

INDEX

Note: Page numbers in *italics* indicate figures.
Page numbers followed by a “t” indicate tables.

- ACAM2000, 123t, 471-475, 474t. See also *Smallpox*.
- Acetaminophen, 143
- ACIP. See *Advisory Committee on Immunization Practices*.
- ActHIB (Hib-T), 121t, 171t, 336, 338t-339t, 340
- Active Bacterial Core surveillance (ABCs), 76
- Acute disseminated encephalomyelitis (ADEM), 262
- Ad-hoc committees and task forces, 81-82
- Adacel (Tdap), 65t, 123t, 322t-324t, 329. See also *Tdap vaccine*.
- Adaptive immune system, 19, 27, 41
- Additives in vaccines, 249-250
- Adenovirus, 295-299
 - clinical features, 295-296
 - epidemiology and transmission, 296
 - immunization program, 296
 - pathogen, 295
 - vaccines, 16, 296, 297t
 - contraindications/precautions, 298-299
 - immunogenicity/efficacy, 298
 - recommendations, 297t, 299
 - safety, 298
 - storage, 120t
- Adjuvants, 26, 27, 28t-29t, 247-249. See also *specific vaccines*.
- action mechanisms of, 28t-29t
- alum/aluminum, 26, 28t, 247-249
- AS01, 29t, 249
- AS03, 28t, 269, 387
- AS04, 28t, 249
- in combination vaccines, 529
- CpG1018, 28t, 249
- MF59, 29t, 249
- Administration of vaccines, 118-119, 135-178. See also *Delivery of vaccines; Recommendations; Vaccine practice*.
- anxiety, pain, and fever, dealing with, 143
- coding and billing for, 145-147
- contraindications and precautions, 174-176
- emergencies following, 144-145
- errors in administration, 168-169, 168t
 - corrections for, 170t-173t
 - expired or invalid doses, 118, 155, 170t
- general guidelines, 118-119
- general issues, 135-139
 - air bubbles, 135-139
 - quick jab technique, 139, 143
 - gloves not required for, 110, 135
 - grace period, 111, 153, 155
 - interchangeability of vaccines from different manufacturers, 163
- Administration of vaccines (*continued*)
 - intervals for vaccinations, 153-162, 156t-161t
 - doses of same vaccine, 155-162
 - inactivated vaccines, 154-155
 - lapse in series and, 162-163
 - between live vaccines and antibody-containing blood products, 164-165, 166t-167t
 - live vaccines not given at the same time, 154
 - safety of giving concomitantly, 64t, 153-154
 - minimum age and intervals, 155-162, 156t-161t, 282
 - multiple vaccines
 - simultaneous administration of, 64t, 139, 153-154
 - exceptions, 153
 - no maximum number of vaccinations in single day, 174
 - using different sites for, 139, 153
 - needle type and length, 139, 141t
 - for persons who have had the disease, 164
 - prefilled syringes, 119, 174
 - routes of administration, 139-143
 - intradermal, 142, 143
 - intramuscular, 139, 140
 - intranasal, 142-143, 142
 - jet injectors, 143
 - needle type and length, 139, 141t
 - oral, 139-142, 142
 - subcutaneous, 139, 140
 - schedules for. See *Schedules*.
 - ten simple rules, 153-168

Adolescent immunization, 95, 133, 279

barriers to immunization, 96t

coverage goals, 91

coverage rates, 73, 74

Denver Health example, 133, 133t

DTap series vs Tdap, 246, 329-330

hepatitis B vaccine, 282, 286, 359

HPV vaccine, 283, 286, 370, 375-376

immunization platforms
 - early adolescent, 279, 294t
 - late adolescent, 279, 294t

improving delivery, 133, 133t

N meningitidis, 95, 282, 291, 423, 424, 432

schedules
 - catch-up, 286-287
 - routine adult, 290-291
 - routine young adult, 282-283
 - special, 288t-289t
 - special immunizations, 288t-289t

standards for, 92-95

syncope and, 144, 375

Adoptees, international, 213-215

Adult immunization, 279, 290-293. See also *Older adults*.

coverage goals, 92

- Adult immunization (*continued*)
 improving rates of, 133, 134t-135t
 at pediatric office visit, 129, 130t
 schedules, 67, 290-291. See also *specific vaccines*.
 by age group, 290-291
 by medical condition, 292-293
 standards for, 95-97, 98t-99t
 young adult immunization platform, 294t
- Adventitious agents, 265-266
- Adverse events, 76-82. See also *Vaccine Safety Net*; *specific vaccines*.
 causality and, 77, 77t, 99
 clinical trials and numbers of subjects to detect, 56-58, 57t
 contraindications and precautions, 174-176
 screening for, 133, 136t-138t
 definition of adverse event following immunization, 77, 77t
 effect on recommendations, 229t
 genetics and, 45-46
 mandatory reporting requirements, 78, 94
 Reportable Events, 97-99, 100t-103t
 Reporting System (VAERS), 77-79, 105
 required reporting of, 94
- Advisory Committee on Immunization Practices (ACIP), vi, 63-70, 66
 recommendations, vii, 63-70, 64t-65t, 279
 Category A or B, 70, 72t
 GRADE approach, 67-70, 71t
 on simultaneous administration of vaccines, 64t
 working groups of, 67
- Advocacy organizations, 545t-546t
- Affinity maturation, 25
- AFIX, 132-133
- Afluria (IV, influenza), 143, 388t
- Age. See also *Schedules for immunization*.
 definition of, vii
 grace period and, 111, 153, 155
 minimum ages for vaccines, 155-162, 156t-161t, 282
- Agencies and committees, 66
- AIDS, polio vaccine not the cause of, 263-264
- Alcoholism, vaccinations recommended, 292-293
- Allergies, 174, 251-253, 394. See also *specific vaccines*.
 allergic reactions to vaccine components, 174, 298.
 See also *contraindications and precautions for specific vaccines*.
 to eggs, 64t, 250, 393-394, 515
- Allied Vaccine Group, 545t
- Alternative schedules, 238, 250-251
- Alum/aluminum salts, 26, 28t, 247-249
- American Academy of Family Physicians (AAFP), vii, 544t
- American Academy of Pediatrics (AAP), vii, 544t
 recommendations, 70-71, 132, 279
 Red Book, 71
- American College Health Association (ACHA), 544t
- American College of Obstetricians and Gynecologists (ACOG), 279, 544t
- American College of Physicians (ACP), 544t
- American Immunization Registry Association, 545t
- American Medical Association (AMA), 545t
- American Nurses Association (ANA), 545t
- American Pharmacists Association (APA), 545t
- American Public Health Association (APHA), 545t
- Anamnestic response, 26, 31
- Anaphylaxis, 100t-103t, 144-145, 229t, 447
- Animal workers, vaccination of, 220t, 450t
- Anogenital warts, 368
- Anthrax, 301-308
 antibiotic therapy, 302
 antibody therapy (obiltoximab), 303
 bioterrorism potential, 301-302, 305
 clinical features, 301
 epidemiology and transmission, 301-302
 immunization program, 302-303
 pathogen, 301, 558t
 vaccines, 12t, 303, 304t
 characteristics and specifics of, 304t, 558t
 contraindications/precautions, 305
 immunogenicity/efficacy, 303
 military use, 303, 305
 pre-exposure vaccination, 302-303, 304t, 306t
 recommendations/schedule, 304t, 305
 for civilian use, 305, 306t-307t
 military use, 303, 305
 postexposure prophylaxis, 303, 304t, 306t
 safety, 303-305
 storage, 120t
- Antibodies, 19-32. See also *Immune globulin*; *Immune response*
 action mechanisms and sites, 19-21, 20
 antibody-containing products, intervals for live vaccines and, 164-165, 166t-167t
 antibody-dependent cell-mediated cytotoxicity, 21, 35
 broadly neutralizing, 21
 deficiency/dysfunction syndrome, 181
 engineered, 19
 germline, 22
 passive immunization with, 18-19
 persistence of, 30-31
 prevention of viral infection, 21
 production of, 21-32, 23
 adjuvants and, 26, 27, 28t-29t, 247-249
 extrafollicular reaction, 21-22, 23
 germinal center reaction, 23, 24-32
 quantification/measurement of, 40
 specificity of, 19, 27-30
 testing for, 169
 rubella antibodies, 199
 time course of responses, 26-27, 30
 to toxins, 40
- Antigen-presenting cells (APCs), 23, 24-25, 32, 34

- Antigens, 11, 27, 32. See also *Antibodies*.
 adjuvants and, 26, 27
 antigen sparing, 26
 antigenic competition, 529
 antigenic drift, 381
 antigenic shift, 381
 cross-reactive, 30
 immunogenicity, 31-32
 number of
 in combination vaccines, 247, 248t
 in routine vaccines, 247, 248t
 polysaccharide, 17, 21-22, 23, 31
 reassortment, 16, 381, 386-387
 T-cell independent, 22
- Antitoxins, 19
- Antivaccinationism, 239, 240t-242t
- Anxiety, dealing with, 143
- APCs. See *Antigen-presenting cells*.
- Apremilast, 194
- AS01, 29t, 249
- AS03, 28t, 269
- AS04, 28t, 249
- Aspirin, Reye syndrome and, 136t, 220t, 395, 505
- Asplenia, 193-194, 288t, 292-293
- Association for Prevention Teaching and Research, 545t
- Association of State and Territorial Health Officials, 545t
- Asthma, 252, 395
- Attenuation of vaccines, 11-16, 12t
 altered site of infection, 16
 engineered, 16
 heterologous host, 16
 reassortment, 16
 serial passage, 11-16
- Autism, 254-258
 MMR vaccine and, 254-256
 thimerosal and, 256-258
- Autoimmune diseases, 253
- Avian flu, 270, 387
- B cells, 21, 22, 25, 27
 B-cell deficiencies, 187-192
 B-cell receptor, 21, 31
 clonal expansion/proliferation of, 21, 25
 memory B-cells, 23, 26, 31
- Bacille Calmette-Guérin (BCG), 16
Bacillus anthracis, 301, 558t. See also *Anthrax*.
- Bacteria. See also *specific bacteria*.
 Active Bacterial Core surveillance system, 76
 antibody effects on, 19-21, 20
 attenuation of, 16
 T-cells and, 35
 vaccines against, 35
- BARDA (Biomedical Advanced Research and Development Authority), 62
- BCG (Bacille Calmette-Guérin), 16
- Behavioral Risk Factor Surveillance System (BRFSS), 75, 547t
- Bell's Palsy, 268-269, 432
- Bexsero. See *MenB-4C*.
- Bill & Melinda Gates Foundation, 545t
- Biologics License Application (BLA), 54, 58-59
- Biomedical Advanced Research and Development Authority (BARDA), 62
- Bioterrorism
 anthrax and, 301-302, 305
 smallpox and, 47, 470
- BioThrax, 120t, 304t. See also *Anthrax*.
- Bird flu (influenza A; H5N1), 387. See also *Influenza*.
- Birth defects, 174, 270
 percentage of all babies born with, 199
- BLA (Biologics License Application), 54, 58-59
- Bleeding diathesis, 220t
- Blood transfusion, interval for live vaccines and, 166t-167t
- Bloodborne Pathogens Standard, 109-111
- Bone marrow (HSCT) transplantation, 198, 200t-203t
- Books on vaccines, 548t
- Booster vaccination, 27, 30, 31
- Boostrix (Tdap), 65t, 123t, 322t-324t. See also *Tdap vaccine*.
- Bordetella pertussis*, 315-316, 317, 558t. See also *Pertussis*.
- Borulism, immune globulin (BabyBig), 167t
- Brain damage, pertussis vaccine concerns, 258-259
- "Breakthrough therapy" category, 59
- Breast-feeding, 198-205, 478t, 516. See also *Pregnancy*.
- BRFSS (Behavioral Risk Factor Surveillance System), 75, 547t
- Brighton Collaboration, 80, 545t
- Butte County, California (hepatitis A in), 42-43
- Cancer
 chemotherapy for, 197-198
 HPV and, 367-368, 369
 polio vaccine, SV40 contamination and, 263
- Catch-up immunization schedules
 children, age 4 months-6 years, 284-285
 children, age 7-18 years, 286-287
- Causal relationships, 77t, 99, 225-228, 226
- CBER, 53-55, 54, 66
- CD4, 23, 24, 32, 34, 180
- CD8, 32, 34, 180
- CD40, 23
- CDC. See *Centers for Disease Control and Prevention*.
- Celiac disease, 253
- Centers for Biologics Evaluation and Research (CBER), 53-55, 54, 66
- Centers for Disease Control and Prevention (CDC), 62, 66, 544t
 disease surveillance, 76
 vaccine stockpiles, 62, 89
- Cervarix (HPV2), 28t, 370. See also *Human papillomavirus*.
- Cervical cancer, 367-368, 369, 376, 558t

