cm indicates puberty has begun.
- ▶ Penile growth occurs approximately 6 to 12 months after testicular enlargement and grows from a prepubertal size of 3.5 to 5.5 cm to an adult average length of 12 cm (range 7.5 to 15.5 cm).
- ▶ Growth spurt begins about one year after the first testicular changes (average age 12.5 years), peaks after 1.5 years, and lasts 2 to 4 years.
- ▶ Accompanying changes, such as axillary and facial hair and deepening voice, occur later in puberty. Gynecomastia may occur in up to 50% of boys, generally at SMR 4.

Female

- ▶ Average age of onset is 10 to 11 years (10.5 years in White girls; 9.5 years in Black girls) and begins with thelarche, breast development; adrenarche, the appearance of pubic hair, occurs an average of 6 months later.
- ▶ Sexual maturity rating for females ranges from 1 to 5 and describes breast development and pubic hair growth. A preadolescent with breast development and no pubic hair growth would be considered an SMR or Tanner Stage 1. An adolescent with mature, adult-like breasts and adult-like pubic hair would have a SMR of 5.
- ▶ Precocious puberty is the onset of changes before 8 years of age or menarche (menstruation) before age 10 years.
- ▶ Delayed puberty is no breast development by age 13 years or no menses by 15 to 16 years.
- ▶ Isolated breast budding is common, and more frequent in Black girls. It occurs in 1%–3% of 3-year-olds, rising to 27.2% of Black girls and 6.7% of White girls by 7 years. Premature adrenarche without progression of pubertal development is usually benign and more common in Black girls.
- ▶ Menarche occurs at an average age of 12 to 13 years (range 10 to 15) or SMR 3.

Tooth Eruption

- ▶ Deciduous teeth usually begin around 6 months of age with the central incisors and move laterally.
- ▶ All 20 deciduous teeth have erupted by 2½ to 3 years of age.
- ▶ Delayed dentition is considered when no teeth have erupted by 13 months of age.
- ▶ Shedding of deciduous teeth begins at about 6 years of age and continues through age 12.
- ▶ Eruption of the first permanent teeth occurs with the first molars at about age 6 years.
- ▶ Eruption of all 32 permanent teeth may not be complete until ages 17 to 21 with third molars.

Developmental Surveillance and Screening

Patterns of Development

- ▶ Sequence of development is basically the same in all children but the rate varies (see Tables 3-11 and 3-12).
- ▶ Attainment of developmental landmarks in one area does not always run parallel with another area of development.
- ▶ Development is dependent on the maturation of the nervous system.
- ▶ Generalized activity precedes specific movements (the young infant kicks and waves arms with excitement, whereas the older infant reaches out and grasps).
- ▶ Development occurs in a cephalocaudal direction (head control develops before walking) and a proximal-to-distal direction (use of shoulders before fingers).
- ▶ Loss of certain primitive reflexes must occur before the corresponding voluntary movement is acquired (grasp reflex lost before deliberately grasping objects can occur).

Developmental Screening

- ▶ AAP recommends developmental screenings with a high-quality tool at least three times before a child's third birthday, at the 9-month, 18-month, and 24- or 30-month pediatric visits.
- ▶ A widely used developmental screening tool is the Ages and Stages Questionnaire.
- ▶ Purpose is to identify children in need of further evaluation.
- ▶ All states are required to have a system to identify and treat developmental disabilities in children ages 3 to 5 years (most states have voluntarily extended these years).
- ▶ The Modified Checklist for Autism in Toddlers–Revised (MCHAT-R) is used to screen toddlers for autism spectrum disorders at 18 and 24 months.

Interpreting Results

- ▶ Attainment of milestones is listed in ranges (there is a wide range of normal).
- ▶ An important finding in any developmental screening is the loss of developmental milestones previously achieved.
- ▶ Language and fine motor skills are sensitive indicators of intellectual development.
- ▶ Early attainment of gross motor skills is not a major indicator of advanced intellectual development but does usually preclude the condition of mental retardation.

