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versus nonvaccinees; (3) Are there rare causally related adverse events? If so, what is the incidence rate, and are there risk factors for developing the adverse event that could lead to vaccine contraindications? and (4) What is the impact of vaccination in protecting the community (i.e., herd immunity) by preventing or reducing transmission? Answering these questions requires a comprehensive surveillance system to detect and determine characteristics of disease in the postvaccine era and whether such disease is the result of failure to vaccinate or vaccine failure. If the former, what measures can be taken to enhance vaccine uptake, or should recommendations for vaccination be broadened if substantial numbers of cases are occurring in groups for whom vaccine is not rec ommended? If there is evidence of vaccine failure, is it the result of vac cine mishandling (e.g., improper storage) or is the rate of failure within expected levels (e.g., the measured vaccine effectiveness is within levels expected based on the prelicensure trials)? If effectiveness is low, are there groups at higher risk for vaccine failure, and if so, would additional doses of vaccines or alternative schedules reduce that risk? Assessing Vaccine Safety Adequately assessing vaccine safety is critical to the success of immunization programs and requires an existing comprehensive system to monitor safety. In the United States, there are several systems in place to assess safety in the postlicensure setting. The Vaccine Adverse Event Reporting System (VAERS) allows providers, parents, and patients to report adverse events. The VAERS program functions more to raise hypotheses about whether receipt of a vaccine or vaccines causes an adverse event than it does to evaluate causation. The Vaccine Safety Datalink (VSD) is a collaborative project between CDC’s Immunization Safety Office (ISO) and eight health care organizations. The VSD was initiated in 1990 and continues to moni tor safety of vaccines over large populations and to conduct studies to assess rare and serious adverse events following immunization. The Clinical Immunization Safety Assessment (CISA) Project is a national network of vaccine safety experts from the CDC’s ISO, seven medical research centers, and other partners, which provides a comprehensive vaccine safety public health service to the nation. Vaccine Injury Compensation Most vaccine-preventable dis eases are transmitted person-to-person. Thus, when individuals are vaccinated, they are protected from disease and indirectly are protect ing others in society who either cannot be vaccinated (e.g., have medi cal contraindications to vaccine) or fail to make an adequate immune response. Therefore, if someone is injured by vaccine, society should provide that person compensation. This is the basis of the National Vaccine Injury Compensation

Program (NVICP). This program offers compensation for the injured vaccine recipient and reduces the risk of liability for the vaccine provider and the manufacturer, as persons who receive vaccines covered by the NVICP must first go through this com pensation process before suing the provider or manufacturer. Vaccine Hesitancy Over the past decade there has been an increase in vaccine hesitancy. Reasons for vaccine hesitancy are multifactorial and include concerns over vaccine safety, questioning whether specific vaccines are needed to prevent disease, and mistrust of the public health sector and medical professionals recommending the vaccines. This hesitancy has increased since the COVID-19 pandemic coinci dent with the proliferation of antivaccine tropes and with concern over loss of autonomy of individuals to make decision for themselves. These concerns can often be alleviated or lessened by addressing the spe cific questions raised by the hesitant individual and by a presumptive approach where vaccines are presented as the standard of care. A strong recommendation for a vaccine by a trusted health care provider is one proven mechanism to reduce vaccine hesitancy. Websites maintained by the CDC, NIH, and various specialty and subspeciality organiza tions have extensive information about vaccines, and providers should refer their patients to these credible sources. ■ ■SUMMARY Few programs have had the impact of vaccines in reducing health burdens. This is the result of a rigorous system to ensure that recom mended vaccines are safe and effective, and of an equally rigorous

system to ensure that persons for whom vaccines are recommended receive them. With the development and introduction of new vaccines, public health gains are expected to increase in coming years as long as high vaccine coverage levels can be maintained.

■ ■FURTHER READING Cunningham AL et al: Vaccine development: From concept to early clinical testing. Vaccine 34:6655, 2016. Li X et al: Estimating the health impact of vaccination against ten pathogens in 98 low-income and middle-income countries from 2000 to 2030: A modelling study. Lancet 397:398, 2021. McCarthy NL et al: Monitoring vaccine safety using the Vaccine Safety Datalink: Utilizing immunization registries for pandemic influenza. Vaccine 29:4891, 2011. National Academies of Sciences, Engineering and Medicine: The critical public health value of vaccines: Tackling issues of access and hesitancy: Proceedings of a workshop. Washington DC, National Academies Press, 2021. National Vaccine Advisory Committee: Protecting the public’s health: Critical functions of the Section 317 Immunization Pro gram—a report of the National Vaccine Advisory Committee. Public Health Rep 128:78, 2013. O’leary ST et al: Strategies for improving vaccine communication and uptake. Pediatrics 153:e2023065483, 2024. Pickering LK et al: Principles of vaccine licensure, approval and rec ommendations for use. Mayo Clin Proc 95:600, 2020. Plotkin SA: Correlates of protection induced by vaccination. Clin Vaccine Immunol 17:1055, 2010. Shattock AJ et al: Contribution of vaccination to improved survival CHAPTER 129 and health: Modelling 50 years of the Expanded Programme on Immunization. Lancet 403:2307, 2024. Walton LR et al: The history of the United States Advisory Committee on Immunization Practices (ACIP). Vaccine 33:405, 2015. Immunization Principles and Vaccine Use Sarah Meyer, Amanda Cohn,

Georgina Peacock

Immunization Principles

and Vaccine Use Few medical interventions of the past century can rival the effect that immunization has had on longevity, economic savings, and quality of life. Twenty-one diseases are

now preventable through vaccines routinely administered to children and adults in the United States (Table 129-1), and most vaccine-preventable diseases of childhood are at historically low levels (Table 129-2). In the past few years, the adult immunization landscape has changed substantially with an increased number of recommended routine vaccines. The COVID-19 pandemic identified a need for improved infra structure to ensure adult vaccination, especially for those who are uninsured and who have limited access to health systems. Health care providers in a variety of settings deliver the vast majority of vaccines in the United States and therefore play an integral role in the nation's public health system. ■ ■VACCINE IMPACT Direct and Indirect Effects Many immunizations against specific infectious diseases protect individuals against infection and thereby prevent symptomatic illnesses. In addition, specific vaccines may blunt the severity of clinical illness (e.g., rotavirus vaccines and severe gastroenteritis) or reduce complications (e.g., zoster vaccines and