- Chemotherapy, 197-198
- Chickenpox, 35, 164, 472t, 499, 503. See also *Varicella*.
- Children. See also *Adolescent immunization; Infants*.
 - aspirin therapy and, 136t, 395, 396
 - Childhood Immunization Support Program, 71
 - cocooning strategy, 128-129
 - coding for routine visit, 146, 148t-149t
 - costs of immunization, 82t
 - coverage goals, 91
 - coverage rates, 73, 74
 - HIV-infected, 183-187
 - immunization schedules, 282-287
 - catch-up, age 4 months-6 years, 284-285
 - catch-up, age 7-18 years, 286-287
 - exemptions from, 112-113
 - financing for, 82-83
 - grace period, 111, 153, 155
 - hepatitis A, 282, 345t
 - hepatitis B, 282, 352, 359
 - influenza, 384-386, 385, 396
 - MMR, 415
 - pneumonia, 487-488
 - routine schedule, children age 0-18 years, 282-283
 - special immunizations, 288t-289t
 - Tdap and DTaP, 282
 - varicella, 506
 - immunization standards, 92-95
 - impact of routine childhood vaccination, 52t
 - pain relief for, 143
 - participation in Immunization Information Systems (IISs), 131-132
 - school-aged immunization platform, 294t
 - Vaccines for Children (VFC) Program, 71, 83, 84t-85t
- Children's Health Insurance Program (CHIP), 86
- Children's Vaccine Program at PATH, 545t
- Cholera, 309-314
 - clinical features, 309
 - epidemiology and transmission, 309-310
 - immunization program, 310
 - pathogen, 309, 558t
 - vaccine, 311, 312t-313t, 558t
 - contraindications/precautions, 311-313
 - immunogenicity/efficacy, 311
 - oral, 16, 310
 - recommendations, 312t, 313
 - for travel, 219, 313
 - safety, 311-313
 - storage, 123t
 - trade name (Vaxchora), 312t
- Chronic fatigue syndrome (CFS), 270
- Classification of vaccines, 12t-13t
- Clinical Immunization Safety Assessment (CISA) Network, 80, 545t
- Clinical trials, 55-58
 - numbers of subjects required, 56-58, 57t
 - phase 1, 2, 3, and 4 trials, 55-58, 56
 - protection of human subjects, 55
- Clonal expansion/proliferation, 21, 25
- Clostridium tetani*, 315, 317, 558t. See also *Tetanus*.
- CMV-IGIV, 167t
- CoCASA, 133, 547t
- Cochlear implants, 182, 288t
- Cocooning strategy, 128-129
- Coding and billing, 145-147
 - CPT codes, 145, 148t-149t
 - ICD codes, 145-146, 148t-149t
 - NDCs (National Drug Codes), 146
 - routine infant office visit (example), 146, 148t-149t
- College students, vaccination of, 220t, 424, 433
- Combination vaccines, 529-542, 559t
 - advantages of, 529-530
 - improved coverage and timeliness, 530
 - reduction in number of antigens, 247
 - reduction in number of shots, 153, 529, 530
 - background on, 529-530
 - noninferiority standard, 530
 - overimmunization concern, 531
 - production and usage issues, 529
 - reimbursement for, 530
 - specific vaccines, 532-541t, 559t
 - DTaP-based, 532t-536t
 - immunogenicity/efficacy, 530
 - other than DTaP-based, 538t-541t
 - recommendations, 531
 - safety, 530-531
 - terminology, vii, 558t-559t
- Communicating about vaccines, 225-236. See also *Concerns about vaccines, addressing*.
 - antivaccinationism, 239, 240t-242t
 - public harm from, 237, 243, 244
 - biases, 225-227
 - causality, ideas about, 225-228, 226
 - HPV vaccine for adolescents, 376, 377t
 - human nature and perceptions about vaccines, 225-228, 226
 - motivational interviewing, 228-230, 231t
 - pitfalls to avoid, 235t
 - risks vs benefits, 225-236, 230t, 243
 - sources of information, 230-233, 232
 - specific concerns, 245-270
 - strategies for, 228-234
 - teaching vaccine confidence, 234-236
 - vaccine refusal, 236-239, 243
- Community education, 132
- Community immunity. See *Herd immunity*.
- Community service providers, 221t

- Compensation. See *Vaccine Injury Compensation Program*.
- Complement deficiencies, 180, 193, 288t, 292-293
- Complement-mediated lysis, 20, 21
- Component vaccines, 12t, 17-18
- Comprehensive Clinic Assessment Software Application (CoCASA), 133, 547t
- Concerns about vaccines, addressing, 225-277
- action vs inaction, 225, 227
 - antivaccinationism, 239, 240t-242t
 - emotional appeals and tropes, 240t, 242t
 - flawed thinking, 241t
 - public harm from, 237, 243, 244
 - causal relationships, 225-228, 226
 - chronic fatigue, 270
 - communicating risks and benefits, 225-236
 - balancing risk vs benefit, 228, 229t, 230t
 - biases, 225-227
 - communication strategies, 228-234
 - human nature and perceptions, 225-228, 226
 - language and meaning, 235t
 - motivational interviewing, 228-230, 231t
 - safety, meaning of, 228
 - sources of information, 230-233, 232
 - costs of public concern, 243, 244
 - miscarriage and birth defects, 270
 - sources of information on vaccines, 230-233, 232
 - specific concerns, 245-270
 - additives, 249-250
 - adjuvants, 247-249
 - adventitious agents in vaccines, 265-266
 - AIDS, polio vaccine and, 263-264
 - allergies and autoimmune diseases, 251-253
 - alternative schedules, 250-251
 - autism, MMR vaccine and, 254-256
 - autism, thimerosal and, 256-258
 - Bell's Palsy, 268-269
 - brain damage, pertussis vaccine and, 258-259
 - cancer, SV40 contamination and, 263
 - demyelinating diseases, 259-262
 - febrile seizures, 266-267
 - fetal tissue, 254
 - Guillain-Barré syndrome, 259-261
 - immune overload, 246-247
 - immune thrombocytopenia, 268
 - Kawasaki disease, 265
 - mad cow disease, 262-263
 - multiple sclerosis, 261-262
 - narcolepsy, 269-270
 - natural vs vaccine-induced immunity, 246
 - necessity of vaccines, 245
 - nonspecific negative effects, 253-254
 - polio vaccine, AIDS pandemic and, 263-264
- Concerns about vaccines, addressing, specific concerns (*continued*)
- polio vaccine, SV40 contamination, 263
 - rotavirus vaccines and intussusception, 267-268
 - SIDS, 264
 - vaccine acceptance, hesitancy, and confidence, 225, 226t
 - vaccine refusal, 236-239, 243
- Conjugate (protein-polysaccharide) vaccines, 31-32
- advantages of, 31-32, 33t
- Contaminants, 174, 249-250, 265-266. See also *specific vaccines*.
- Contraindications and precautions, 174-176. See also *specific vaccines*.
- definitions, 174, 175
 - distinguishing between, 175
 - misconceptions and erroneous contraindications, 128, 177t-178t
 - screening for, 133, 136t-138t
- Correctional facility staff/inmates, 221t, 342, 348, 352, 360, 397
- Correlates of protection, 36-41, 38t-39t
- problems with, 37-40
- Corynebacterium diphtheriae*, 315, 317, 558t. See also *Diphtheria*.
- Costs, 82-86, 146-147. See also *Financing of immunization*.
- public sector funds, 82-86
 - of routine childhood vaccinations, 82t
 - savings due to immunization, 52t
 - with school-located vaccination, 129-130
 - of vaccine development, 53
 - of vaccine-preventable diseases, 95
 - vaccine purchasing group, 146
 - of vaccines, vii, 82t, 146-147. See also *specific vaccines*.
 - combination vaccines, 530
 - purchase price, vii, 82t, 146-147
 - variation in, 146-147
- Coverage, 73-76, 547t
- defined, 73
 - goals, 91-92
 - for adolescents, 91
 - for adults, 92
 - for children, 91
 - improved, with combination vaccines, 530
 - monitoring, 73-76
 - rates for adolescents, 73, 74
 - rates for children, 73, 74
 - school surveys, 75
- Cowpox, 469
- Cows, mad cow disease and, 262-263
- CpG 1018, 29t
- CPT codes, 145, 148t-149t
- Cross-protection, 30, 36
- CSF leaks, 182, 288t
- Current Procedural Terminology codes. See *CPT codes*.
- Cytokines, 23, 24
- Cytotoxic T cells (Tc cells), 25, 32-36, 34
- activation of, 32, 34
 - cross-protection and, 36
 - implications for vaccination, 35-36

- Cytotoxicity, antibody-dependent cell-mediated, 21
- Daptacel (DTaP), 120t, 321, 322t-324t
- Day care workers, vaccination of, 221t, 349, 397
- Deaths
- from influenza, 382, 383-384, 384
 - from measles, 408
 - from pneumonia, 209, 482
 - premature, 253-254
 - from smallpox, 469-470
 - sudden infant death syndrome (SIDS), 264
- Defense Medical Surveillance System (DMSS), 80
- Deferral of doses, 88
- Delayed-type hypersensitivity, 174, 247
- Delivery of vaccines, 127-133
- immunization coalitions, 132
 - Immunization Information Systems (IISs), 131-132
 - medical home and immunization neighborhood, 128-129
 - missed opportunities, 127-128, 176
 - monitoring, 73-76
 - other strategies for improving, 132-133
 - AFIX, 132-133
 - community education, 132
 - 4 Pillars Program, 133, 134t-135t
 - reminder, recall, and tracking systems, 127
 - school-located vaccination, 129-131
 - standing orders, 131
- Demyelinating diseases, 259-262
- Dendritic cells, 24
- Denver Health, adolescent immunization strategies, 133, 133t
- Department of Defense (DOD), 66
- Defense Medical Surveillance System, 80
- Development of vaccines. See *Vaccine development and licensure*.
- Developmentally disabled, staff of institutions, 221t, 360
- Diabetes, 252-253
- vaccination recommendations, 182, 288t, 292-293, 360
- DiGeorge syndrome, 180
- Diphtheria, tetanus, and pertussis, 315-333. See also *individual entries for Diphtheria, Tetanus, Pertussis*.
- clinical features, 316-317
 - epidemiology and transmission, 317-318
 - immunization programs, 318-320
 - pathogens, 315-316, 558t
 - vaccines, 320, 322t-324t, 326t-327t
 - administration errors and remedies, 170t
 - characteristics and specifics of, 322t-324t, 326t-327t, 558t
 - contraindications/precautions, 325-327
 - DTaP-based, 322t-324t, 532t-536t
 - immunogenicity/efficacy, 320-321
 - recommendations, 319, 320-321, 329-330
 - adolescents, 246
 - adult. See *Tdap vaccine*.
 - children/infants. See *DTaP vaccine*.
- Diphtheria, tetanus, and pertussis, vaccines (*continued*)
- safety, 321-328
 - trade names, 322t, 326t
 - Adacel (Tdap), 322t-324t, 329
 - Boostrix (Tdap), 322t-324t
 - Daptacel (DTaP), 322t-324t
 - Infanrix (DTaP), 322t-324t
 - waning immunity, 246, 321
- Diphtheria, 315-333. See also *Pertussis; Tetanus*.
- clinical features, 316
 - correlates of protection, 38t
 - epidemiology and transmission, 317
 - immunization program, 318
 - pathogen, 315, 558t
 - vaccines, 12t, 320, 322t-324t, 326t-327t, 558t. See also *DT; DTaP vaccine; Tdap vaccine*.
 - combination vaccines, 532t-536t
 - contraindications/precautions, 325-327
 - DTwP replacement by DTaP, 225, 253, 318, 529
 - immunogenicity/efficacy, 320-321
 - recommendations, 319, 323t, 329-330
 - adult. See *DTaP; Tdap*.
 - safety, 321-328
 - schedule, 323t, 329-330
 - storage, 120t
 - trade names, 322t, 326t
 - Adacel (Tdap), 322t-324t
 - Boostrix (Tdap), 322t-324t
 - Daptacel (DTaP), 322t-324t
 - Diphtheria and Tetanus Toxoids Adsorbed (DT), 326t-327t
 - Infanrix (DTaP), 322t-324t
 - Tenivac (Td), 326t-327t
 - waning immunity, 321
- Diphtheria and Tetanus Toxoids Adsorbed (DT), 120t, 326t-327t
- Disease-modifying antirheumatic drugs (DMARDs), 194-195
- DMARDs (disease-modifying antirheumatic drugs), 194-195
- Dosing, administration errors, and remedies, 168-169, 170t-173t
- Drug users, injecting, 220t, 349, 360
- DT (diphtheria, tetanus toxoids), 120t, 326t-327t, 329
- contraindications/precautions, 328-329
- DTaP vaccine, 322t-324t, 532t-536t. See also *Diphtheria, tetanus, and pertussis*.
- administration errors and remedies, 170t
 - combination vaccines, 532t-536t
 - Kinrix (DTaP-IPV), 120t, 532t-536t
 - Pediarix (DTaP-HepB-IPV), 64t, 532t-536t
 - Pentacel (DTaP-IPV/Hib-T), 120t, 532t-536t
 - Quadracel (DTap-IPV), 120t, 532t-536t
 - safety record, 530-531
 - contraindications/precautions, 328
 - DTwP replaced by, 225, 253, 318, 529
 - immunogenicity/efficacy, waning immunity and, 246