Psychosocial Development

Erikson's Stages of Psychosocial Development

Erikson (1964) outlines a series of tasks that a person either accomplishes or if not, develops specific failures that may be continued throughout life. These tasks and the life stage they are first established during include:

- ▶ Trust (failure causes mistrust); infant
- ▶ Autonomy (failure leads to feelings of shame and doubt); toddler

TABLE 3-11.
DEVELOPMENTAL LANDMARKS

TASKS	AVERAGE AGE* (RANGE)
<i>Gross Motor Skills</i>	
Lifts head 45°	1½ months (½ to 3½ months)
Rolls over	4 to 5 months (2 to 6 months)
Head control (no bobbing)	4 to 5 months
Sits alone	6 months (5 to 9 months)
Pulls to stand	8 to 9 months (6 to 10 months)
Crawls (reciprocal)	9 to 10 months (8 to 11 months)
Cruises	9 to 10 months (8 to 13 months)
Walks alone	11 to 12 months (9 to 15 months)
Walks upstairs holding rail	18 months (14 to 21 months)
Throws ball overhand	19 to 20 months (16 to 24 months)
Pedals tricycle	28 months (21 to 36 months)
Balances on one foot	28 to 30 months (22 to 38 months)
Hops on one foot	3 to 3½ years (3 to 4½ years)
Tandem walk	4 to 4½ years (3½ to 5 years)
Skips	5 years
FINE MOTOR SKILLS	AVERAGE AGE* (RANGE)
Unfists	3 to 4 months
Holds objects placed in hand	3 to 4 months (2½ to 5 months)
Reaches for objects	4 months (3 to 5 months)
Transfers objects	6 months (4½ to 7 months)
Ulnar raking	6 months (5 to 7 months)
Inferior pincer	9 to 10 months
Mature pincer	11 to 12 months
Deliberate throw	12 to 13 months
Spontaneous scribble	14 to 16 months (12 to 16 months)
Tower of 2	15 months (12½ to 20 months)
Tower of 4	18 months (16 to 20 months)
Tower of 6	24 months (17 to 30 months)
Imitates line	24 months (19 to 30 months)
Tower of 10	36 months
Copies circle	36 months (30 to 42 months)
Uses scissors	3 years
Copies square	4 years (4 to 5 years)
Draws three-part human figure	4 years (3½ to 5 years)
Copies triangle	5 years
Draws six-part human figure	5½ years (4½ to 6 years)

CONTINUED

LANGUAGE (RECEPTIVE AND EXPRESSIVE)	AVERAGE AGE* (RANGE)
Localizes sound	4 to 9 months
Babbling vowels	5 to 6 months
Babbling consonants	6 to 7 months
Dada or mama nonspecific	9 to 10 months
Dada or mama specific	10 to 12 months
1 to 2 words	11 to 13 months
Follows one-step command	11 to 15 months
10 to 15 words, 25% intelligible	15 to 18 months
Points to named pictures when asked, "Show me"	18 to 24 months
Approximate 50-word vocabulary and joins 2 words together	21 to 24 months
Says "me" and "mine," with approximate 100-word vocabulary	2 years
Follows two-step commands	30 months
A few possessives ("my ball") and progressives (-ing, "I playing")	30 months
Concept of I and questions	30 months
Knows a few colors, pronouns, and plurals, as well as full name and age. Has about a 250-word vocabulary, 3- to 4-word sentences (75% intelligible). As a rule the number of words in a sentence equals child's age (2 by age 2, 3 by 3, etc.)	36 months
Counts to 4, can say a nursery rhyme, asks and answers why, how, and when, knows opposite analogies, and uses past tense	4 years
Understands meaning of words, counts to 10, fluent speech, future tense	5 years
SOCIAL, INTERACTIVE, AND VISION	
Regards face	Birth to 1 month
Smiles responsively	1 to 1½ months
Regards hand	4 to 5 months
Smiles at mirror image	5 months
Plays peek-a-boo	5½ to 8½ months
Plays pat-a-cake	10 months
Indicates wants	12 months (10 to 14 months)
Imitates housework	15 months (13 to 18 months)
Washes and dries hands	22 months (19 months to 2½ years)
Puts on clothing	22 months