TABLE 129-1 Diseases Preventable with Vaccines Routinely Administered in the United States to Children and/or Adults CONDITION TARGET POPULATION(S) FOR ROUTINE USE Pertussis Children, adolescents, adults Diphtheria Children, adolescents, adults Tetanus Children, adolescents, adults Poliomyelitis Children Measles Children Mumps Children Rubella, congenital rubella syndrome Children Hepatitis B Children and high-risk adults Haemophilus influenzae type b infection Children and high-risk adults Hepatitis A Children and high-risk adults Influenza Children, adolescents, adults Varicella Children Pneumococcal disease Children, older adults, and high-risk adultsa Serogroups A, C, W, Y meningococcal disease Adolescents and high-risk children

and adults Serogroup B meningococcal disease High-risk children and adultsa Rotavirus infection Infants Human papillomavirus infection, cervical and anogenital cancers Adolescents and young adultsa Zoster Older adults and high-risk adults Respiratory syncytial virus Infants, high-risk children, pregnant personsa PART 5 Infectious Diseases COVID-19 Children, adolescents, adults Dengue High-risk children (i.e., those living in endemic areas and with laboratory confirmation of prior infection) Mpox High-risk adults aOthers in certain age groups may be vaccinated based on shared clinical decision-making. postherpetic neuralgia). Some immunizations also reduce transmis sion of infectious disease agents from immunized persons to others, thereby reducing the impact of infection spread. This indirect impact is known as herd immunity. The level of immunization in a population that is required to achieve indirect protection of unimmunized persons varies substantially with the specific vaccine and disease. For example, because of how transmissible measles is, an estimated 95% of the popu lation needs to be vaccinated to achieve herd immunity, whereas with polio, an estimated 80% coverage is needed. Over the past 30 years, due to the implementation of the Vaccines for Children Program, children have had broad access to routine childhood vaccines, regardless of insurance status. For routinely rec ommended vaccines in the United States, major declines in rates of vaccine-preventable diseases among both children and adults have become evident (Table 129-2). For example, vaccination of children <5 years of age against Streptococcus pneumoniae has led to not only a 96% reduction in invasive pneumococcal disease, but also substantial reductions in incidence among adults through herd immunity. Among children born during 1994–2023, the childhood vaccination series will prevent 508 million illnesses and 1,129,000 deaths over the course of their lifetime and save nearly $2.7 trillion in societal costs (U.S.). Control, Elimination, and Eradication of Vaccine-Preventable Diseases Immunization programs are associated with the goals of controlling, eliminating, or eradicating a disease. Control of a vaccinepreventable disease reduces poor illness outcomes and often limits the disruptive

impacts associated with outbreaks of disease in com munities, schools, and institutions. Control programs can also reduce absences from work for ill persons and for parents caring for sick

TABLE 129-2 Decline in Vaccine-Preventable Diseases in the

United States following Widespread Implementation of National

Vaccine Recommendations REDUCTION (%) IN CASES AFTER WIDESPREAD VACCINATION ANNUAL NO. OF PREVACCINE CASES (AVERAGE) NO. OF CASES REPORTED IN 2023a CONDITION Smallpox 29,005

Diphtheria 21,053

> 99 Measles 530,217

> 99 Mumps 162,344

> 99 Pertussis 200,752

Polio (paralytic) 16,316

Rubella 47,745

> 99 Congenital rubella syndrome

Tetanus

Haemophilus influenzae type b infection age <5 years 20,000 27b

> 99 Hepatitis A 117,333 11,500c

Hepatitis B (acute) 66,232 13,300c

Invasive pneumococcal infection: all ages 63,067 17,700d

Rotavirus hospitalizations

(<3 years old) 62,500 16,250e

Varicella 4,085,120 26,919f

a2023 reported cases unless otherwise specified (provisional as of February 2024). bAn additional 12 type b infections are estimated to have occurred among 257 reports of H. influenzae infection caused by unknown types among children <5 years of age. cData from the CDC's Viral Hepatitis Surveillance, 2021. dUnpublished data from the CDC's Active Bacterial Core Surveillance, 2020. eData from the CDC's New Vaccine Surveillance Network, 2021; U.S. rotavirus disease now has a biennial pattern. fData from CDC's varicella program, 2021. Source: Adapted from SW Roush et al: JAMA 298:2155, 2007 and Morb Mortal Wkly Rep 65:924, 2017. children, decrease absences from school, and limit health care utiliza tion associated with treatment visits. Elimination of a disease is a more demanding goal than control, usually requiring the reduction to zero of cases in a defined geographic area but sometimes defined as reduction in the indigenous sustained transmission of an infection in a geographic area. As of 2024, the United States had eliminated indigenous transmission of measles, rubella, poliomyelitis, and diphtheria. Importation of pathogens from other parts of the world continues to be important, and public health efforts are intended to respond promptly to such cases in order to limit forward spread of the infectious agent. Eradication of a disease is achieved when its elimination can be sus tained without the need to continue interventions. The only vaccinepreventable disease of humans that has been globally eradicated thus far is smallpox. Although smallpox vaccine is no longer given routinely, the disease has not reemerged naturally because all chains of human transmission were interrupted through earlier vaccination efforts and humans were the only natural reservoir of the virus. Currently, a major health initiative is targeting the global eradication of polio. Two of the three wild poliovirus types (types 2 and 3) have been eradicated globally. However, endemic transmission of wild poliovirus type 1 con tinues in Afghanistan and Pakistan, and circulating vaccine-derived polioviruses have been detected in areas of the world where poliovirus had been eliminated, including a case of vaccine-derived poliovirus type 2 in New York in 2022. Detection of a case of disease that has been targeted for eradication or elimination is considered a sentinel event that could permit the infectious agent to become reestablished in the community or region. Therefore, such episodes must be promptly reported to public health authorities.