- DTaP vaccine (*continued*)
 minimum ages and intervals, 155-162, 156t, 282
 recommendations, 319, 323t, 329
 preference for same product for entire series, 163
 wound management, 332t-333t
 safety, 321-328
 encephalopathy and, 174, 325
 Guillain-Barré syndrome, 328
 schedule, 323t, 329-330
 children, age 0-18 years, 282
 catch-up, children age 4 months-6 years, 284
 storage, 120t
 trade names (Daptacel, Infanrix), 322t-324t
 waning immunity and, 246, 321
 DTwP vaccine, 225, 253, 318, 529
- Eculizumab (Solaris), 189 footnote, 193
 Education on immunizations, 93, 225-277
 Effectiveness of vaccines, vs efficacy, 58
 Efficacy. See also *specific vaccines*.
 correlates of protection, 36-41, 38t-39t
 effectiveness vs, 58
- Eggs
 allergy to, 64t, 515
 influenza vaccines, 64t, 387, 393-394
 “egg-free,” 387, 388t
 yellow fever vaccine and, 250
- Elimination of disease, 46-48, 49t
- Emergencies, 144-145
 anaphylaxis, 144-145
 power and weather, vaccine storage during, 126t
 PREP Act, 105
 syncope, 100t-103t, 144
- Emergency preparedness, 62, 105
 Public Readiness and Emergency Preparedness (PREP) Act, 105
 vaccine stockpiles for, 62, 89
 vaccine storage and handling, 126t
- EMLA cream, 143
- Encephalitis
 Japanese, 401-406
 measles and, 408
 yellow fever vaccine and, 515, 517
- Encephalopathy, 100t-103t, 258-259
 acute, as vaccine contraindication, 174
 DTaP/Tdap vaccine and, 174, 325, 328
- Engerix-B (Hep-B vaccine), 120t, 353, 354t-357t, 359
- Engineered agent vaccines, 12t, 17-18
- Engineered subunits, 12t, 17-18
- Epidemiology and Prevention of Vaccine-Preventable Diseases*.
 See “Pink Book”.
- Epitopes, 19, 27
 carrier-induced epitopic suppression, 529
 epitope spreading, 26
 Eradication of disease, 46-47, 49t
 Errors in administration of vaccines, 168-169, 168t
 corrections for, 170t-173t
 ERSD, vaccinations in, 288t, 292-293, 360
 Every Child by Two, 545t
 Excipients and contaminants, 174, 249-250, 265-266, 529.
 See also *specific vaccines*.
 Exemptions from immunization requirements, 112-113
 Extinction of disease, 47
 Extrafollicular reaction, 21-22, 23
- FDA. See *Food and Drug Administration (FDA)*.
 Fear of vaccines, harm from, 237, 243, 244
 Febrile seizures, 143, 154, 229t, 266-267, 414, 513-515, 531
 Fetal tissue in vaccine manufacture, 254
 Filamentous hemagglutinin (FHA), 17, 40, 315
 Fimbriae (FIM), 17, 40, 315
 Financing of immunization, 82-86, 530
 financial risk, 53
 public sector funds, 82-86
 Section 317 funds, 83-86
 state and local funds, 86
 universal purchase states, 82
 Vaccines for Children (VFC) Program, 83, 86
- Flu. See *Influenza*.
 Fluad, 387, 388t
 MF59 adjuvant in, 29t, 387
 Fluarix (IIV, influenza), 171t, 388t
 Flublok (rIIV) (“egg-free” influenza vaccine), 387, 388t
 Flucelvax (ccIIV), 387, 388t
 Flulaval, 171t, 388t
 Flumist (LAIV, live influenza), 121t, 142, 388t
 Fluvirin (IIV, influenza), 389t
 Fluzone (IIV, influenza), 171t, 389t
 Fluzone High-Dose (hdIIV, influenza), 209, 389t, 392
 Fluzone Intradermal (IIV, influenza), 142, 387
 Food and Drug Administration (FDA), 66, 544t
 vaccine development and licensure, 53, 54, 59, 78
 Food handlers, vaccination of, 220t, 349
 Foresters, vaccination of, 220t
 Formaldehyde, 17, 250
 4 Pillars Program, 133, 134t-135t
 Freezer, storage of vaccines in, 119-125, 123t-124t
- Gardasil (HPV4), 370, 373, 374
 Gardasil 9 (HPV9), 371-376, 372t-373t. See also *Human papillomavirus*.
 Gastroenteritis. See *Rotavirus*.
 Gelatin, 113, 250. See also *specific vaccines*.
 Genetics of vaccine responses, 45-46
 Germinal center reaction, 23, 24-32
 heterotypic (cross-protective) responses, 30
 homotypic responses, 27-30
 implications for vaccination, 26-32

- Germline antibodies, 22
- Gloves, 110, 135
- Glycogen storage disease (GSD), 208
- Good Clinical Practice (GCP), 54, 55
- Good Laboratory Practices (GLPs), 54, 55
- Good Manufacturing Practices (GMPs), 53-55, 54
- Good Pharmacovigilance Practices (GPPs), 58
- Governmental agencies and committees, 66, 544t
- Grace period, 111, 153, 155
- GRADE approach, 67-70, 71t
- Guillain-Barré syndrome, 103t, 259-261, 328
 - as contraindication/precaution
 - for DTaP/Tdap vaccine, 328
 - for influenza vaccines, 394, 395
 - for *N meningitidis* vaccines, 261, 432
 - swine flu vaccine and, 29, 80
- H1N1, H3N2, H5N1. See *Influenza, strains*.
- Haemophilus influenzae* type b (Hib), 335-340. See also *Influenza*.
 - clinical features, 335
 - epidemiology and transmission, 245, 335-336
 - immunization program, 336
 - pathogen, 335, 558t
 - vaccines, 12t, 336, 338t-339t
 - administration errors and remedies, 171t
 - characteristics and specifics of, 338t-339t, 558t
 - combination vaccine: Pentacel (DTaP-IPV/Hib-T), 532t-536t
 - contraindications/precautions, 337
 - immunogenicity/efficacy, 246, 336-337
 - minimum ages and intervals, 156t
 - optimizing immunity with, 187
 - recommendations, 337-340, 338t
 - safety, 337
 - reportable events, 102t
 - schedule, 337, 339t
 - adults, by age, 291
 - adults, by medical condition/indication, 293
 - adults, high risk, 291
 - children, age 0-18 years, 282
 - catch-up, children age 4 months-6 years, 284
 - storage, 121t
 - trade names, 338t
 - ActHIB (Hib-T), 338t-339t
 - Hiberix (HibT), 338t-339t
 - PedvaxHIB (Hib-OMP), 338t-339t
- Handling, storage, and transport of vaccines, 117-127
 - administration of vaccines, 118-119
 - basics of, 117
 - during emergencies, 126t
 - Immunization Tsar/Tsarina, 117, 118t, 132
 - inventory, 117-118
 - keeping VFC vaccines separate, 118
 - Handling, storage, and transport of vaccines (*continues*)
 - signs, 117, 119, 125
 - storage of vaccines, 119-125, 120t-124t
 - correct temperature for, 125
 - transportation of vaccines, 125-127
 - Harm. See *Public harm*.
 - HAV. See *Hepatitis A*.
 - Havrix (HepA), 120t, 334t-336t, 343
 - HBIG. See *Hepatitis B immune globulin (HBIG)*.
 - HBV. See *Hepatitis B*.
 - Health care personnel, 210-213
 - continuing education for, 94
 - needlestick injuries/blood exposure, 109-111
 - postexposure evaluation and prophylaxis, 110-111
 - rationale for immunization, 210
 - reporting of adverse events, 94
 - sharps use and precautions, 109-110
 - universal precautions, 110
 - vaccination recommendations, 94, 113-114, 210-213, 292-293
 - hepatitis B, 110, 210-211, 352, 360
 - influenza, 114, 212, 397
 - MMR, 212, 410
 - polio, 440
 - smallpox, 471, 477
 - Tdap, 211
 - varicella, 212-213
 - VariZIG, 213
 - Health care providers
 - addressing concerns about vaccines, 225-277
 - as trusted source of information, 230-233, 232
 - Healthcare Effectiveness Data and Information Set (HEDIS), 76, 547t
 - Healthy People 2020*, 91-92, 131
 - Heart disease, 288t, 292-293
 - Hemagglutinin, 209, 315, 391, 407
 - Hematopoietic stem cell transplantation (HSCT), 198
 - vaccination recommendations, 198, 200t-203t
 - Hemodialysis, 288t, 292-293, 360
 - HepaGam B, 353
 - Hepatitis A, 341-350
 - in Butte County, California, 42-43, 343
 - clinical features, 341
 - correlates of protection, 38t
 - epidemiology and transmission, 341-342
 - herd immunity and, 42-43, 343
 - immune globulin, 348-349
 - immunization program, 50, 342-343
 - pathogen, 341, 558t
 - vaccines, 12t, 334t-336t, 343
 - administration errors and remedies, 170t
 - characteristics and specifics of, 334t-336t, 558t
 - combination vaccine: Twinrix (HepA-HepB), 120t, 538t-541t
 - contraindications/precautions, 347

- Hepatitis A, vaccines (*continued*)
 immunogenicity/efficacy, 343-347
 minimum ages and intervals, 156t, 282
 recommendations, 342-343, 347-349
 for chronic liver disease, 182
 for correctional facilities, 342, 348
 for food handlers, 220t, 349
 for morticians, 220t
 postexposure prophylaxis, 166t, 342, 348-349
 pre-exposure prophylaxis, 347-348
 for travel, 216, 348
 safety, 347
 reportable events, 102t
 schedule, 335t
 adults, by age, 291
 adults, by medical condition/indication, 293
 children, age 0-18 years, 282
 catch-up, children age 4 months-6 years, 285
 catch-up, children age 7-18 years, 286
 seroconversion rates, 343
 storage, 120t
 trade names (Havrix, Vaqta), 334t
- Hepatitis B, 351-366
 clinical features, 351-352
 correlates of protection, 38t, 40
 epidemiology and transmission, 352
 HBsAg (hepatitis B surface antigen), 17, 351
 HBsAg/HBsAb status and, 361-362, 364t-366t
 testing for, 169, 183, 205, 359, 360, 361
 immune globulin (HBIG), 18-19, 353, 361-362
 immunization program, 352-353, 358
 pathogen, 351, 558t
 vaccines, 12t, 353, 354t-357t
 administration errors and remedies, 170t-171t
 characteristics and specifics of, 354t-357t, 558t
 combination vaccines
 Pediarix (DTaP-HepB-IPV), 64t, 532t-536t
 Twinrix (HepA-HepB), 120t, 538t-541t
 contraindications and precautions, 359
 immunogenicity/efficacy, 353-357
 minimum ages and intervals, 156t, 162, 282
 purified subunits, 17
 recommendations, 182, 352, 359-362
 adult vaccination, 360
 for correctional facilities, 352, 360
 for diabetics, 182, 293, 360
 health care personnel, 110, 210-211, 352, 360
 HIV-infected children, 183
 infants, 352, 360, 361
 newborns, 205, 360, 361
 postexposure prophylaxis, 167t, 361-362, 364t-366t
 preterm/low birth weight infants, 205-208
- Hepatitis B, recommendations (*continued*)
 travel, 217, 360
 universal infant, child and adolescent immunization, 359-360
 safety, 264, 358-359
 reportable events, 101t
 schedule, 352, 356t
 adults, by age, 291
 adults, by medical condition/indication, 293
 children, age 0-18 years, 282
 catch-up, children age 4 months-6 years, 284
 catch-up, children age 7-18 years, 286
 storage, 120t
 trade names (Engerix-B, Recombivax HB, Heplisav-B), 354t
- Hepatitis B immune globulin (HBIG), 18-19, 353
 interval for live vaccines and, 167t
 recommendations, 361-362
 trade names (Nabi-HB, HepaGam B, HyperHEP B S/D), 353
- Hepatitis B surface antigen/antibody (HBsAg/HBsAb). See under Hepatitis B.
- Heplisav-B (Hep-B vaccine), 353-357, 354t-357t, 359-360
- Herd immunity, 41-45, 42
 Herd immunity threshold, 41, 43, 45
 Herd severity effect, 45
- Herpes zoster. See *Zoster (herpes zoster; shingles)*.
- Heterologous effects, 253
 Heterologous host, 16
 Heterologous hyperimmune sera, 19
 Heterologous infections, 247
 Heterotypic (cross-protective) responses, 30, 36
- Hib. See *Haemophilus influenzae type b*.
- Hib-OMP. See *PedvaxHIB*.
- Hib-T. See *ActHIB; Hiberix*.
- Hiberix (HibT), 64t, 171t, 336-337, 338t-339t, 340
- HIV (human immunodeficiency virus) infection, 183-187, 263-264
 children/adolescents, 183-187
 infants, 183
 postexposure prophylaxis, 110-111
 vaccination recommendations, 183-187, 288t, 292-293
 contraindications/precautions, 187
 H. influenzae type b (Hib), 187
 hepatitis B, 183, 360
 influenza, 397
 MMR and VAR, 180, 183-187
 N. meningitidis, 187, 188-191
 pneumonia, 184-186, 187
- HLAs (human leukocyte antigens), 24, 46
- Hospital workers, 113-114
- HPV. See *Human papillomavirus (HPV)*.
- HPV2, HPV4, HPV9. See *Human papillomavirus (HPV) vaccines*.
- Human cell lines, 254
- Human immunodeficiency virus. See *HIV*.
- Human leukocyte antigens (HLAs), 24, 46