*Ages vary somewhat between different texts

TABLE 3-12.
DEVELOPMENTAL WARNING SIGNS

6 weeks	Absence of auditory alertness Lack of visual fixation (focusing) Excessive head lag on pulling to sitting position
6 months	Persistence of hand regard Failure to follow 180° (for both near and far objects) Persistent fisting Preference of one hand
10 months	Absence of babble Absence of weight-bearing while held Failure to sit without support
18 months	No spontaneous vocalizations No pincer grasp Inability to stand without support
2 years	No recognizable words No walking

- ▶ Initiative (failure leads to feelings of guilt); preschooler
- ▶ Industry (failure leads to feelings of inferiority); school-age
- ▶ Identity (failure leads to role confusion); adolescent
- ▶ Intimacy (failure leads to isolation); young adult
- ▶ Generativity (failure leads to stagnation); middle adult
- ▶ Integrity (failure leads to despair); older adult

Piaget's Cognitive Development Theory

Piaget (1969) focuses on cognitive thinking, which occurs in a sequential manner as a result of continuous interaction with the environment. The stages are:

- ▶ Sensorimotor (infancy)
- ▶ Preoperational thinking
- ▶ Concrete operations
- ▶ Formal operations (uses logic, determines possibilities, problem-solves, and makes decisions)

Screening Tests

- ▶ Purpose: Early detection of treatable conditions in children who are asymptomatic.
- ▶ Not all abnormalities are identified on screening tests; continual monitoring of child's condition and repeat testing may be necessary.
- ▶ Use of screening tests will change as incidence of disease changes (e.g., lead poisoning and TB testing) and as technology improves (e.g., newborn hearing tests).

- ▶ Screening tests may be recommended primarily for high-risk groups (e.g., lead, cholesterol, TB) at certain ages but tests can be ordered if indicated at other ages.
- ▶ Common screening tests listed in Table 3-13.

Preparticipation Sports Screening

- ▶ Children and adolescents participating in sports should have a preparticipation examination (PPE). No standardization of PPEs exists and evaluations may vary.
- ▶ The PPE should involve parents for athletes younger than 18 years of age.
- ▶ The goal of the PPE is to evaluate for the presence of conditions that may lead to injury or death because of sports participation. Particular attention of the PPE should be directed at the cardiopulmonary and musculoskeletal systems.
- ▶ Most sudden deaths in young athletes are due to cardiac causes, many undetected. See Table 3-14 for causes of sudden cardiac death. Exercise-associated cardiac symptoms may be the only sign of cardiac disease. When taking a cardiac history, note symptoms such as chest pain, syncope, palpitations, dizziness, or tachycardia (especially with exercise).
- ▶ Family history of congenital, inherited, or early onset heart disease, or sudden death should be noted. A leading cause of sudden cardiac death is inherited hypertrophic cardiomyopathy. Other inherited conditions such as anomalous left coronary artery or prolonged QT syndrome may also cause sudden death.
- ▶ Note a past medical history of congenital or acquired heart conditions. Most patients with prior cardiac conditions will require cardiac consultation for sports participation.
- ▶ Elicit a medication history. Use of certain medications may increase the risk of arrhythmias or sudden death.
- ▶ Physical exam (focusing on the cardiac system): Obtain vital signs, especially heart rate, rhythm, and blood pressure. Tachycardia, bradycardia, and irregular rhythms may be signs of cardiac disease and require further evaluation. All diastolic murmurs and Grade III/IV murmurs or higher require further evaluation.
- ▶ When taking a history of the musculoskeletal system, note symptoms such as pain, limited movement, localized or diffuse areas of swelling, and previous injury requiring rehabilitation. If such symptoms are present, they may indicate disease, acute injury, or overuse syndromes, and clearance for sports participation should be deferred until further evaluation.
- ▶ Physical examination of the musculoskeletal system: Range of motion (ROM) of all joints and muscle strength tests should be done. Having the patient duck walk allows for assessment of ankles, knees, and hips. General ROM and muscle strength tests should be done as well as sports-specific tests focusing on parts of the body: neck (gymnastics, dance, football, wrestling), upper body (swimming, baseball, tennis), and lower body (football, soccer, dance).
- ▶ Optimal timing for PPE is 6 weeks or more before onset of the season; this affords time for further evaluating any problems, rehabilitating detected problems, and improving conditioning, should the athletes be unconditioned.