Epidemic and Pandemic Preparedness and Response Clusters of cases of a vaccine-preventable disease detected in an institution, a medical practice, or a community may signal important changes in the pathogen, vaccine, or environment. Several factors can give rise to increases in vaccine-preventable disease, including (1) low rates of immunization that result in an accumulation of susceptible persons (e.g., measles resurgence among vaccination abstainers); (2) changes in the infectious agent that permit it to escape vaccine-induced protection (e.g., non-vaccine-type pneumococci); (3) waning of vaccine-induced immunity (e.g., pertussis among adolescents and adults vaccinated in early childhood); and (4) point-source introductions of large inocula (e.g., food-borne exposure to hepatitis A virus). Reporting episodes of outbreak-prone diseases to public health authorities can facilitate recognition of clusters that require further interventions. The COVID-19 pandemic highlighted the importance of a strong immunization program: robust surveillance systems to detect emerging infectious disease threats; public–private partnerships to accelerate the development of novel vaccines; and systems in place to rapidly imple ment a vaccination program and monitor vaccine safety and effective ness. On a global scale, the "100

Days Mission” is being explored by the Coalition for Epidemic Preparedness Innovations (CEPI) and partners as a response to the next “Disease X” to make safe, effective vaccines, therapeutics, and diagnostics within 100 days of identification. PUBLIC HEALTH REPORTING Recognition of suspected cases of dis eases targeted for elimination or eradication—along with other dis eases that require urgent public health interventions, such as contact tracing, administration of chemo- or immunoprophylaxis, or epi demiologic investigation for common-source exposure—is typically associated with special reporting requirements. Many diseases against which vaccines are routinely used, including measles, pertussis, and Haemophilus influenzae type b invasive disease, are nationally notifi able. Clinicians and laboratory staff have a responsibility to report some vaccine-preventable disease occurrences to local or state public health authorities according to specific case-definition criteria. All providers should be aware of state or city disease-reporting require ments and the best ways to contact public health authorities. A prompt response to vaccine-preventable disease outbreaks can greatly enhance the effectiveness of control measures. GLOBAL CONSIDERATIONS Vaccinations are estimated to prevent 3.5–5 million deaths every year on a global scale. The COVID-19 pandemic led to disruptions of routine vaccination programs, resulting in declines in vaccine coverage in more than 100 countries. Although there have been promising signs of recovery, with diphtheria-pertussistetanus (DPT) coverage in 2022 nearly recovered to 2019 levels, gaps remain for other vaccines. For example, 22 million children missed their first dose of measles vaccine in 2022 compared with 19 million in 2019. As a result, the World Health Organization, the United Nations Children’s Fund, Gavi, the Vaccine Alliance, and the Bill & Melinda Gates Foundation launched “The Big Catch-Up” to support recovery of childhood vaccination rates to at least prepandemic levels. Enhancing Immunization in Adults Although immunization has become a centerpiece of routine pediatric medical visits, it has not been as well integrated into routine health care for adults. This chapter focuses on immunization principles and vaccine use in adults. Accumulating evidence suggests that immunization coverage can be increased through efforts directed at consumer-, provider-, institu tion-, and system-level factors. The literature suggests that the applica tion of multiple strategies is more effective at raising coverage rates than is the use of any single strategy. RECOMMENDATIONS FOR ADULT IMMUNIZATIONS The CDC’s Advi sory Committee on Immunization Practices (ACIP) makes recom mendations for administration of vaccines approved or authorized by the U.S. Food and Drug Administration (FDA) for use in children and adults in the U.S. civilian population. The ACIP is a federal advisory committee that consists of up to 20 voting members (experts in fields associated with immunization) appointed by the Secretary of the U.S. Department of Health and Human Services, as well as ex officio

members representing federal agencies and nonvoting representatives of various liaison organizations, including major medical societies and managed-care organizations. ACIP recommendations are available at www.cdc.gov/acip-recs/hcp/vaccine-specific/.

ACIP makes several types of recommendations. Routine, catch-up, and risk-based recommendations are those in which everyone in a particular age or risk group is recommended to receive vaccination. Examples include recombinant zoster vaccination for adults age ≥50 years and hepatitis B vaccination for adults age 19–59 years. Shared clinical decision-making recommendations are individually based and informed by a decision process between the health care provider and patient. With shared clinical decision-making recommendations, the decision to vaccinate is informed by the best available evidence on who may benefit from vaccination; the individual’s characteristics, values, and preferences; the health care provider’s clinical discretion;