- Human papillomavirus (HPV), 367-379
 cancers and, 367-368, 369, 376
 clinical features, 367-368
 epidemiology and transmission, 368-369
 immunization program, 370
 pathogen, 367, 558t
 sexual activity and, 368-369
 vaccines, 370-376, 372t-373t
 administration errors and remedies, 171t
 characteristics and specifics of, 372t-373t, 558t
 communicating about, 376, 377t
 contraindications/precautions, 375
 HPV2 (Cervarix), 28t, 370
 HPV4 (Gardasil), 371, 373, 374
 HPV9 (Gardasil 9), 371-374, 372t-373t
 recommendations, 370, 372t, 375-376
 safety, 375-376
 syncope, 375
 venous thromboembolic events (VTEs), 375
 schedule, 370, 372t-373t
 adults, by medical condition/indication, 292
 children, age 0-18 years, 282
 catch-up, children 7-18 years, 286
 young adult, by age group, 290
 storage, 121t
 immunogenicity/efficacy, 371-374
 minimum ages and intervals, 156t-157t
 recommendations, 370, 372t, 375-376
 adolescents, 375-376
 adults, 376
 safety, 374-375
 reportable events, 103t
 storage, 121t
 Human rabies immune globulin (HRIG), 167t, 443, 447, 447-448, 454t
 Hundred-day cough. See also *Pertussis*.
 Hygiene hypothesis, 251
 HyperHEP B S/D, 353
 Hyperimmune globulin, 18-19
 HyperRAB S/D (rabies immune globulin), 447
 Hypersensitivity, delayed-type, 174, 247
 HyperTET S/D, 320
 Hyporesponsiveness, 22

 ICD codes, 145-146, 148t-149t
 IGIM (intramuscular immune globulin)
 intervals for live vaccines and, 166t
 for measles, 418
 for travel, 216
 IIV (inactivated influenza vaccine). See *Influenza, vaccines, IIV*.
 Illegal drug users, 220t, 349, 360
 Immune deficiency states, 183-198. See also *Impaired immunity*.
 Immune globulin, 18-19. See also *Antibodies*.
 botulism (BabyBig), 167t
 hepatitis A, 348-349
 hepatitis B (HBIG), 18-19, 353, 361-362
 intravenous (IGIV), 166t, 418
 isotypes, 19, 22
 for measles, 418
 for rabies, 443, 447, 448, 454t
 vaccinia, 476
 varicella (VariZIG), 18, 167t, 501, 506-508
 Immune memory, 23, 26, 31
 Immune overload, 246-247
 Immune response
 adaptive immune system, 19, 27, 41
 anamnestic response, 26, 31
 antibodies, 19-32
 persistence of, 30-31, 530
 cytotoxic T cells, 32-36, 34
 extrafollicular reaction, 21-22, 23
 genetics and, 45-46
 germinal center reaction, 23, 24-32
 homotypic vs heterotypic, 27-30
 innate immune system, 24-32, 27
 stimulating, 26-27, 27, 30
 priming and boosting, 26-27, 30, 31
 timing of, 27, 30
 Immune thrombocytopenia (ITP), 229t, 268, 414
 Immunity
 correlates of protection, 36-41, 38t-39t
 impaired. See *Impaired immunity*.
 natural vs vaccine-induced, 246
 waning, 48, 246, 321
 Immunization, 11-19
 active, 11
 booster, 27, 30, 31
 correlates of protection, 36-41, 38t-39t
 definition of, 11
 ethical and moral arguments for, 113, 237, 250
 herd immunity, 41-45
 mandates and legislation regarding, 111-114
 passive, 18-19
 primary, 26-27, 30
 reactions to. See *Adverse events*.
 schedules. See *Schedules for immunization*.
 standards. See *Standards, principles, and regulations*.
 Immunization Action Coalition (IAC), 546t
 Immunization coalitions, 132
 Immunization Information Systems (IISs), 131-132
 Immunization platforms, 279-280, 294t
 Immunization practices, standards and guidelines for, 91-152
 Immunization programs, 46-48. See also *specific vaccines*.
 childhood, impact of, 50, 52t

- Immunization programs (*continued*)
 control/elimination/eradication/extinction of disease, 46-48, 49t
 goals of, 46-48, 49t, 91-92
 impact of, 47-50, 49t, 52t, 58
 triumphs of, 48, 49t
- Immunization Safety Review Committee (ISRC), 81
- Immunization Tsar or Tsarina, 132
- Immunocompromised states. *See Impaired immunity.*
- Immunogenicity, 31-32. *See also Immune response; specific vaccines.*
 clinical trials to determine, 56-58, 56
 efficacy and, 36
 immunogenicity bridging, 56
- Immunoglobulins. *See Immune globulin.*
- Immunology, basic, 19-36. *See also Immune response.*
- Immunosuppression. *See Impaired immunity.*
- Imogam Rabies-HT (rabies immune globulin), 447
- Imovax Rabies (RAB-HDC), 444t-446t
- Impact of vaccines, 46-50, 52t, 58
- Impaired immunity, 179-198
 general considerations, 179-181
 close contacts, immunization of, 181
 differences in immunocompromised states, 179-180
 official recommendations vs package insert, 181
 risks vs benefits, 179
 suboptimal immune responses, 180-181
 guidelines for vaccination, 179-181
 contraindications and precautions, 415
- immune deficiency states, 183-198
 asplenia, 193-194
 B-cell (humoral) deficiencies, 187-192
 cancer chemotherapy, 197-198
 complement deficiencies, 193
 disease-modifying antirheumatic drugs (DMARDs), 194-195
 hematopoietic stem cell transplantation, 198, 200t-203t
 HIV infection, 183-188
 phagocyte disorders, 192
 qualitative and quantitative differences in, 179-180
 solid organ transplantation, 195-198, 196
 steroid use, 194
 T-cell deficiencies, 192
- immune globulin recommendations, 418
- live vaccine use in households of, 165-168
- live vaccines generally contraindicated for, 175, 195
 exceptions, 194
- newborns, 182
- optimizing immunity
 to *H influenzae*, 187, 192, 193, 197
 to *N meningitidis*, 187, 188-191, 193
 to *S pneumoniae*, 184-186, 187, 192, 193, 195, 197
 other predisposing conditions, 182, 198-219
 passive immunoprophylaxis for, 181
- Impaired immunity (*continued*)
 vaccine recommendations, 183-198, 288t, 292-293
 contraindications and precautions, 292, 465, 504, 515
 general considerations, 179-182
 measles, postexposure vaccination for, 418
 N. meningitidis, 424
 pneumococcal vaccines, 182, 184-186
- Inactivated vaccines, 12t, 17-18
 characteristics of, 14t-15t
 component vaccines, 17-18
 intervals for vaccination, 154-155
 purified subunits, 17
 vs live vaccines, 14t-15t, 36, 253
 whole agent, 17
- Inborn errors of metabolism, 208
- Indications, 68t-69t
 labeled indications, 59
 vs official recommendations, 62, 64t-65t
- Infanrix (DTaP), 320-321, 322t-324t
 storage, 120t
- Infants. *See also Children; Newborns.*
 birth vaccinations, 129, 205, 282, 352, 358
 botulism immune globulin (BabyBig), 167t
 cocooning strategy, 128-129
 hepatitis B vaccination, 205-208, 352, 358, 359
 standing orders for, 359
 infant-toddler immunization platform, 294t
 maternal antibody protection, 18
 maternal immunization, benefits for, 129, 198, 392
 MMR/immune globulin, 418
 newborns, 182, 205
 pain relief for, 143
 preterm and low birth weight, 205-208, 465, 508
 rotavirus vaccination, 208, 461t-462t, 465-466
 susceptibility gap, 198
 varicella vaccination, 508
- Infectious Diseases Society of America, 545t
- Inflammatory bowel disease, 253
- Inflammatory reaction, 24
- Influenza, 381-399
 clinical features, 382-383
 correlates of protection, 37, 38t
 deaths from, 382, 383-384, 384
 epidemics/pandemics, 381-382
 2009 A(H1N1), 105, 259-260, 269, 270, 382, 393-394
 California (2009—2010), 383-384
 Spanish flu (1918), 382
 epidemiology and transmission, 383-384
 immunization program, 384-386, 385
 cost-effectiveness of, 386
 pathogen, 381-382, 558t
 antigenic shift and drift, 381
 reassortment and, 381, 386-387

Influenza (*continued*)

- strains, 381-382, 386
 - A and B, 381-382, 386
 - A(H1N1), 381, 382, 383-384, 386
 - special surveillance efforts, 80
 - A(H3N2), 381, 382, 386, 392
 - A(H5N1, avian flu), 387
- vaccines, 288t-290t, 386-387, 388t-390t
 - for 2017-2018 season, 388t-390t
 - administration errors and remedies, 171t
 - annual production of, 386-387
 - characteristics and specifics of, 388t-390t, 558t
 - “egg-free” (Flublok, Flucelvax), 387, 388t
- IIV (inactivated), 12t, 387, 388t-390t
 - A (H5N1) vaccine, against avian flu, 270, 387
 - contraindications/precautions, 393-394
 - egg allergy, no longer included as, 393-394
 - egg-based production, 387, 393-394
 - “egg-free” vaccines (Flublok, Flucelvax), 387, 388t
 - Fluad, 29t, 387, 388t
 - high-dose (Fluzone High-Dose), 388t, 392
 - immunogenicity/efficacy, 391-392
 - safety, 267, 393-394
 - storage, 121t
 - trade names, 388t-390t
- immunogenicity/efficacy, 391-393
 - effectiveness, 391
- LAIV (live-attenuated), 12t, 387, 388t
 - administration errors and remedies, 171t
 - contraindications/precautions, 182, 394-395
 - immunogenicity/efficacy, 392-393
 - effective against A(H3N2), 393
 - ineffective against A(H1N1), 393
 - reassortment backbone, 387
 - safety, 394-395
 - storage, 121t
 - trade names, 388t
- quadrivalent vaccines, 386
- recommendations, 384-386, 385, 393, 396-397
 - annual vaccination, 396
 - children, 384-386, 396
 - children on long-term aspirin therapy, 397
 - chronic medical conditions, 396-397
 - during pregnancy, 206t, 392, 396
 - health care personnel, 114, 212, 397
 - high risk/priority patients, 396-397
 - minimum ages and intervals, 157t, 282
 - older adults, 209
 - for travel, 217
 - universal vaccination, 384-386, 385, 396
- safety, 393-395
 - Bell's palsy, 268-269

Influenza, vaccines, safety (*continued*)

- chronic fatigue syndrome, 270
- Guillain-Barré syndrome, 259-260, 394, 395
- miscarriage, 270
- MS, 261-262
- narcolepsy, 269-270
- reportable events, 103t
- schedule
 - adults, by age, 290
 - adults, by medical condition or indication, 292
 - children, age 0-18 years, 282
- shortages of, 87
- storage of, 121t
- trade names, 388t-389t
 - Afluria, 388t
 - Fluad, 387, 388t
 - Fluarix, 388t
 - Flublok, 387, 388t
 - Flucelvax, 387, 388t
 - Flulaval, 388t
 - Flumist, 121t, 388t
 - Fluvirin, 389t
 - Fluzone, 389t
 - Fluzone High-Dose, 209, 389t, 392
- Injury. *See National Childhood Vaccine Injury Act; Vaccine Injury Compensation Program.*
- Innate immunity, 24-32
 - adjuvants and, 26, 27
 - stimulating, 26-27, 27
- Institute for Vaccine Safety, Johns Hopkins, 546t
- Institute of Medicine (IOM), 81, 251
- International adoptees, refugees, and immigrants, 213-215
- Internet resources, 544t-547t
- Intervals for vaccinations, 153-162, 156t-161t
 - doses of same vaccine, 155-162
 - grace period, 111, 153, 155
 - inactivated vaccines, 154-155
 - lapse in series and, 162-163
 - live vaccines, 154
 - between live vaccines and antibody-containing blood products, 164-165, 166t-167t
 - minimum intervals and ages, 155-162, 156t-161t
 - simultaneous administration, 153-154
- Intradermal administration, 142, 143
- Intramuscular administration of vaccines, 139, 140
- Intravenous immune globulin (IGIV), 166t
- Intussusception, 229t, 267-268, 465
- Inventory of vaccines, 117-118
 - keeping VFC vaccines separate, 118
 - rotation of stock, 117
- IPOL (IPV), 121t, 438t. *See also Polio, vaccines.*
- IPV. *See Polio, vaccines.*