TABLE 3-13.
COMMON SCREENING TESTS

SCREENING TESTS	AGES FOR SCREENING	TESTING AND INTERPRETATION
Neonatal, Metabolic, Hematological, and Genetic Screening	All full-term infants before discharge and in some cases at 1 to 2 weeks of age	All states screen for phenylketonuria (PKU) and hypothyroidism; most screen for galactosemia. Tandem mass spectrometry has greatly increased the number of conditions tested. Conditions tested for are determined by states (see https://genes-r-us.uthscsa.edu/sites/genes-r-us/files/nbsdisorders.pdf for list). All positives require immediate confirmation and referral.
Hearing Screening	Newborns	Recommended screening tools for newborns include the evoked otoacoustic emissions (EOAE) and auditory brainstem response (ABR). Screen initially with EOAE, test failures with ABR. Passed ABRs are rescreened in 3 to 6 months and failures are referred for further evaluation. (Some facilities use only ABR for high-risk infants but current recommendations are for the two-stage EOAE-ABR.)
Hearing Screening	4 to 5 years of age	Audiometric screening: Minimal evaluation should be 20 dB HL with frequencies of 1, 2, and 4 kHz. Any unheard frequency is a failure and the child should be retested at a later date. Failure again requires a referral.
Anemia Screening	Hemoglobin/hematocrit or complete blood count (CBC) is recommended at 12 months, 2 years, and adolescence.	Early screening allows for detection of iron deficiency anemia and congenital anemias such as thalassemia. Treatable anemias are followed with a repeat CBC after intervention.
Lead Screening	Selectively obtain blood lead levels (BLLs) at 9 to 12 months and again at 2 years in children at high risk.	<p>CDC recommends screening children in the following circumstances:</p> <ul style="list-style-type: none"> • The child resides in a zip code where more than 27% of housing was built before 1950; • The child receives services from public assistance programs for the poor, such as Medicaid or the Supplemental Food Program for Women, Infants, and Children (WIC); or • The child's parent or guardian answers "yes" or "I don't know" to any of the following three questions: <ul style="list-style-type: none"> o Does your child live in or regularly visit a house that was built before 1950? o Does your child live in or regularly visit a house built before 1978 with recent or ongoing (within the past 6 months) renovations or remodeling? o Does your child have a sibling or playmate who has or had lead poisoning? <p>All Medicaid recipients must be screened at 12 and 24 months.</p>

CONTINUED

Cholesterol and Lipid Screening	Obtain fasting or lipid profile in at-risk children after 2 years of age but before 10 years; adolescent levels more accurately reflect adult levels. Retest every 3 to 5 years if levels are acceptable.	<p>Screen children older than 2 years and younger than 10 years of age who:</p> <ul style="list-style-type: none"> • Have a family history of premature (younger than 50 years old in men, younger than 60 years old in women) cardiovascular disease (myocardial infarct, stroke, or peripheral vascular disease) or whose family history is unknown; or • Are overweight or obese. <p>Optional testing may be obtained on <i>any</i> child with possible risk factors such as cigarette smoking, hypertension, obesity, diabetes mellitus, or physical inactivity.</p>
Tuberculin (TB) Skin Test	Annual testing, with Mantoux skin tests, for children at high risk. For children with no risk factors who live in high-prevalence regions or who lack a clear history, do periodic testing at ages 1, 4 to 6, and 11 to 16 (can be any age).	<p>Children at high risk include those who:</p> <ol style="list-style-type: none"> 1. Have contact with infected adults; 2. Have clinical or x-ray findings suggestive of TB; 3. Are immunosuppressed (e.g., have HIV); 4. Have chronic illness (diabetes, renal disease); 5. Come from high-prevalence countries (or have parents who do); or 6. Have or had frequent exposure to high-risk adults: HIV-positive persons, homeless persons, drug abusers, persons in poor health, nursing home residents, and migrant workers. <p>Tests results are positive (read by induration of transverse diameter) if:</p> <ul style="list-style-type: none"> • Larger than 5 mm with risk factors 1 to 3 (above) • Larger than 10 mm with risk factors 4 to 6 and/or younger than 4 years of age, or they possess adult risk factors listed in 6 • Larger than 15 mm for all persons
Vision Screening	Obtain visual acuity (V/A) and binocular vision by age 4 to 5 years on all children and, if possible, yearly or every other year after.	<p>Test V/A with the Snellen chart standardized at 20 feet. Use a Tumbling E or Lea chart (uses symbols like apple, circle, square, and house) if letters cannot be recognized. A failed test is V/A 20/40 or greater in either eye or if there is a two-line discrepancy between the eyes (e.g., 20/20 in one eye and 20/40 in another).</p> <p>Referrals are made for all failures.</p> <p>Binocular vision testing only an adjunct to V/A, usually obtained with the Random Dot E test or the Stereo Fly test.</p> <p>All children should be tested once for color blindness.</p>
Blood Pressure (BP)	Annual BP measurements beginning at 3 years of age.	If BP is elevated, repeat. Children with persistent (3 times) BP readings above 95th percentile need a thorough history, physical, lab, and possibly x-rays to determine if an underlying etiology exists.