and the characteristics of the vaccine being considered. Examples of shared clinical decision-making recommendations include human papilloma virus vaccination of adults age 27-45 years and serogroup B meningococ cal vaccination of adolescents and young adults age 16-23 years. ADULT IMMUNIZATION SCHEDULES Immunization schedules for adults in the United States are updated regularly, through an adden dum after ACIP votes on a new recommendation as well as an annual update, and can be found online (www.cdc.gov/vaccines/hcp/imzschedules/adult-age.html). The adult immunization schedule is also approved by seven provider organizations and published annually in Annals of Internal Medicine and Morbidity and Mortality Weekly Report (www.cdc.gov/mmwr). The adult immunization schedules for 2024 are summarized in Fig. 129-1. Additional information and specifications are contained in the footnotes to these schedules. CHAPTER 129 ■ ■IMMUNIZATION PRACTICE STANDARDS Administering immunizations to adults involves a number of pro cesses, such as deciding whom to vaccinate, assessing vaccine contra indications and precautions, providing vaccine information statements (VISs), ensuring appropriate storage and handling of vaccines, admin istering vaccines, and maintaining vaccine records. In addition, pro vider reporting of adverse events that follow vaccination is an essential component of the vaccine safety monitoring system. In 2014, the Stan dards for Adult Immunization Practice were revised to help providers take steps to ensure that their patients are fully immunized, including assessing the immunization status of patients at every clinical encoun ter, strongly recommending vaccines that patients need, administering vaccines or referring the patient to a vaccination provider, and docu menting vaccines received by the patient. Immunization Principles and Vaccine Use Deciding Whom to Vaccinate Every effort should be made to ensure that adults receive all indicated vaccines as expeditiously as pos sible. When adults present for care, their immunization history should be assessed and recorded, and this information should be used to identify needed vaccinations according to the most current version of the adult immunization schedule. Decision-support tools incorporated into electronic health records can provide prompts for needed vaccina tions. Standing orders, which are often used for routinely indicated vaccines (e.g., influenza and zoster vaccines), permit a nurse or another approved licensed practitioner to administer vaccines without a spe cific physician order, thus lowering barriers to adult immunization. Assessing Contraindications and Precautions Before vac cination, all patients should be screened for contraindications and precautions. A contraindication is a condition that increases the risk of a serious adverse reaction to vaccination. A vaccine should not be administered when a contraindication is documented. For example, a history of an anaphylactic reaction to a dose of vaccine or to a vac cine component is a contraindication for further doses. A precaution is a condition that may increase the risk of an adverse event or that may compromise the ability of the vaccine to evoke immunity (e.g., administering measles vaccine to a person who has recently received immune globulins or other blood products and may consequently have transient passive immunity to measles virus). Normally, a vaccine is

Vaccine 19–26 years 27–49 years 50–64 years ≥65 years COVID-19 1 or more doses of updated (2023–2024 Formula) vaccine (see notes) Influenza inactivated (IIV4) or Influenza recombinant (RIV4) 1 dose annually or or Influenza live, attenuated (LAIV4) 1 dose annually Respiratory syncytial virus (RSV)

Seasonal administration during pregnancy. See notes. ≥60 years Tetanus, diphtheria, pertussis (Tdap or Td) 1 dose Tdap each pregnancy; 1 dose Td/Tdap for wound management (see notes) 1 dose Tdap, then Td or Tdap booster every 10 years Measles, mumps, rubella (MMR)

1 or 2 doses depending on indication (if born in 1957 or later) For healthcare personnel, see notes Varicella (VAR)

2 doses (if born in 1980 or later) 2 doses Zoster recombinant (RZV)

2 doses for immunocompromising conditions (see notes) 2 doses Human papillomavirus (HPV)

2 or 3 doses depending on age at initial vaccination or condition 27 through 45 years Pneumococcal (PCV15, PCV20, PPSV23) See notes Hepatitis A (HepA)

2, 3, or 4 doses depending on vaccine Hepatitis B (HepB)

Meningococcal A, C, W, Y (MenACWY) 1 or 2 doses depending on indication, see notes for booster recommendations Meningococcal B (MenB)

2 or 3 doses depending on vaccine and indication, see notes for booster recommendations 19 through 23 years Haemophilus influenzae type b (Hib) 1 or 3 doses depending on indication Mpox PART 5 Infectious Diseases Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of immunity Recommended vaccination for adults with an additional risk factor or another indication HIV infection CD4 percentage and count Immunocompromised (excluding HIV infection) Men who have sex with men VACCINE Pregnancy COVID-19 See notes IIV4 or RIV4 1 dose annually LAIV4 1 dose annually if age 19–49 years RSV Seasonal administration. See notes See notes See notes Tdap or Td Tdap: 1 dose each pregnancy 1 dose Tdap, then Td or Tdap booster every 10 years MMR * VAR * See notes RZV See notes HPV * 3 dose series if indicated Pneumococcal HepA HepB See notes Age ≥60 years MenACWY MenB Hib Asplenia: 1 dose Mpox See notes See notes See notes Not recommended for all adults, but recommended for some adults based on either age OR increased risk for or severe outcomes from disease Recommended based on shared clinical decision-making Recommended for all adults who lack documentation of vaccination, OR lack evidence of immunity a. Precaution for LAIV4 does not apply to alcoholism. b. See notes for influenza; hepatitis B; measles, mumps, and rubella; and varicella vaccinations. c. Hematopoietic stem cell transplant. FIGURE 129-1 Recommended adult immunization schedules, United States, 2024. Additional information, including footnotes for each vaccine, contraindications, and precautions, can be found at www.cdc.gov/vaccines/hcp/imz-schedules/adult-age.html. The recommendations in this schedule were approved by the Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP), the American Academy of Family Physicians (AAFP), the American College of Physicians (ACP), the American College of Obstetricians and Gynecologists (ACOG), and the American College of Nurse-Midwives (ACNM). For complete statements by the ACIP, visit www.cdc.gov/acip-recs/hcp/vaccine-specific/.

See notes 2, 3, or 4 doses depending on vaccine or condition Recommended vaccination based on shared clinical decision-making No recommendation/ Not applicable Kidney failure, End-stage renal disease or on dialysis Asplenia, complement deficiency Heart or lung disease Chronic liver disease; alcoholisma Diabetes 1 dose annually if age 19–49 years Precaution: Might be indicated if benefit of protection outweighs risk of adverse reaction Contraindicated or not recommended *Vaccinate after pregnancy, if indicated Recommended for all adults, and additional doses may be necessary

based on medical condition or other indications. See notes. No Guidance/ Not Applicable