- Isotype switching, 22, 26
 Isotypes, 19, 22
 ISRC (Immunization Safety Review Committee), 81
 Ixario (JEV-VC), 402, 404t
- Japanese encephalitis, 401-406
 clinical features, 401
 correlates of protection, 38t
 epidemiology and transmission, 402
 immunization program, 402-403
 pathogen, 401, 558t
 vaccines, 12t, 403, 404t
 characteristics and specifics of, 404t, 558t
 contraindications/precautions, 405
 immunogenicity/efficacy, 403
 JEV-MB, 402, 405
 JEV-VC (Ixario), 402, 404t
 recommendations, 402, 405
 laboratory workers, 405
 for long-term travel, 218, 405
 outdoors activities, 405
 safety, 403-405
 schedule, 404t
 storage, 121t
 trade name: Ixario (JEV-VC), 402, 404t
- Jenner, Edward, 16
- JEV. *See Japanese encephalitis.*
- Kawasaki disease, 265
- Kidney failure/disease, 182, 288t, 292-293, 360
- Kinrix (DTaP-IPV), 120t, 170t, 532t-536t
- Labeled indications, 59
 vs official recommendations, 62, 64t-65t
- Laboratory workers, vaccination of, 220t, 405, 433, 440, 450t, 470, 476, 497, 516
- LAIIV (live-attenuated influenza vaccine). *See Influenza, vaccines, LAIV.*
- Langerhans cells, 24
- Latex, 136t, 174. *See also specific vaccines.*
- Licensure. *See Vaccine development and licensure.*
- Life-course immunization, 209
- Live vaccines, 11-16, 12t, 21, 253
 attenuation of, 11-16
 characteristics of, 14t-15t
 intervals for receipt of antibody-containing products, 164-165, 166t-167t
 intervals for vaccinations, 154
 pregnancy and immunocompromised persons, 165-168, 174, 194, 204, 206t-207t
 vs inactivated vaccines, 14t-15t, 46, 253
- Liver disease, 288t, 292-293
- Lockjaw. *See Tetanus.*
- Long-term care facilities, 221t
- Lung disease, vaccinations recommended, 292-293
- Lyme disease, 268
 correlates of protection, 38t
- Mad cow disease (MCD), 262-263
- Major histocompatibility complex (MHC), 45-46
 class I molecules (MHC-I), 32, 34, 35
 class II molecules (MHC-II), 23, 24, 25, 32, 34
- Mandates and exemptions, 111-114
- Manufacturers of vaccines, 87, 547t
 financial risk for, 53
 interchangeability of vaccines, 163
 number of, 87
 vaccine design defect claims, legal immunity from, 104-105
- Measles, Mumps, Rubella, 407-420
 clinical features, 408-409
 correlates of protection, 38t
 criteria/evidence of immunity, 199, 416t-417t
 epidemiology and transmission, 409-410
 deaths from, 408
 measles endemic in UK, 215
 measles outbreaks in US (2000-2015), 244, 411-412
 immune globulin (for measles), 418
 immunization program, 410-411
 pathogens, 407-408, 558t
 elimination of measles and rubella (Americas), 48, 49t, 414
 resurgence of, 48, 245, 410, 411-414
 due to undervaccination, 243, 244, 411
 measles, 243, 245, 411-414
 mumps, 410, 413
 rubella
 congenital rubella syndrome (CRS), 409, 414
 declared eliminated from the Americas, 414
 maternal-fetal transmission, 409, 414
 proof of immunity, 199, 416t
 vaccines (MMR), 12t, 411, 412t-413t
 characteristics and specifics of, 412t-413t, 558t
 combination vaccine (MMRV), 266-267, 410, 538t-541t.
 See also MMRV vaccine.
 vs MMR plus VAR, 410, 531
 contraindications/precautions, 415-416
 evidence/proof of immunity, 199, 416t-417t
 in HIV-infected children, 183-187
 immunogenicity/efficacy, 410, 411-414
 interval for receipt of antibody-containing products, 164-165, 166t-167t
 primary vaccine failure, 411
 recommendations, 64t-65t, 410-411, 415-418
 during measles outbreaks, 418
 health care personnel, 212, 410
 postexposure prophylaxis (measles), 418
 travel, 215

- Measles, Mumps, Rubella (*continued*)
 safety, 414-415
 autism concerns, 254-256
 febrile seizures, 229t, 414
 ITP, 229t, 268
 reportable events, 100t-101t
 schedule, 412t-413t
 adults, by age, 290
 adults, by medical condition/indication, 292
 children, age 0-18 years, 282
 catch-up, children age 4 months-6 years, 285
 catch-up, children age 7-18 years, 286
 minimum ages and intervals, 157t, 282
 storage, 122t
 trade name (M-M-R_{II}), 412t
- Medicaid, 86, 544t
- Medical home, 128-129
- Medicare, 86, 544t
- Membrane attack complex, 20, 21
- Memory B-cells, 23, 26, 27, 31
- Memory T and Th-cells, 26, 27
- Men who have sex with men, 220t, 292-293, 360
- Menactra (MenACWY-D), 41, 171t, 425, 426t-429t
 contraindications, 261, 432
 immunogenicity, 430
 minimum ages and intervals, 157t
 recommendations, 163, 422, 432, 433
 safety, 103t, 261, 269, 432
 schedules, 188-189, 282, 286, 293
 storage, 121t
- MenB, 12t, 425
 schedules, 188-189, 282, 291, 293
 use of same product in series, 163
- MenB-4C (Bexsero), 172t, 425, 426t-429t
 adjuvant, 28t
 immunogenicity, 431
 minimum ages and intervals, 157t
 recommendations, 64t, 206t, 423-425, 433
 schedules, 163, 172t, 282, 291, 293
 storage, 121t
- MenB-FH1bp (Trumenba), 172t, 425, 426t-429t
 adverse effects, 431-432
 composition and action mechanism, 425
 immunogenicity, 431
 minimum ages and intervals, 157t
 recommendations, 64t, 423-425, 433
 schedules, 163, 172t, 188
 storage, 122t
- Meningitis, 421-422. See also *Neisseria meningitidis*.
 aseptic, 401, 407, 409, 435
 invasive meningococcal disease (IMD), 422
 meningococcal, 421-422
- Meningococcal vaccines. See *Neisseria meningitidis*.
- Menomune-A/C/Y/W-135 (MPSV4), 40, 103t, 423, 430
- Menveo (MenACWY-CRM), 425, 426t-429t, 432
 Bell's palsy and, 432
 immunogenicity, 430-431
 safety, 432
 storage, 121t
- Mercury (thimerosal) in vaccines, 256-258, 388t-389t
- Methotrexate, 194
- MF59 (adjuvant), 29t, 387
- MHC, MHC-I, MHC-II. See *Major histocompatibility complex*.
- Military personnel, 47, 111, 220t
 adenovirus vaccination, 299
 anthrax vaccination, 303, 305
 smallpox vaccination, 471
 typhoid fever vaccination, 492
- Minimum age and intervals for vaccination, 155-162, 156t-161t, 282
- Miscarriage, 270
- Missed opportunities, 127-128, 176
- MMR vaccine. See *Measles, Mumps, Rubella*.
- MMRV vaccine (ProQuad), 410, 538t-541t. See also *Measles, Mumps, Rubella*.
 administration errors and remedies, 172t
 contraindications and precautions, 531
 febrile seizures and, 229t, 266-267, 531
 interval for receipt of antibody-containing products, 164-165, 166t-167t
 storage, 123t
 vs MMR plus VAR, 410, 531
- Monitoring
 adverse events. See *Adverse events*.
 vaccine delivery and coverage, 73-76
 vaccine safety, 76-82
- Monocytes, 24
- Morbidity and mortality, from vaccine-preventable diseases, 95
- Morbidity and Mortality Weekly Report*, 67
- Morticians, vaccination of, 220t
- Motivational interviewing, 228-230, 231t
- MPSV4 (Menomune-A/C/Y/W-135), 40, 103t, 423, 430
- Multiple sclerosis, 261-262
- Multiple vaccines, simultaneous administration of, 64t, 139, 153-154.
 See also *Combination vaccines*.
 exceptions, 153
 immune overload concept, 246-247
 number of antigens, 248t
- Mumps. See *Measles, Mumps, Rubella*.
- Mycobacterium bovis*, 16
- Nabi-HB, 353
- Narcolepsy, 269-270
- National Academy of Medicine (formerly Institute of Medicine), 251
- National Adult Immunization Plan, 97
- National Center for Immunization and Respiratory Diseases (NCIRD),
 62, 66, 76

- National Childhood Vaccine Injury Act, 77-79, 81, 97
- National Coalition for Adult Immunization, 96
- National Drug Codes (NDCs), 146
- National Foundation for Infectious Diseases, 546t
- National Health Interview Survey (NHIS), 75, 547t
- National Immunization Survey (NIS), 73-75, 547t
- National Institute of Allergy and Infectious Diseases (NIAID), 544t
- National Meningitis Association, 546t
- National Notifiable Disease Surveillance System (NNDDSS), 76, 547t
- National Respiratory and Enteric Surveillance System (NREVSS), 76
- National Vaccine Advisory Committee (NVAC), 66, 73, 544t
 - adult immunization standards, 95-97, 98t-99t
 - immunization registries, 132
 - pediatric immunization standards, 92-95
- National Vaccine Error Reporting Program (VERP), 168
- National Vaccine Injury Compensation Program. See *Vaccine Injury Compensation Program (VICP)*.
- National Vaccine Plan, 71-73, 95
- National Vaccine Program Office (NVPO), 66, 71-73, 544t
- Native Americans and Alaska Natives, 220t, 482
- Natural infection, vs immunization, 246
- Necessity of vaccines, 245
- Needle length, 139, 141t
- Needlestick injuries, 109-111
- Neighborhood, immunization, 128-129
- Neisseria meningitidis*, 421-434
 - clinical features, 421-422
 - correlates of protection, 38t
 - epidemiology and transmission, 422
 - serogroups, 422, 432
 - immunization program, 423-425, 424
 - cost-benefits, 425
 - pathogen, 421, 558t
 - vaccines, 425, 426t-429t
 - adjuvants, 28t, 427t
 - administration errors and remedies, 171t-172t
 - characteristics and specifics of, 426t-429t, 558t
 - contraindications/precautions, 188-189, 261, 432
 - HibMenCY-T, 423
 - immunogenicity/efficacy, 430-434
 - licensure of, 40
 - MenACWY, 12t, 188-189, 422, 424, 433
 - schedules
 - adolescent, 422
 - adult, 291, 293
 - children, 282, 286
 - MenACWY-CRM, 423, 425, 426t-429t, 432, 433
 - Bell's palsy and, 269
 - immunogenicity, 430-431
 - MenACWY-D, 423, 425, 426t-429t, 432
 - contraindications, 261
 - immunogenicity, 430
 - shortage of, 88
- Neisseria meningitidis* (continued)
 - MenB, 12t, 424, 426t, 433
 - MenB-4C, 28t, 153, 426t-429t, 433
 - composition of, 425
 - MenB-FHbp, 28t, 153, 188, 426t-429t
 - adverse effects, 431-432
 - composition and action mechanism, 425
 - recommendations, 64t, 423-425, 433
 - minimum ages and intervals, 157t, 282
 - MPSV4 (Menomune-A/C/Y/W-135), 40, 423, 424, 430
 - reportable events, 103t
 - optimizing immunity with, 188-191
 - recommendations, 64t, 423-425, 424, 432-433
 - adolescents, 95, 282, 291, 423, 432
 - college students, 424, 433
 - during pregnancy, 206t
 - travel, 219, 433
 - universal adolescent immunization, 423, 424
 - use of same product in series, 163, 433
 - safety, 431-432
 - Bell's palsy, 269, 432
 - Guillain-Barré syndrome, 260-261, 432
 - reportable events, 103t
 - schedule, 424, 428t, 432-433
 - adults, by age, 291
 - adults, by medical condition/indication, 293
 - children, age 0-18 years, 282, 432
 - catch-up, children age 7-18 years, 286
 - storage, 121t-122t
 - trade names, 426t
 - Bexsero (MenB-4C), 426t
 - Menactra (MenACWY-D), 426t
 - Menomune-A/C/Y/W-135 (MPSV4), 40, 423, 424
 - Menveo (MenACWY-CRM), 426t
 - Trumenba (MenB-FHbp), 426t
 - Neutralization of pathogens, 19, 20, 21
 - New Vaccine Surveillance Network (NVSN), 76
 - Newborns, 18, 129, 205, 508. See also *Infants*.
 - neonatal tetanus, 316
 - vaccinations given at birth, 129, 205, 282, 352, 358, 359
 - Nomenclature, vi-vii, 549t-559t
 - Noninferiority, 37, 56
 - Numbers, talking about/understanding, 225-227
- Obiltoximab, 303
- Occupational Safety and Health Administration (OSHA), 109-111
- Office visit, coding and billing example, 146, 148t-149t
- Older adults, 209, 290, 294t
 - influenza immunization, 209
 - life-course immunization, 209
 - pneumonia immunization, 209, 483, 485t, 487
 - zoster vaccination, 209, 522, 525t, 527