TABLE 3-14.
CAUSES OF SUDDEN CARDIAC DEATH

<i>Electrical cardiac abnormalities</i>
Congenital long QT syndrome
Ventricular tachycardia
Wolff Parkinson White syndrome
<i>Acquired cardiac abnormalities</i>
Infection (myocarditis)
Trauma (commotio cordis)
Toxicity (illicit or performance enhancing drugs)
Environment (hypo-, hyperthermia)
<i>Structural cardiac abnormalities</i>
Hypertrophic cardiomyopathy
Marfan syndrome
Congenital coronary artery anomalies
Mitral valve prolapse
Aortic stenosis

From "Sudden Cardiac Death in Young Athletes: Practical Challenges and Diagnostic Dilemmas," by N. Chandra, R. Bastiaenen, M. Papadakis, & S. Sharma, 2013, *Journal of the American College of Cardiology*, 61, 1027–1040.

- ▶ Sports physicals should not replace the routine physical exam but may include preventative healthcare teaching on such topics such as the use of nutritional supplements, steroids, and prevention of injuries.
- ▶ Results of the PPE may allow for full participation (the most common result), temporary deferral due to illness or injury, partial deferral (i.e., no contact or collision sports), or recommendations for appropriate sports for certain conditions.

Anticipatory Guidance

Purpose is to provide parents with information regarding upcoming development issues. Examples include:

AGES	COMMON ISSUES
Birth to 1 year	Teething Introduction of foods Nighttime awakening Childproofing the home
1 to 3 years	Introduction of whole cow's milk Weaning off the bottle Toilet training Temper tantrums Discipline and setting limits Tooth care and dental visits

CONTINUED

Preschool to school age	School readiness, school problems Responsibilities and chores TV and video monitoring Sports, play, and hobby safety
Teen years	Sexual and reproductive health issues Cigarettes, drugs, peer pressure Mood swings Safety, sports Junk food

HEALTH CARE AND INTERVENTION CONSIDERATIONS

Models and Theories Related to Health Care

Maslow's Hierarchy of Needs

Maslow (1954) suggests that some needs are more important than others and must be met before other needs can be considered. The hierarchy is as follows:

1. Survival needs: water, food, sleep
2. Safety and security: protection from hazards
3. Love and belonging: affection, intimacy, companionship
4. Self-esteem: sense of worth
5. Self-actualization: achieving potential

Health Belief Model

Becker's (1974) model attempts to explain why healthy persons do or do not take advantage of screening programs and involves variables such as perceptions of susceptibility and seriousness of a disease, benefits of intervention, perceived barriers to change, and expectations of efficacy.

Trans-Theoretical Model of Change

Prochaska and DiClemente's (1984) six predictable stages of change:

1. Precontemplation
2. Contemplation
3. Preparation
4. Action
5. Maintenance
6. Termination

Self-Efficacy or Social Cognitive Theory Model

According to Bandura (1977):

- ▶ Self-efficacy is the perception of one's ability to perform a certain task at a certain level of accomplishment.

- ▶ Behavior change and maintenance are a function of outcome expectations and efficacy expectations.

Cultural Influences

Cross-cultural experiences are commonplace today, including in the medical arena. If the health-care provider is sensitive to issues surrounding health care and the traditional health beliefs of the patient, more comprehensive health care can be provided.