not administered when a precaution is noted. However, situations may arise when the benefits of vaccination outweigh the estimated risk of an adverse event, and the provider may decide to vaccinate the patient despite the precaution. In some cases, contraindications and precautions are temporary and may lead to mere deferral of vaccination until a later time. For example, moderate or severe acute illness with or without fever is generally considered a transient precaution to vaccination and results in postponement of vaccine administration until the acute phase has resolved; thus, the superimposition of adverse effects of vaccination on the underlying illness and the mistaken attribution of a manifestation of the underlying illness to the vaccine are avoided. Contraindications and precautions to vaccines licensed in the United States for use in adults are summarized in Table 129-3. It is important to recognize con ditions that are not contraindications in order not to miss opportunities for vaccination. For example, in most cases, mild acute illness (with or without fever) or a history of a mild to moderate local reaction to a previous dose of the vaccine are not contraindications to vaccination. History of Immediate Hypersensitivity to a Vaccine Compo nent A severe allergic reaction (e.g., anaphylaxis) to a previous dose of a vaccine or to one of its components is a contraindication to vac cination. While most vaccines have many components, substances to which individuals are most likely to have had a severe allergic reaction include egg protein, gelatin, and yeast. In addition, although natural rubber (latex) is not a vaccine component, some vaccines are supplied in vials or syringes that contain natural rubber latex. These vaccines can be identified by the product insert and should not be administered to persons who report a severe (anaphylactic) allergy to latex unless the benefit of vaccination clearly outweighs the risk for a potential allergic reaction. The much more common local or contact hypersensitivity to latex, such as to medical gloves (which contain synthetic latex that is not linked to allergic reactions), is not a contraindication to adminis tration of a vaccine supplied in a vial or syringe that contains natural rubber latex. ■ ■SPECIFIC ADULT POPULATIONS Pregnant Persons Several vaccines are recommended for preg nant persons in the United States: tetanus and diphtheria toxoids and acellular pertussis (Tdap), inactivated influenza, COVID-19, and respiratory syncytial virus (RSV) vaccine, as well as hepatitis B vaccine (if not already vaccinated). Tdap and RSV vaccine are administered to pregnant persons specifically to prevent severe pertussis and RSV disease, respectively, in their infants, while influenza, COVID-19, and hepatitis B (HepB) vaccines are given to protect both the pregnant person and infant. Tdap vaccine is recommended during each pregnancy at the 27th through 36th week of gestation (preferably during the earlier part of this time period), regardless of prior vaccination status, in order to prevent pertussis in young infants. Annual influenza vaccination is rec ommended for everyone age ≥6 months, including pregnant persons in any trimester, ideally during September or October. Vaccination during July or August can be considered for pregnant persons in their third trimester if vaccine is available. Staying up to date with COVID-19 vaccination is recommended for everyone age ≥6 months, including pregnant persons in any trimester. It is recommended that every infant receive protection against severe RSV disease, either through maternal RSV vaccination during the 32nd through 36th week of gestation (dur ing September to January) or through infant administration of nirse vimab, a long-acting monoclonal antibody. Pregnant persons may need additional vaccines as well, such as HepB vaccine if not already vaccinated, since all adults age 19 through 59 years are recommended to receive HepB vaccination. Pregnancy is not a contraindication to administration of most other inactivated vaccines when otherwise indicated or when the benefits of vaccination are judged to outweigh potential risks (e.g., serogroup B meningo coccal vaccination); it is recommended that

human papillomavirus (HPV) and recombinant zoster vaccination are delayed until after pregnancy. Live-virus vaccines (e.g., measles, mumps, and rubella

[MMR], varicella) are contraindicated during pregnancy because of the hypothetical risk that vaccine virus replication will cause congenital infection or have other adverse effects on the fetus. Patients who are breast-feeding or trying to get pregnant should stay up to date on all recommended vaccines, especially as certain congenital infections (e.g., rubella) are preventable through vaccination.

Immunocompromised Persons Immunocompromised persons are at increased risk for severe outcomes from infectious diseases. Therefore, staying up to date on recommended vaccines is impor tant for this population. Immunocompromised patients may need to receive vaccines at an earlier age than the general population (e.g., pneumococcal and zoster at age ≥19 years instead of age ≥50 years), receive additional doses of a recommended vaccine (e.g., three-dose primary series and additional doses of COVID-19), receive vaccines based on a particular type of immunocompromising condition (e.g., meningococcal vaccination for those with complement deficiency), or have different vaccine recommendations based on degree of immune suppression, particularly for live-virus vaccines. Live-virus vaccines elicit an immune response due to replication of the attenuated (weak ened) vaccine virus that is contained by the recipient’s immune system. In persons with compromised immune function, enhanced replication of vaccine viruses is possible and could lead to disseminated infection with the vaccine virus. For this reason, live-virus vaccines are con traindicated for persons with severe immunosuppression, the defini tion of which may vary with the vaccine. Severe immunosuppression may be caused by many disease conditions, including hematologic or other malignancy. In some of these conditions, all affected persons are severely immunocompromised. In others (e.g., HIV infection), the degree to which the immune system is compromised depends on the severity of the condition, which in turn depends on the stage of disease or treatment. For example, MMR vaccine may be given to HIVinfected persons with CD4 percentage of ≥15 and count of ≥200/μL. CHAPTER 129 Older Adults As age increases, the ability to mount adaptive and innate immune responses declines, resulting in increased susceptibility to infectious diseases and reduced responses after vaccination. This immunosenescence, along with increased rates of underlying condi tions, increases the risk of severe outcomes of infectious diseases in older adults. Long-term care facility residents among this age group are potentially at even greater risk due to increased frailty as well as risk of transmission associated with congregate settings. In addition to staying up to date on all recommended vaccines (e.g., COVID-19, Td/Tdap), there are specific vaccine recommendations for older adults: zoster vaccine in adults age ≥50 years, pneumococcal conjugate vaccine for adults age ≥50 years, and RSV vaccine in all adults aged ≥75 years and in those age 60–74 years at increased risk for severe RSV. Further more, adults age ≥65 years are recommended to receive a higher-dose influenza vaccine (i.e., high-dose, adjuvanted, or recombinant vaccine) rather than the standard-dose vaccine. Immunization Principles and Vaccine Use Health Care Workers Health care workers are recommended to stay up to date with all vaccines recommended for them based on age or underlying condition (including influenza and COVID-19 vac cines), and they may be recommended to receive additional vaccines due to their occupational exposure (e.g., meningococcal vaccine for laboratory personnel who handle Neisseria meningitidis isolates). As part of their participation in the Centers for Medicare and Medicaid Services’ Hospital Inpatient Quality Reporting program, acute-care hospitals and select other facilities are required to report the propor tion of their health care personnel who have

received seasonal influ enza and COVID-19 vaccination. Some institutions and jurisdictions have added mandates on influenza vaccination of health care workers and have expanded on earlier requirements related to vaccination or proof of immunity for hepatitis B, measles, mumps, rubella, and varicella. ■ ■VACCINE INFORMATION STATEMENTS A Vaccine Information Statement (VIS) is a one-page (twosided) information sheet produced by the CDC that informs vaccine