- Opsonization, 19-21, 20
- OPV. See *Polio, vaccines*.
- Oral administration of vaccines, 139-142, 142
- OSHA (Occupational Safety and Health Administration), 109-111
- Overimmunization, 531
- Package insert (PI), 59-62, 181
labeled indications, 59, 64t-65t
- Pain (of administration), dealing with, 143
- Palivizumab (Synagis), 165, 166t
- Pandemrix, 269-270
- Parents of Kids With Infectious Diseases, 546t
- Partial doses, 174
- Passive immunization, 18-19
during pregnancy, 18, 204
potential interference with vaccines, 19
- Pasteur, Louis, 16, 17
- Pathogens. See also *pathogen subentry under specific agents*
antibody effects on, 19-21, 20, 558t-559t
pathogen-specific antibodies and T-cells, 19
pathogen-specific molecular patterns (PAMPs), 24, 26
- Paternity, 227
- PCV13. See *Pneumococcal vaccines, PCV13*.
- Pediarix (DTaP-HepB-IPV), 64t, 120t, 532t-536t
safety, 530
- Pediatric immunization standards, 92-95. See also *Children; Infants*.
- Pediatric Infectious Diseases Society, 545t
- PedvaxHIB (Hib-OMP), 337-340, 338t-339t
adjuvant, 28t
- Pentacel (DTaP-IPV/Hib-T), 120t, 170t, 532t-536t
safety, 530-531
- Personal belief exemptions, 113
- Pertactin (PRN), 17, 40, 315
- Pertussis, 315-333. See also *Diphtheria; Tetanus*.
clinical features, 316-317
epidemiology and transmission, 317-318
prevention for infants by maternal immunization, 129
immunization program, 318-320
pathogen, 315-316, 558t
pertussis toxin (PT), 315-316
resurgence of, 48
vaccines, 320, 322t-324t, 558t
combination vaccines, 532t-536t
contraindications/precautions, 325-327
immunogenicity/efficacy, 320-321
number of antigens, reduction in, 248t
recommendations, 318-320, 319, 323t, 329-330
adult. See *Tdap vaccine*.
children/infants. See *DTaP vaccine*.
safety, 321-328
allergies and, 325, 328
brain damage concerns, 258-259
- Pertussis, vaccines, safety (*continued*)
encephalopathy, 174, 325, 328
reportable events, 100t
schedule, 323t, 329-330
trade names, 322t, 326t
Adacel (Tdap), 322t-324t
Boostrix (Tdap), 322t-324t
Daptacel (DTaP), 322t-324t
Infanrix (DTaP), 322t-324t
whole-cell, 17
waning immunity and, 48, 318-320
- Phagocyte disorders, 192
- Phagocytosis, 24
- Pharmacists
American Pharmacists Association, 545t
vaccine administration by, 128
- Phase 1, 2, 3, and 4 trials, 55-58, 56
- "Pink Book" (*Epidemiology and Prevention of Vaccine-Preventable Diseases*), 67
- Plasma cells, 21, 22, 23, 31
- Pneumococcal vaccines, 481-489, 484t-485t
characteristics and specifics of, 483, 484t-485t, 559t
contraindications/precautions, 487
correlates of protection, 39t
cost-effectiveness of, 483
immunization program, 482-483
impact of, 43, 45, 50
immunogenicity/efficacy, 483-487
minimum ages and intervals, 158t, 282
optimizing immunity with, 184-186
- PCV7, 482, 483-486
serotype replacement and, 43-45, 45, 50
shortages of, 88
- PCV13 (Prevnar 13), 482-483, 484t-485t, 486-487
administration errors and remedies, 172t
immunogenicity/efficacy, 486
minimum age and intervals, 158t, 282
optimizing immunity with, 184-186
safety, 267, 487
schedule, 485t
adults, by age, 290
adults, by medical condition/indication, 292
children, age 0-18 years, 282, 487-488
catch-up, children, age 4 months-6 years, 285
storage, 122t
- PPSV23 (Pneumovax 23), 482-483, 484t-485t, 486-488
administration errors and remedies, 172t
immunogenicity/efficacy, 486-487
minimum age and intervals, 158t
optimizing immunity with, 184-186
safety, 487

- Pneumococcal vaccines, PPSV23 (Pneumovax 23) (*continued*)
 schedule, 485t
 adults, by age, 290
 adults, by medical condition/indication, 292
 storage, 122t
 recommendations, 487-488
 in immunocompromised persons, 182
 older adults, 209, 483, 485t
 safety, 487
 reportable events, 102t
 serotype replacement, 43-45, 45, 50, 482
 storage, 122t
- Pneumonia, 481-489. See also *Pneumococcal vaccines*.
 clinical features, 246, 481-482
 invasive pneumococcal disease (IPD), 481
 epidemiology and transmission, 482
 immunization program, 482-483
 mortality from, 209, 482
 optimizing immunity to, 184-186
 pathogen, 481, 559t
 serotype replacement, 43-45, 45, 482
- Pneumovax 23 (PPSV23), 484t-485t. See also *Pneumococcal vaccines*, *PPSV23*.
- Policy. See *Vaccine policy*.
- Polio, 435-440
 clinical features, 435
 correlates of protection, 38t
 epidemiology and transmission, 435-436
 continued indigenous cases in U.S., 436
 elimination of wild-type from U.S., 47, 49t, 436
 endemic countries, 437
 OPV-derived polio cases, 47, 436
 immunization program, 436-437
 pathogen, 435, 559t
 proof of immunity, 436-437
 vaccines, 437, 438t-439t
 characteristics and specifics of, 438t-439t
 combination vaccines, 439t(footnote), 532t-536t
 Kinrix (DTaP-IPV), 120t, 532t-536t
 Pentacel (DTaP-IPV/Hib-T), 120t, 532t-536t
 Quadracel (DTaP-IPV), 532t-536t
 immunogenicity/efficacy, 437
 inactivated (IPV), 437, 438t-439t, 529
 combination vaccines, 439t(footnote), 532t-536t
 contraindications/precautions, 439
 minimum ages and intervals for, 157t, 282
 recommendations, 436, 439-440
 safety, 437-439
 schedule, 438t, 439
 children, age 0-18 years, 282
 catch-up, children 7-18 years, 286
 catch-up, children age 4 months-6 years, 285
 storage, 121t
- Polio, vaccines, inactivated (IPV) (*continued*)
 oral (OPV), 436-437, 529
 3-valent, 437, 439
 destruction of vaccine stocks, 47-48
 polio cases caused by, 47, 436
 proof of immunity, 436-437
 proof of vaccination (for travel), 217
 recommendations, 436, 439-440
 for travel, 217-218, 437, 440
 safety, 437-439
 AIDS not caused by, 263-264
 reportable events, 101t
 SV40 and, 263
 trade name (IPOL), 121t, 438t
- Polysaccharide antigens, 21-22, 23, 31
 immune response to, 21-22, 23
- Polysaccharide vaccines, 17-18, 22, 31-32, 33t
 hyporesponsiveness and, 22
 original polysaccharide sin, 22
 protein-polysaccharide vaccines, 23, 31-32
 advantages of, 31-32, 33t
 pure, 17-18, 22
- Postherpetic neuralgia (PHN), 519, 520, 522
- PPSV23. See *Pneumococcal vaccines*, *PPSV23*.
- Precautions. See *Contraindications and precautions*.
- Prefilled syringes, 119, 174
- Pregnancy, 198-205, 206t-207t, 288t
 as indication for vaccination, 199, 206t
 passive immunization in, 18, 204
 rubella
 maternal-fetal transmission, 409, 414
 postexposure prophylaxis, 418
 proof of immunity, 199, 416t
 smallpox, effects on, 469
 vaccination during, 198-205, 206t-207t, 288t, 292-293
 adolescents, 288t
 birth defect concerns, 174, 198, 270
 concerns and considerations, 198-205
 contraindications/precautions, 165, 168, 204, 206t, 292, 415, 439, 478t
 immune globulin for postexposure to rubella/mumps, 418
 indications for, 199, 206t
 influenza, 206t, 292, 392, 395, 396
 live vaccines, 165
 generally contraindicated during pregnancy, 174, 204, 206t-207t
 exceptions to, 174, 206t-207t
 live vaccines for household contacts, 165-168, 204
 maternal immunization platform, 294t
 Tdap, 199, 206t, 288t, 292, 320, 330
 varicella, 506
 VariZIG, 204, 506
 yellow fever, 174, 206t, 516
- PREP Act, 105

- Preservatives, 243, 249, 258. See also *specific vaccines*.
- Prevention of infection, 19, 35-36
vs prevention of disease, 35, 77
- Prevnar, 484t-485t. See also *Pneumococcal vaccines, PCV13*.
- Primary immunization, 26-27, 30
- Primary vaccine failure, 31, 60t-61t, 501
- Priming and boosting, 26-27, 30, 31
- PRISM (Post-licensure Rapid Immunization Safety Monitoring), 79-80
- ProQuad, 538t-541t. See also *MMRV vaccine (ProQuad)*.
- Protein-polysaccharide vaccines, 31-32
advantages of, 31-32, 33t
- Public harm, from fear and refusal of vaccines, 237, 243, 244
- Public health, 46-50. See also *Concerns about vaccines, addressing*
impact of vaccines, 46-50, 49t, 58, 230t
risks of refusal of vaccination, 238, 243, 244
- Public health emergency
preparedness for, 62, 105
vaccine stockpiles for, 62, 89
- Public Readiness and Emergency Preparedness Act, 105
- Public safety workers, vaccination of, 221t, 360, 471
- Purified subunits, 12t, 17
- Purple Book*, vi
- Quadracel (DTap-IPV), 120t, 532t-536t
- Questions about vaccines. See *Concerns about vaccines*.
- RAB-HDC (Imovax Rabies), 444t-446t, 447
- RAB-PCEC (RabAvert), 444t-446t, 447
- RabAvert (RAB-PCEC), 444t-446t
- Rabies, 441-455
clinical features, 441-442
correlates of protection, 38t
epidemiology and transmission, 442
immune globulin (HRIG), 167t, 443, 447-448, 454t
immunization program, 442
pathogen, 441, 559t
vaccines, 12t, 444t-446t
administration errors and remedies, 173t
characteristics and specifics of, 12t, 444t-446t, 559t
contraindications/precautions, 447-448
immunogenicity/efficacy, 447
no minimum age for, 162
postexposure prophylaxis, 65t, 443, 454t-455t
with immune globulin (HRIG), 443, 447-448, 454t
regimens for, 445t, 454t-455t
pre-exposure vaccination, 443, 445t, 450t-453t
recommendations, 448, 450t-455t
animal evaluation, 452t-453t
for animal handlers, 450t
for travel, 218, 450t
safety, 447-448
schedule, 445t, 450t
- Rabies, vaccines (*continued*)
storage, 122t
trade names (Imovax Rabies, RabAvert), 444t
- Rabies immune globulin, human (HRIG), 443, 447, 448, 454t
interval for live vaccines and, 167t
- Ramsay Hunt syndrome, 520
- Rapid cycle analysis, 79
- Reactions to vaccines. See also *Adverse events*.
anaphylaxis, 100t-103t, 144-145
injection-site. See *specific vaccines*.
- Reassortment, 16, 381, 386-387
- Recall and tracking systems, 127
- Recombinant DNA technology, 17-18
- Recombinant subunit vaccines, 12t, 17-18
- Recombivax HB (HepB), 120t, 353, 354t-357t, 359
- Recommendations, vii, 62-73, 153-178. See also *Administration of vaccines; specific vaccines*.
ACIP, vii, 63-70, 64t-65t
administration errors and corrections, 168-169, 170t-173t
adult immunization, schedule, 67
agencies involved with, 63-70, 78
Category A or B, 70, 72t
considerations for making, 70
contraindications and precautions, 174-176
disease burden and, 70
General Best Practice Guidelines, 67
general recommendations, 67, 153-178
GRADE approach, 67-70, 71t
harmonized schedule for children and adolescents, 67
influenza vaccines, 67, 396-397
intervals for receipt of antibody-containing blood products, 164-165, 166t-167t
minimum age and intervals for vaccinations, 155-162, 156t-161t, 282
official, vs labeled indications, 62, 64t-65t
routine schedules, 279-294. See also *Schedules for immunization*.
special circumstances, 183-198
terminology in reference to, 68t-69t
vaccination of persons who have had the disease, 164
vaccine handling, storage, and transport, 117-127
vs package insert, 59-62, 64t-65t, 181
working groups for, 67
"Red Book" (*Report of the Committee on Infectious Diseases*), 71
- Refrigerator, storage of vaccines in, 119-125, 120t-123t
- Refusal of vaccination, 236-239
forms for, 237
harm to children/civic duty, 237
modified schedules, 238
physician dismissal of vaccine-refusing families, 238
public harm from, 237, 243, 244
reasons for, 236
- Registries. See *Immunization Information Systems*.
- Regulations. See *Standards, principles, and regulations*.