- ▶ **Family:** A group of two or more adults and/or children who are usually related and reside together in a household and whose adults participate in the essential functions of providing food, clothing, shelter, safety, and education for themselves and any children. The concept of the traditional husband-wife-children pattern has been broadened. The family initially teaches the belief patterns, religion, culture, and values of a society. *Healthy People 2020* has identified families as the bedrock of society.
- ▶ **Ethnicity:** The race, tribe, or nation with which a person or group identifies and which influences their beliefs and behavior. Traits of an ethnic group include religion, culture, language, and appearance.
- ▶ **Culture:** The shared patterns of values, behaviors, and beliefs that are common among members of a group and have both practical and symbolic components.
- ▶ **Community:** A group of families often sharing the same race, tribe, or culture who have beliefs or behavior not shared by others.
- ▶ **Individual:** One member of a family, community, or cultural group.
- ▶ **Environment:** General circumstances such as climate, altitude, and temperature affect all people, while more specific items such as air pollution, fluoride in the water, water contamination, crime, poverty, and transportation are examples of things that might be manipulated with a more positive or more negative effect on the population.

Evidence-Based Health Care

- ▶ To reduce the numbers of conflicting or varying recommendations for the diagnosis and treatment of common problems, the trend is to base decisions on evidence from randomized controlled research trials. Meta-analyses of these trials, together with individual trials, have gained acceptance as valid foundations on which care can be based. Availability of information about the status of research in these areas is growing through use of the Internet.
- ▶ Outcome studies will replace tradition, intuition, and personal preference for how different clinical problems should be handled. NPs should have sufficient research skills to be able to critically evaluate and participate in outcome studies that will relate to their clinical practice.

Clinical Guidelines

- ▶ Standards of practice are devised from research by experts in the field to guide and standardize practice across the nation. NPs should know how to analyze clinical guidelines to determine those that are written by objective scholars and are without organizational, professional, or pharmaceutical bias. See the National Guideline Clearinghouse at <https://www.guideline.gov>.
- ▶ Factors to consider in evaluating guidelines include: Source of guideline, appropriateness of methodology used to develop guideline, use of expert opinion/clinical experience in decision-making, public policy issue considerations, feasibility issues, use of peer review, congruence with other practice guidelines, timeliness, and funding source.

Critical Thinking and Decision-Making

- ▶ Critical thinking involves acquisition of knowledge with an attitude of deliberate inquiry. Part of critical thinking may be innate, but most persons can learn to think critically.
- ▶ Decision-making is a higher level of critical thinking. It involves making decisions based on an understanding of the different options and the possible desirability of the outcomes of each option in the mind of the clinician and the patient.
- ▶ Pattern recognition, similarity recognition, common-sense understanding, skilled know-how, sense of importance, and deliberative rationality are all important aspects that influence decision-making.

Communication

- ▶ The written and oral transfer of information regarding the structure, process, and outcome of healthcare encounters. Good communication is a necessity for healthcare providers for interviewing and teaching patients, recording information and decisions, and sharing or clarifying information with others involved in the patient's care. All communication is privileged and confidential and written documentation is subject to specific standards and audits.

Types of Special Communication

- ▶ Triage
 - ▷ The prioritization and sorting of patients according to a preexisting standard. Used in disaster and emergency settings.
- ▶ Case management
 - ▷ Case management is a system of controlled oversight and authorization of services and benefits provided to patients.
 - ▷ The case manager is an advocate in the managed care environment for both consumers and providers; managing can also mean balancing key issues of access, cost, and outcomes.

- ▶ Interprofessional relationships
 - ▷ NPs work closely with many other types of healthcare providers. The NP role boundaries are not always clear and may vary from state to state or even institution to institution. Some principles in establishing and maintaining relationships with others include:
 - ▶ Flexibility
 - ▶ Willingness to listen
 - ▶ Respect for others' views, beliefs, and traditions
 - ▶ Ability to make changes
 - ▶ Assertiveness in clarifying your own opinions, beliefs, and traditions
 - ▶ Tolerance
 - ▶ Patience

CASE STUDIES

Case 1

A mother arrives for a first-time visit with her 12½-month-old for a well-child exam. They “have not had a check-up for a while.” The child has no medical conditions, no history of chickenpox, and no known allergies. Family history is negative for tuberculosis, anemias, or other medical conditions. Their previous place of residence was an army base in Utah and no information is available about the base. They have “traveled a lot”—twice since the baby was born. The parents were stationed overseas in the Middle East for a few months. The immunization record reveals that the child has received three DTaP (last one 6 months ago), two IPV (last one 8 months ago), three Hib (last one 6 months ago), and three hepatitis B vaccines (last one 2 months ago).