PART 5 Infectious Diseases TABLE 129-3 Contraindications and Precautions for Commonly Used Vaccines in Adults VACCINE FORMULATION CONTRAINDICATIONS AND PRECAUTIONS All vaccines Contraindication Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component Precaution Moderate or severe acute illness with or without fever. Defer vaccination until illness resolves. Td Precautions GBS within 6 weeks after a previous dose of TT-containing vaccine History of Arthus-type hypersensitivity reactions after a previous dose of TD- or DT-containing vaccines (including MenACWY). Defer vaccination until at least 10 years have elapsed since the last dose. Tdap Contraindication History of encephalopathy (e.g., coma or prolonged seizures) not attributable to another identifiable cause within 7 days of administration of a vaccine with pertussis components, such as DTaP or Tdap Precautions GBS within 6 weeks after a previous dose of TT-containing vaccine Progressive or unstable neurologic disorder, uncontrolled seizures, or progressive encephalopathy. Defer vaccination until a treatment regimen has been established and the condition has stabilized. History of Arthus-type hypersensitivity reactions after a previous dose of TT- or DT-containing vaccines (including MenACWY). Defer vaccination until at least 10 years have elapsed since the last dose. HPV Contraindications History of immediate hypersensitivity to yeast Pregnancy (vaccinate after pregnancy if indicated) MMR Contraindications History of immediate hypersensitivity reaction to gelatina or neomycin Pregnancy (vaccinate after pregnancy if indicated) Known severe immunodeficiency (e.g., hematologic and solid tumors; chemotherapy; congenital immunodeficiency; long-term immunosuppressive therapy; severe immunocompromise due to HIV infection) Family history of altered immunocompetence (i.e., congenital or hereditary immunodeficiency in a first-degree relative), unless the immune competence of the potential vaccine recipient has been substantiated clinically or verified by a laboratory Precautions Recent receipt (within 11 months) of antibody-containing blood product History of thrombocytopenia or thrombocytopenic purpura Need for tuberculin skin testing or interferon γ release assay (IGRA) testing Varicella Contraindications Pregnancy (vaccinate after pregnancy if indicated) Known severe immunodeficiency History of immediate hypersensitivity reaction to gelatina or neomycin Family history of altered immunocompetence (i.e., congenital or hereditary immunodeficiency in a first-degree relative), unless the immune competence of the potential vaccine recipient has been substantiated clinically or verified by a laboratory Precaution Recent receipt (within 11 months) of antibody-containing blood product Receipt of specific antiviral drugs (acyclovir, famciclovir, or valacyclovir) 24 h before vaccination Use of aspirin or aspirin-containing products Influenza, inactivated, injectable Precautionb History of GBS within 6 weeks after a previous influenza vaccine dose Influenza, live attenuated nasal spray Contraindicationsb Pregnancy Immunosuppression, including that caused by medications or by HIV infection; known severe immunodeficiency (e.g., hematologic and solid tumors; chemotherapy; congenital immunodeficiency; long-term immunosuppressive therapy; severe immunocompromise due to HIV infection) Close contact with severely immunosuppressed persons who require a protected environment, such as isolation in a bone marrow transplantation unit Receipt of oseltamivir or zanamivir within 48 h before vaccination, peramivir within the previous 5 days, or baloxavir within the previous 17 days. Active cerebrospinal fluid/oropharyngeal communications/leaks Cochlear

implants Anatomic or functional asplenia (e.g., sickle cell disease) Precautions History of GBS within 6 weeks of a previous influenza vaccine dose Medical conditions that might predispose to higher risks of complications from influenza, such as diabetes mellitus; chronic pulmonary disease (including asthma); chronic cardiovascular disease (except hypertension); renal, hepatic, neurologic/neuromuscular, hematologic, or metabolic disorders (Continued)

TABLE 129-3 Contraindications and Precautions for Commonly Used Vaccines in Adults VACCINE FORMULATION CONTRAINDICATIONS AND PRECAUTIONS Pneumococcal polysaccharide None, other than those listed for all vaccines Pneumococcal conjugate None, other than those listed for all vaccines Hepatitis A Contraindication History of immediate hypersensitivity to neomycin Hepatitis B Contraindications History of immediate hypersensitivity to yeast (for Engerix-B and Recombivax-HB) Pregnancy: Heplisav-B and PreHevbrio are not recommended; use other hepatitis B vaccines if indicated Meningococcal conjugate None, other than those listed for all vaccines Serogroup B meningococcal Precaution Pregnancy (vaccination may be indicated if benefits of protection outweigh risks of adverse reaction) Zoster Precaution Current herpes zoster infection COVID-19 Precaution Diagnosed nonsevere allergy (e.g., urticaria beyond the injection site) or nonsevere, immediate (onset <4 h) allergic reaction after administration of a previous dose Myocarditis or pericarditis within 3 weeks after a dose Multisystem inflammatory syndrome in children (MIS-C) or multisystem inflammatory syndrome in adults (MIS-A) Respiratory syncytial virus None, other than those listed for all vaccines Mpox None, other than those listed for all vaccines aExtreme caution must be exercised in administering MMR, varicella, or live zoster vaccine to persons with a history of anaphylactic reaction to gelatin or gelatin-containing products. Before administration, skin testing for sensitivity to gelatin can be considered. However, no specific protocols for this purpose have been published. bHistory of severe allergic reaction (e.g., anaphylaxis) to egg is a labeled contraindication to the use of inactivated influenza vaccine and live attenuated influenza vaccine. However, CDC’s Advisory Committee on Immunization Practices recommends that any licensed, recommended, and appropriate inactivated influenza vaccine or recombinant influenza vaccine may be administered to persons with egg allergy of any severity (www.cdc.gov/acip-recs/hcp/vaccine-specific/flu.html). Abbreviations: DT, diphtheria toxoid; DTaP, diphtheria, tetanus, and pertussis; GBS, Guillain-Barré syndrome; HPV, human papillomavirus; MenACWY, quadrivalent meningococcal conjugate vaccine; MMR, measles, mumps, and rubella; Td, tetanus and diphtheria toxoids; Tdap, tetanus and diphtheria toxoids and acellular pertussis;