- Religious exemptions, 112-113
- Reminder, recall, and tracking systems, 127
- Report of the Committee on Infectious Diseases*. See *“Red Book”*.
- Reportable Events Table, 97, 100t-103t
- Reporting of adverse events, 77-79, 95, 100t-103t
- mandatory reporting, 78, 94
 - to VAERS, 77-79, 105, 168t
- Respiratory disease
- adenovirus and, 295
 - vaccinations recommended, 292-293
- Respiratory syncytial virus (RSV), antibody against, (palivizumab, Synagis), 166t
- Reverse genetics, 387
- Reverse vaccinology, 18
- Reye syndrome, 136t, 220t, 396, 505
- RhoGAM, 167t
- Risks and benefits of vaccines, 76, 228, 229t, 230t, 245
- communicating about, 225-236, 230t
 - human nature and perceived value, 225-228, 226
 - public health risk of vaccine refusals, 237, 243, 244
 - risks of alternate schedules, 251
- Rotarix (RV1), 122t, 267, 459-465, 460t-462t. See also *Rotavirus, vaccines*.
- immunogenicity, 459-463
- RotaShield (RRV-TV), 458
- RotaTeq (RV5), 122t, 267, 459-465, 460t-462t. See also *Rotavirus, vaccines*.
- immunogenicity, 459-463
- Rotavirus, 457-467
- clinical features, 457
 - epidemiology and transmission, 458
 - immunization program, 458-459, 463
 - rotavirus activity in U.S., decline in, 463-464, 463, 464
 - pathogen, 467, 559t
 - vaccines, 459, 460t-462t
 - benefits of, 230t
 - characteristics and specifics of, 460t-462t, 559t
 - contraindications/precautions, 459, 465
 - cost-effectiveness, 458-459
 - development cost, 53
 - immunogenicity/efficacy, 459-463
 - minimum ages and intervals, 158t, 165, 282
 - oral administration, 139-142, 142
 - reassortment and, 16
 - recommendations, 65t, 465-466
 - all infants, 465-466
 - preterm infants, 208, 465
 - risk-benefit analysis, 230t
 - RRV-TV, 458
 - RV-1 (Rotarix), 12t, 459-465, 460t-462t
 - RV-5 (RotaTeq), 12t, 16, 459-465, 460t-462t
 - development cost, 53
 - licensing, 267-268, 459
- Rotavirus, vaccines (*continued*)
- safety, 464-465
 - intussusception concerns, 229t, 267-268, 465
 - porcine circovirus contamination, 266
 - reportable events, 102t
 - schedule, 461t-462t
 - adults, by age group, 290
 - children, age 0-18 years, 282
 - catch-up, children, 4 months-6 years, 284
 - infants, 461t-462t
 - serial passage, 16
 - storage, 122t
- Routes of administration, 139-143. See also *Administration of vaccines*.
- Routine schedules. See *Schedules for immunization*.
- RSV. See *Respiratory syncytial virus (RSV)*.
- Rubella. See *Measles, Mumps, Rubella*.
- Rubeola. See *Measles*.
- Rules for vaccination, 153-168. See also *Recommendations*.
- RZV (recombinant zoster vaccine). See *Zoster*.
- Sabin, Albert, 11
- Sabin Vaccine Institute, 546t
- Safety of vaccines, 225-277. See also *Adverse events; Vaccine Safety Net; and specific vaccines*.
- communicating about, 225-236
 - meaning of safety, 228
 - monitoring of safety, 76-82
 - on-time schedules, 251
 - postmarketing surveillance, 58, 76
 - safety does not mean harmless, 228
 - Vaccine Safety Net, 76-82, 78
- Salicylates. See *Aspirin*.
- Salk, Jonas, 17
- Salmonella typhi*, 16, 215, 491, 559t. See also *Typhoid fever*.
- Schedules for immunization, 279-294. See also *specific vaccines*.
- adults, by age group, 290-291
 - adults, by medical condition, 292-293
 - children, age 0-18 years, 282-283
 - catch-up schedule, children age 4 months-6 years, 284-285
 - catch-up schedule, children age 7-18 years, 286-287
 - children and adolescents, special immunizations, 288t-289t
 - modified/alternative, 238, 250-251
 - safety of, 251
- Schools
- school immunization mandates, 111-113
 - exemptions from, 112-113
 - school-located vaccination (SLV), 129-131
- Screening for contraindications/precautions, 133, 136t-138t
- Section 317 funds, 83-86
- Serial passage, 11-16
- Seroconversion, 169
- Serology, 169

- Serotype replacement, 43-45, 45, 50, 482
- Sewage workers, 221t
- Sharps use and precautions, 109-110
- Shingles. See *Zoster (herpes zoster; shingles)*.
- Shingrix (RZV; recombinant zoster vaccine), 522, 523, 524t-526t
storage, 122t
- Shortages of vaccines, 87-88
deferral of doses and, 88
- Side effects. See *Adverse events*.
- SIDS (sudden infant death syndrome), 264
- Simian virus 40 (SV40), 263
- Smallpox, 469-480
bioterrorism potential of, 47, 470
clinical features, 469-470
diagnosis of, 472t-473t
differentiating from chickenpox, 472t-473t
mortality rates, historically, 469-470
correlates of protection, 38t
epidemiology and transmission, 470
immunization program, 470-471
ring vaccination, 470-471
pathogen, 469, 559t
cross-protection, 471
elimination/eradication of, 46-47, 49t, 470
vaccines, 123t, 471-477, 474t
ACAM2000, 474t
administration and handling, 142, 143, 475
characteristics and specifics of, 471, 474t, 559t
contraindications/precautions, 168, 204, 475, 478t-479t
Dryvax, 471, 475-476
immunogenicity/efficacy, 475
post-event vaccination, 471
pre-event vaccination, 470, 471
recommendations, 470-471, 476-477
safety, 475-476
schedule, 474t
storage, 123t
trade name (ACAM2000), 123t, 474t
vaccinia immune globulin (VIG), 476
- Special circumstances, 179-224
adults over 65 years of age, 209
health care personnel, 210-213
immune deficiency states, 183-198
impaired immunity, 179-198
B-cell (humoral) deficiencies, 187-192
cancer chemotherapy, 197-198
disease-modifying antirheumatic drugs (DMARDs), 194-195
general considerations, 179-181
hematopoietic stem cell transplantation, 198, 200t-203t
HIV infection, 183-187
impaired immunity, 179-182
solid organ transplantation, 195-198, 196
- Special circumstances (*continued*)
inborn errors of metabolism, 208
international adoptees, refugees, and immigrants, 213-215
miscellaneous special situations, 219, 220t-221t
newborns, 182, 205
other predisposing conditions, 182, 198-219
pregnancy, postpartum, and breastfeeding, 198-205, 206t-207t
preterm and low birth weight infants, 205-208
travel, 215-219
- Spelunkers, 221t, 450t
- Standards, principles, and regulations, 91-116. See also *Vaccine infrastructure; Vaccine practice*.
Bloodborne Pathogens Standard, 109-111
coverage goals, 91-92
federal requirements regarding vaccination, 106t-108t
Healthy People 2020, 91-92
immunization practices, standards, 92-97
adult, 95-97, 98t-99t
child and adolescent, 92-95
mandates and exemptions, 111-114
National Childhood Vaccine Injury Act, 77, 97
National Vaccine Injury Compensation Program (VICP), 97-105
Occupational Safety and Health Administration (OSHA), 109-111
Public Readiness and Emergency Preparedness Act, 105
Reportable Events Table, 97, 100t-103t
reporting of adverse events, 77-79
training, 111
Vaccine Adverse Event Reporting System (VAERS), 77-79, 105
Vaccine Information Statements (VISs), 105, 106t-108t
- Standing orders, 131
- Steroids, impaired immunity and, 194
- Stockpiles of vaccines, 62, 89
- Storage of vaccines, 119-125, 120t-124t. See also *specific vaccines*.
emergency provisions for, 126t
in freezer, 119-125, 123t-124t
in refrigerator, 119-125, 120t-123t
temperature monitoring and logs, 119-125
- Streptococcus pneumoniae*, 481, 559t. See also *Pneumococcal vaccines; Pneumonia*.
- Students. See *College students*.
- Subcutaneous administration of vaccines, 139, 140
- Subunits
engineered, 12t, 17-18
purified, 17
recombinant, 12t, 17-18
- Sudden infant death syndrome (SIDS), 264
- Supply of vaccines, 62, 87-88
- Surrogates of immunity. See *Correlates of protection*.
- Surveillance, 76-82. See also *Vaccine Safety Net*.
special surveillance efforts, 80-81
SV40 contamination of early polio vaccine, 263
- Swine flu, 382
vaccine, 29, 80

- Synagis (palivizumab), 165, 166t
 Syncope, 100t-103t, 144, 375
 Systems immunology, 18
- T cells, 27, 253
 cytotoxic (Tc cells), 25, 32-36, 34
 activation of, 32, 34
 deficiency of, 180, 192
 helper (Th-cells), 23, 24-25, 32
 memory Th-cells, 26
 memory T-cells, 26, 27
 T-cell-dependent responses, 32, 35
 T-cell-independent antigens and responses, 22, 32
 T-cell receptor (TCR), 24-25
- Table injury, 104
- Task Force on Safer Childhood Vaccines, 81
- Td (tetanus, diphtheria) vaccine, 326t-327t
 minimum ages and intervals for, 158t
 recommendations, 329
 for wound management, 332t-333t
 schedule, 329, 329-330
 adults, by age, 290
 adults, by medical condition/indication, 292
 catch-up, children age 7-18 years, 286
 trade names
 Tenvirac, 326t-327t
 Tetanus and Diphtheria Toxoids Adsorbed, 326t-327t
- Tdap vaccine, 320-321. See also *Diphtheria, tetanus, and pertussis; DTaP vaccine*.
 administration errors and remedies, 173t
 contraindications/precautions, 328
 Guillain-Barré syndrome, 328
 immunogenicity/efficacy, 320-321
 licensure of, 40
 minimum ages and intervals, 158t, 282
 recommendations, 65t, 318, 319, 323t, 329-330
 health care personnel, 211
 pregnancy, 199, 206t, 288t, 320, 330
 for wound management, 332t-333t
 safety, 325, 328
 schedule, 323t, 329-330
 adults, by age, 290
 adults, by medical condition/indication, 292
 catch-up, children, age 7-18 years, 286
 children, age 7-18 years, 282
 storage, 123t
 trade names (Adacel, Boostrix), 322t-324t
- Temperature for vaccine storage, 125
- Tenvirac (Td), 123t, 326t-327t. See also *Td (tetanus, diphtheria)*.
- Terminology, vi-vii, 558t-559t
 indication, recommendation, requirement, 68t-69t
 language and meaning, 235t
- Terrorism. See *Bioterrorism*.
- Tetanus, 315-333. See also *Diphtheria; Pertussis*
 clinical features, 316
 correlates of protection, 39t
 epidemiology and transmission, 245, 317
 immune globulin (TIG), 167t, 316, 320, 332t-333t
 immunization program, 318
 pathogen, 315, 558t
 vaccines, 12t, 320, 322t-324t, 326t-327t. See also *DT; DTap; Td; Tdap; Tetanus toxoid (TT)*.
 characteristics and specifics of, 322t-324t, 326t-327t, 558t
 combination vaccines, 322t-324t, 532t-536t
 contraindications/precautions, 325-328
 immunogenicity/efficacy, 320-321
 recommendations, 320-321, 329-330
 adult. See *Tdap vaccine*.
 children/infants. See *DTaP vaccine*.
 for wound management, 332t-333t
 safety, 321-328
 reportable events, 100t
 schedule, 323t, 329-330
 storage, 123t
 trade names, 322t, 326t
 Adacel (Tdap), 322t-324t
 Boostrix (Tdap), 322t-324t
 Daptacel (DTaP), 322t-324t
 Diphtheria and Tetanus Toxoids Adsorbed (DT), 326t-327t
 Infanrix (DTaP), 322t-324t
 Tenvirac (Td), 326t-327t
 Tetanus and Diphtheria Toxoids Adsorbed (Td), 326t-327t
- Tetanus and Diphtheria Toxoids Adsorbed (Td), 326t-327t
- Tetanus immune globulin (TIG), 167t, 316, 320, 332t-333t
 interval for live vaccines and, 167t
 for postexposure prophylaxis, 320
 precautions, 329
 for wound management, 332t-333t
- Tetanus toxoid (TT), 12t
- Tetanus Toxoids Adsorbed (DT, Td), 326t-327t
 contraindications/precautions, 328-329
- Th-cells (helper T lymphocytes), 23, 24-25, 32, 253
 memory Th-cells, 26, 27
- Thimerosal, 256-258. See also *specific vaccines*.
 in flu vaccines, 388t-390t
- Thrombocytopenia, 229t, 268, 414, 415
- TIG. See *Tetanus immune globulin*.
- Timeline of vaccine development, 51
- Timeliness, of vaccine delivery, 73, 75, 530
- Tofacitinib, 194
- Toll-like receptors (TLRs), 24
- Topical anesthetics, 143
- Toxins, 32, 315-316
 antibodies to, 19, 40