1. What other questions on history are important?
2. What laboratory or screening tests should be obtained, if any?
3. What developmental skills should the child demonstrate?
4. What anticipatory guidance should be provided?
5. What vaccines, if any, should be given today if the history and physical are negative?

Case 2

A 15-year-old girl is at the office for a sport physical to play lacrosse.

1. What are important assessments to obtain on history and physical?
2. Are any laboratory studies or screening tests indicated?
3. What are examples of signs or symptoms that would deter her participation?

CASE STUDY DISCUSSION

Case 1

1. What other questions on history are important?
 - ▷ Nutritional history: Formula or milk, amount, using a cup or bottle, table food or baby food (or both), which foods, food allergies or problems.
 - ▷ Developmental history (past to present, in all four areas—gross motor, fine motor, language, and social): What age did the child roll over, sit, reach out; are there any syllables or words spoken now; how is walking; how is interactive play such as pat-a-cake.
 - ▷ Past medical history: Birth history, any medical conditions, reaction to vaccines, any injuries.
 - ▷ Social history: Living with both parents, family relationships, finances.

2. What laboratory and/or screening tests should be obtained (if any)?

CBC and lead level tests to rule out anemia and elevated BLLs. The BLL is included because no information is available regarding the previous residence. ATB skin test might be indicated because of the parents' frequent travel.

3. What developmental skills should the child demonstrate?

Most children at 12 months are walking, but it is not considered a delay if a child is not walking; however, the child should be crawling and cruising. The child should be saying a few consonants and syllables such as *ma* or *da*, and possibly one to two words. A mature pincer grasp should be present as well as a deliberate throw. Drinking from a cup should be mastered. Playing pat-a-cake or peek-a-boo (some level of interactive play) would be age appropriate.

4. What anticipatory guidance should be provided?

Safety: Childproof the home— by keeping the bathroom door(s) closed, keeping pot handles turned in, not using tablecloths, and covering electric sockets; keeping phone number for poison control near the telephone is also advised.

Nutrition: May transition to whole cow's milk and table foods if this has not been done already (with precautions regarding choking).

Behavior: Temper tantrums may start this early; discuss nighttime awakening.

5. What vaccines, if any, could be given today if the history and physical are negative?
MMR #1, Varicella #1, Hep A #1, and Prevnar #1.

Case 2

1. What are important assessments to obtain on history and physical?
 - ▷ Are there any symptoms of dizziness, chest pain, heart palpitations, or shortness of breath (SOB) with exercise; any joint or back pains or problems?
 - ▷ Is there any past history of any medical conditions or injuries (especially any head injuries or loss of consciousness; any joint injuries)?
 - ▷ What was the age of menarche and are the menses normal?

- ▷ Is there any family history of early heart disease or someone who died at an early age for unknown reasons?
- ▷ Has she played this or any other sports previously; were there any problems?
- ▷ When was the last time she played sports?

The physical exam should emphasize the cardiac and musculoskeletal exam, including vital signs, listening to the heart in at least two positions, putting all joints through range of motion, and performing muscle strength tests.

2. Are any laboratory studies and/or screening tests indicated?

There are no laboratory or screening tests that specifically need to be done for a sports physical but if she has not had a well check or laboratory tests done in 2 years or more, it would be acceptable to obtain a routine CBC, cholesterol test, and urinalysis.

3. What are examples of signs and symptoms that would defer her participation?

The presence of any of the following signs and symptoms would warrant a deferral until resolved or further evaluation is obtained: chest pain, dizziness, palpitations or unusual shortness of breath with exercise, decreased range of motion, pain with movement or weakness of a limb, enlarged organ, fever, hypertension, tachycardia, Grade III or higher heart murmur, click, abnormal growth.

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