TT, tetanus toxoid. recipients (or their parents or legal representatives) about the benefits and risks of a vaccine. VISs are mandated by the National Childhood Vaccine Injury Act (NCVIA) of 1986 and—whether the vaccine recipi ent is a child or an adult—must be provided for any vaccine covered by the Vaccine Injury Compensation Program (VICP). As of February 2024, vaccines that are covered by the NCVIA and that are licensed for use in adults include tetanus, diphtheria, hepatitis A, hepatitis B, HPV, influenza, MMR, pneumococcal conjugate, meningococcal, polio, and varicella vaccines. When combination vaccines for which no separate VIS exists are administered (e.g., hepatitis A and B combination vac cine), all relevant VISs should be provided. In addition, although provi sion of a VIS is not specifically mandated under the Public Readiness and Emergency Preparedness (PREP) Act, which authorizes the Coun termeasures Injury Compensation Program (CICP), CDC has pub lished VISs for the approved or authorized vaccines currently covered under the CICP, including COVID-19 and mpox vaccines. The CICP provides compensation for injuries that occur after the administration of certain countermeasures. VISs also exist for some

vaccines not covered by the VICP or CICP, such as pneumococcal polysaccharide, Japanese encephalitis, rabies, herpes zoster, typhoid, and yellow fever vaccines. The use of these VISs is encouraged but is not mandated. All current VISs are available at two websites: the CDC's Vaccine Information Statements site (www.cdc.gov/vaccines/hcp/vis/) and the Immunization Action Coalition's site (www.immunize.org/vaccines/vis/ about-vis/). (The latter site also includes translations of the VISs.) VISs from these sites can be downloaded and printed. ■ ■STORAGE AND HANDLING Injectable vaccines are packaged in multidose vials, single-dose vials, or manufacturer-filled single-dose syringes. The live attenuated nasal-spray influenza vaccine is packaged in single-dose sprayers. Oral typhoid

(Continued) CHAPTER 129 Immunization Principles and Vaccine Use vaccine is packaged in capsules. Some vaccines, such as MMR and varicella, come as lyophilized (freeze-dried) powders that must be recon stituted (i.e., mixed with a liquid diluent) before use. The lyophilized powder and the diluent come in separate vials. Diluents are not inter changeable but rather are specifically formulated for each type of vaccine; only the specific diluent provided by the manufacturer for each type of vaccine should be used. Once lyophilized vaccines have been reconsti tuted, their shelf-life is limited and they must be stored under appropri ate temperature and light conditions. For example, varicella must be protected from light and administered within 30 min of reconstitution; recombinant zoster and MMR vaccines likewise must be protected from light but can be used up to 6 and 8 h after reconstitution, respectively. Vaccines are stored either at refrigerator temperature (2–8°C) or at freezer temperature (–15°C or colder). In general, inactivated vaccines (e.g., inactivated influenza, pneumococcal polysaccharide, and menin gococcal conjugate vaccines) are stored at refrigerator temperature, while vials of lyophilized-powder live-virus vaccines (e.g., varicella, MMR vaccines) are stored at freezer temperature. Diluents for lyophi lized vaccines may be stored at refrigerator or room temperature. Live attenuated influenza vaccine—a live-virus liquid formulation adminis tered by nasal spray—is stored at refrigerator temperature. Vaccine storage and handling errors can result in the loss of vaccines worth millions of dollars, and administration of improperly stored vaccines may elicit inadequate immune responses or adverse events in patients. To improve the standard of vaccine storage and handling practices, the CDC has published detailed guidance (available at www. cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit. pdf). For vaccine storage, the CDC recommends stand-alone units— i.e., self-contained units that either refrigerate or freeze but do not do both—as these units maintain the required temperatures better than combination refrigerator/freezer units. Dormitory-style combined refrigerator/freezer units should never be used for vaccine storage.

The temperature of refrigerators and freezers used for vaccine stor age must be monitored and recorded at least twice each workday. Ide ally, continuous thermometers that measure and record temperature all day and all night are used, and minimal and maximal temperatures are read and documented each workday. The CDC recommends the use of calibrated digital thermometers with a probe in thermal-buffered material; more detailed information on specifications of storage units and temperature-monitoring devices is provided at the link given above.