- Toxoid vaccines, 12t, 17
- Toxoids, 17
- Tracking systems, 127
- Transplantation
 - hematopoietic stem cell (HSCT), 198, 200t-203t
 - solid organ, 195-198, 196
- Transportation of vaccines, 125-127
- Travel, 215-219
 - disease transmission due to, 243, 245
 - diseases related to
 - cholera, 219, 313
 - invasive meningococcal disease, 218
 - Japanese encephalitis, 218, 401
 - measles, 215
 - rabies, 218
 - typhoid fever, 215, 218, 492
 - yellow fever, 218-219, 516-517
 - proof of vaccination, 217, 219, 517
 - travel medicine clinics, 215
 - vaccination for, 215-219
 - cholera, 219, 313
 - hepatitis A (or IGIM), 216, 348
 - hepatitis B, 217, 360
 - influenza, 217
 - Japanese encephalitis, 405
 - mandatory vaccines (YFV for endemic areas), 219, 517
 - measles, 215
 - meningococcal vaccine (Saudi Arabia/Hajj), 219
 - N meningitidis*, 219, 433
 - polio, 217-218, 437, 440
 - rabies, 450t
 - routine vaccines, being up-to-date, 215-216
 - typhoid fever, 492, 497
 - Web sites on, 219
 - yellow fever, 218-219, 516-517
- Trumenba (MenB-FHbp), 172t, 425, 426t-429t
 - adverse effects, 431-432
 - composition and action mechanism, 425
 - immunogenicity, 431
 - minimum ages and intervals, 157t
 - recommendations, 64t, 423-425, 433
 - safety, 431-432
 - storage, 122t
- Tsar/Tsarina (for immunization), 117, 118t, 132
- TT. See *Tetanus toxoid (TT)*.
- Tuberculin skin test (TST), 415, 516
- Tuberculosis, 16, 415, 505
- TViPSV. See *Typhim Vi*.
- Twinrix (HepA-HepB), 120t, 538t-541t
- Ty21a. See *Vivotif*.
- Typhim Vi (TViPSV), 123t, 493-497, 494t-495t
- Typhoid fever, 491-498
 - clinical features, 491-492
 - epidemiology and transmission, 492
 - immunization program, 492
 - pathogen, 491, 559t
 - vaccines, 493-497, 494t-495t, 559t
 - contraindications/precautions, 496
 - immunogenicity/efficacy, 493
 - recommendations, 497
 - for travel, 218, 492, 497
 - safety, 496
 - schedule, 495t
 - storage, 123t
 - TViPSV (Typhim Vi), 123t, 493-497, 494t-495t
 - Ty21a (Vivotif), 16, 493-497, 494t-495t
- Universal precautions, 110
- Vaccinate Your Family, 546t
- Vaccination. See also *Immunization; Vaccinology*.
 - basic concepts, 11-52
 - cytotoxic T cells, implications for, 35-36
 - defined, 11
 - federal requirements regarding, 106t-108t
 - germinal center reaction, implications for, 26-32
 - goals, 91-92
 - public health impact of, 46-50, 49t, 52t, 58
 - sources of information on, 230-233, 232
 - triumphs of, 48, 49t
- Vaccination programs. See *specific diseases*.
- Vaccine(s). See also *Immunization; specific vaccines*.
 - basic immunology of, 19-36
 - classification of, 12t-13t
 - concerns about, 225-277
 - correlates of protection, 36-41, 38t-39t
 - costs/cost-benefit analyses. See *Costs*.
 - delivery of. See *Delivery of vaccines*.
 - development of. See *Vaccine development and licensure*.
 - effectiveness, vs efficacy, 58
 - funding for. See *Financing*.
 - how they work, 19-36
 - impact of, 46-50, 52t, 58
 - inactivated, 12t, 14t, 17-18
 - interchangeability of vaccines from different manufacturers, 163
 - licensure of. See *Vaccine development and licensure*.
 - live vaccines, 11-16, 21
 - live vs inactivated vaccines, 14t-15t, 46
 - National Vaccine Plan, 71-73
 - necessity of, 245
 - nomenclature and abbreviations, vi-vii, 549t-559t
 - number of, and timeline of development, 51
 - prices of. See *Costs*.

- Vaccine(s) (*continued*)
- recommendations regarding. See *Recommendations*.
 - schedules for. See *Schedules for immunization*.
 - stockpiles of, 62, 89
 - supply/shortages, 62, 87-88
 - timeline of development for specific diseases, 51
 - valency, vii
 - virus stocks, destruction of, 47-48
- Vaccine Adverse Event Reporting System (VAERS), 77-79, 105, 168t
- limitations of, 78-79
 - mandatory reporting to, 78, 94
- Vaccine confidence, 225, 226, 234-236
- Vaccine development and licensure, 53-62, 54
- agencies involved with, 66, 78
 - animal models, 53
 - Biologics License Application (BLA), 58-59
 - “breakthrough therapy” category, 59
 - development costs, 53
 - FDA and, 53, 54, 59
 - financial risk, 53
 - financing for, 82-86
 - package insert (PI), 59-62
 - postmarketing activities, 58
 - prelicensure trials, 55-58, 56
 - steps in, 53-59, 54, 56
 - time required for, 55
 - VRBPAC and, 59
- Vaccine failure, 31, 58, 60t-61t
- causes of, 60t-61t
- Vaccine immunology, 19-36. See also *Immune response*.
- Vaccine Information Statements (VISs), 105, 106t-108t
- Vaccine infrastructure in the United States, 53-59, 54
- Defense Medical Surveillance System, 80
 - disease surveillance, 76
 - emergency preparedness, 62
 - financing, 82-86
 - governmental agencies, 66
 - monitoring delivery, 73-76
 - monitoring safety, 76-82
 - policy and recommendations, 62-73
 - supply, 62, 87-88
 - vaccine development and licensure, 53-62, 54, 78
 - Vaccine Safety Net, 76-82, 78
- Vaccine Injury Compensation Program (VICP), 66, 97-105.
- See also *Vaccine Adverse Event Reporting System (VAERS)*.
 - compensation under, 104
 - proof of causation, 99
 - Reportable Events Table, 97, 100t-103t
 - Table injury, 104
- Vaccine Injury Table (VIT), 97-99, 100t-103t
- Table injury, 104
- Vaccine policy and recommendations, 62-73. See also *Recommendations*.
- agencies involved with, 66
 - terms used in reference to, 68t-69t
- Vaccine practice, 117-152. See also *Administration of vaccines*.
- administration of vaccines, 135-178
 - coding, billing, and costs, 145-147
 - delivery of vaccines, improving, 127-133
 - emergencies, 126t, 144-145
 - general guidelines, 117-127
 - handling, storage, and transport, 117-127
 - inventory, 117-118
 - signs, 117, 119, 125
 - storage, 119-125, 120t-124t
 - transport, 125-127
 - Immunization Tsar/Tsarina, 117, 118t, 132
 - screening for contraindications, 133, 136t-138t
- Vaccine-preventable diseases, 51, 245-246. See also *Public health*.
- annual deaths from, 95, 382, 383-384, 384
 - costs of, 95
 - immunization goals, 91-92
 - necessity of vaccination for, 245
 - resurgence of, 48-50, 245, 410-414
 - surveillance, 76
 - timeline of specific vaccine development, 51
- Vaccine recommendations. See *Recommendations*.
- Vaccine refusal. See *Refusal of vaccination*.
- Vaccine Safety DataLink (VSD), 79
- Vaccine Safety Net, 76-82, 78
- ad-hoc committees and task forces, 81-82
 - Brighton Collaboration, 80
 - Clinical Immunization Safety Assessment (CISA) Network, 80, 545t
 - Defense Medical Surveillance System, 80
 - IOM Consensus Report, 81-82
 - Post-licensure Rapid Immunization Safety Monitoring (PRISM), 79-80
 - Sentinel System, 79
 - Vaccine Adverse Event Reporting System (VAERS), 77-79, 105
 - Vaccine Safety DataLink, 79
- Vaccine stockpiles, 62, 89
- Vaccines and Related Biological Products Advisory Committee (VRBPAC), 59, 66
- Vaccines for Children (VFC) Program, 63, 71, 83, 86, 118
- common questions about, 84t-85t
- Vaccines.gov, 546t
- Vaccinia immune globulin (VIG), 476
- Vaccinia virus, 471. See also *Smallpox*.
- Vaccinology, 11-52. See also *Immunization*.
- basic vaccine immunology, 19-36
 - classical vs reverse, 18
 - correlates of protection, 36-41, 38t-39t
 - genetics of vaccine responses/adverse events, 45-46
 - herd immunity, 41-45, 42
 - immunization, 11-19

- Vaccinology (*continued*)
 public health and vaccines, 46-50, 49t
 systems immunology, 18
- Vaccinomics, 46
- VAERS. See *Vaccine Adverse Event Reporting System*.
- Value of Vaccination, 546t
- Vaqa (HepA), 120t, 334t-336t, 343
- Varicella, 499-509
 chickenpox, 35, 164, 472t, 499, 503
 clinical features, 246, 499-500
 breakthrough/vaccine-modified varicella, 499-500
 diagnosis, 472t-473t
 differentiating from smallpox, 472t-473t
 nosocomial transmission, 212
 correlates of protection, 39t
 epidemiology and transmission, 500
 evidence of immunity, 507t
 herpes zoster (shingles) and. See *Zoster*.
 immune globulin (VariZIG), 167t, 501, 506-508
 immunization program, 501
 one-dose program, 50
 pathogen (varicella-zoster virus, VZV), 163, 499, 520, 559t
 reactivation of latent, 35, 499, 500, 519
 vaccines, 501-508, 502t-503t, 559t. See also *MMRV*.
 administration errors and remedies, 173t
 contraindications/precautions, 504-506
 immunogenicity/efficacy, 501-504
 interval for receipt of antibody-containing products, 164-165, 166t-167t
 minimum ages and intervals, 158t, 282
 recommendations, 506-508
 health care personnel, 212-213
 safety, 504-506
 reportable events, 102t
 schedule, 502t
 adults, by age, 290
 adults, by medical condition, 292
 children, age 0-18 years, 282, 506
 catch-up, children age 4 months-6 years, 285
 catch-up, children age 7-18 years, 286
 serial passage, 11-16
 storage and transport, 124t, 125
 trade name (Varivax), 124t, 502t
 vs zoster vaccines, 35-36
 waning immunity and, 500, 501
- Varicella-zoster immune globulin. See *VariZIG*.
- Varicella-zoster virus (VZV), 163, 499, 520, 559t
 reactivation of latent, 35, 499, 500, 519. See also *Zoster (herpes zoster; shingles)*.
- Variola, 469-470, 559t. See also *Smallpox*.
 last remaining stocks of, 47, 470
 terrorism potential of, 47, 470
- Varivax (varicella vaccine), 124t, 501-508, 502t-503t. See also *Varicella, vaccines*.
- VariZIG, 18, 167t, 501, 506-508. See also *Varicella*.
 for health care personnel, 213
 interval for live vaccines and, 167t
 for pregnant women, 204, 506
- Vaxchora (cholera vaccine), 123t, 219, 311, 312t-313t
- VFC. See *Vaccines for Children (VFC) Program*.
- Vibrio cholerae*, 16, 309, 558t
- VICP. See *Vaccine Injury Compensation Program*.
- Viral infections, 35
- Viral infections, Tc-cells and, 35
- Viral interference, 529
- Vivotif (Ty21a), 16, 123t, 493-497, 494t-495t
- Voices for Vaccines, 546t
- VRBPAC (Vaccines and Related Biological Products Advisory Committee), 66
- Waning immunity, 48, 246, 320, 321, 500, 501
- Warning labels, 110
- Whole agent vaccines, 12t, 17
- Whooping cough. See *Pertussis*.
- World Health Organization (WHO), 253, 544t
- Yellow fever, 511-518
 clinical features, 511
 epidemiology and transmission, 512
 immunization program, 512
 International Certificate of Vaccination or Prophylaxis, 219, 517
 pathogen, 511, 559t
 vaccine for, 12t, 513-517, 514t-515t, 559t
 adverse events, serious, 513-515, 517
 approved sites for administration, 219, 517
 contraindications/precautions, 204, 515-516
 immunogenicity/efficacy, 513
 recommendations, 512, 516-517
 for pregnant women, 174, 206t
 travel, 218-219, 516-517
 safety, 266, 513-516
 schedule, 514t
 storage, 123t
- YF-Vax (yellow fever vaccine), 12t, 123t, 513-517, 514t-515t
- Zostavax (ZVL, zoster vaccine live), 65t, 522-527, 524t-526t
 storage, 124t
- Zoster (herpes zoster; shingles), 519-528. See also *Varicella*.
 clinical features, 519-520
 zoster sine herpete, 520
 correlates of protection, 39t
 epidemiology and transmission, 520-521
 herpes zoster (shingles), 499, 504, 519
 immunization program, 521-522
 coverage goals, 92

Zoster (herpes zoster; shingles) (*continued*)
pathogen, 163, 499, 559t
postherpetic neuralgia (PHN) and, 519, 520, 522
vaccines for, 12t, 522, 524t-526t, 559t
administration errors and remedies, 173t
contraindications/precautions, 523-527, 528
cost-benefit comparison, 521-522
immunogenicity/efficacy, 522-523
indications for, 525t, 527
live (ZVL; Zostavax), 12t, 35, 65t, 522-527, 524t-526t
minimum ages and intervals, 158t
recombinant (RZV; Shingrix), 12t, 35-36, 522, 524t-526t
recommendations, 65t, 522, 527-528
safety, 523-527
schedule, 525t
 adults, by age, 290
 adults, by medical condition/indication, 292
storage, 122t, 124t
trade names (Zostavax; Shingrix), 524t
vs varicella vaccine (VAR), 35-36
varicella exposure and, 520, 521
ZVL (zoster vaccine live). See under Zoster.