■ ■ADMINISTRATION OF VACCINES Most parenteral vaccines recommended for routine administration to adults in the United States are given by either the intramuscular (IM) or the subcutaneous (SC) route; one influenza vaccine formulation approved for use in persons 2–49 years of age is given intranasally. Some vaccines can be given by multiple routes; for example, MMRV

vaccine, one of the MMR vaccines (M-M-R II), and 23-valent pneumo coccal polysaccharide vaccine can be given by either IM or SC route, and the mpox vaccine can be given intradermally or subcutaneously. Vaccines given to adults by the SC route are administered with a 5/8-inch needle into the upper outer-triceps area. Vaccines adminis tered to adults by the IM route are injected into the deltoid muscle (Fig. 129-2) with a needle whose length should be selected on the basis of the recipient's sex and weight to ensure adequate penetra tion into the muscle. Current guidelines indicate that, for men and women weighing <152 lb (<70 kg), a 1-inch needle is sufficient; for women weighing 152–200 lb (70–90 kg) and men weighing 152–260 lb (70–118 kg), a 1- to 1.5-inch needle is needed; and for women weigh ing >200 lb (>90 kg) and men weighing >260 lb (>118 kg), a 1.5-inch needle is required. Additional illustrations of vaccine injection loca tions and techniques may be found at www.immunize.org/wp-content/ uploads/catg.d/p2020.pdf. PART 5 Infectious Diseases Aspiration, the process of pulling back on the plunger of the syringe after skin penetration but prior to injection, is not necessary because no large blood vessels are present at the recommended vaccine injec tion sites. Multiple vaccines can be administered at the same visit; indeed, administration of all needed vaccines at one visit is encouraged. Studies have shown that in general, vaccines are as effective when administered simultaneously as they are individually, and simultaneous administra tion of multiple vaccines is not associated with an increased risk of Site of intramuscular injection: deltoid Dermis Fatty tissue (subcutaneous) Muscle tissue FIGURE 129-2 Technique for IM administration of vaccine.

adverse effects and may increase uptake due to not needing to return for subsequent vaccinations. If more than one vaccine must be admin istered in the same limb, the injection sites should be separated by 1–2 inches so that any local reactions can be differentiated. If a vaccine and an immune globulin preparation are administered simultaneously (e.g., Td vaccine and tetanus immune globulin), a separate anatomic site should be used for each injection. For certain vaccines (e.g., hepatitis B vaccine), multiple doses are required for an adequate and persistent antibody response. The rec ommended vaccination schedule specifies the interval between doses. Many adults who receive the first dose in a multiple-dose vaccine series do not complete the series or do not receive subsequent doses within the recommended interval; this lack of adherence to protocol com promises vaccine efficacy and/or the duration of protection. Providers should implement recall systems that will prompt patients to return for subsequent doses in a vaccination series at the appropriate intervals. With some exceptions (e.g., oral typhoid vaccine), an interruption in the schedule does not require restarting of the entire series or the addi tion of extra doses. Syncope may follow vaccination, especially in adolescents and young adults. Serious injuries, including skull fracture and cerebral hemorrhage, have occurred. Adolescents and adults should be seated or lying down during vaccination. The majority of reported syncope episodes after vaccination occur within 15 min. The CDC recommends that vaccine providers consider observing vaccine recipients, particu larly adolescents, with patients seated or lying down for 15 min after vaccination to decrease the risk of injury should they develop syncope. If syncope develops, patients should be observed until the symptoms resolve. Anaphylaxis is a rare complication of vaccination. All facilities providing immunizations should have an emergency kit containing aqueous epinephrine for administration in the event of a systemic anaphylactic reaction. ■ ■MAINTENANCE OF VACCINE RECORDS All vaccines administered should be fully documented in the patient's permanent medical record. Documentation should include the date of administration, the name or common abbreviation of the vaccine, the vaccine lot number and manufacturer, the administration site, the VIS edition, the date the VIS was provided, and the name, address, and title of the person who

administered the vaccine. Increasing use Intramuscular needle insertion 90°

of two-dimensional bar codes on vaccine vials and syringes that can be scanned for data entry into compatible electronic medical records and immunization information systems may facilitate more complete and accurate recording of required information. ■ ■VACCINE SAFETY MONITORING AND ADVERSE EVENT REPORTING Prelicensure Evaluations of Vaccine Safety Before vaccines are licensed by the FDA, they are evaluated in clinical trials with vol unteers. These trials are conducted in three progressive phases. Phase 1 trials are small, usually involving <100 volunteers. Their purposes are to provide a basic evaluation of safety and to identify common adverse events. Phase 2 trials, which are larger and may involve several hundred participants, collect additional information on safety and are usually designed to evaluate immunogenicity as well. Data gained from phase 2 trials can be used to determine the composition of the vaccine, the number of doses required, and a profile of common adverse events. Vaccines that appear promising are evaluated in phase 3 trials, which typically involve several hundred to several thousand volunteers and are generally designed to demonstrate vaccine efficacy and provide additional information on vaccine safety. Postlicensure Monitoring of Vaccine Safety After licensure, a vaccine's safety is assessed by several mechanisms. The NCVIA of 1986 requires health care providers to report certain adverse events that follow vaccination. As a mechanism for that reporting, the Vaccine Adverse Event Reporting System (VAERS) was established in 1990 and is jointly managed by the CDC and the FDA. This safety surveillance system collects reports of adverse events associated with vaccines cur rently approved or authorized in the United States. Adverse events are defined as untoward events that occur after immunization and that might be caused by the vaccine product or vaccination process. While the VAERS was established in response to the NCVIA, reporting of any adverse event following vaccination—whether in a child or an adult, and whether or not it is believed to have actually been caused by vaccination—is encouraged through the VAERS. The adverse events that health care providers are required to report are listed in the reportable-events table at vaers.hhs.gov/docs/VAERS_Table_of_Report able_Events_Following_Vaccination.pdf. The number of VAERS reports submitted varies each year. In 2019, VAERS received more than 48,000 reports. Approximately 85–90% of the reports described mild side effects such as fever, arm soreness, or mild irritability; the remaining reports are classified as serious. However, a report to VAERS does not mean that a vaccine caused an adverse event. Anyone can file a VAERS report, including health care providers, manufacturers, and vaccine recipients or their parents or guardians. VAERS reports may be submitted online or in paper form (vaers.hhs. gov/reportevent.html); additional information can be obtained by email (info@vaers.org) or phone (800-822-7967). The VAERS form asks for the following information: the type of vaccine received; the timing of vaccination; the time of onset of the adverse event; and the recipient's current illnesses or medications, history of adverse events following vaccination, and demographic characteristics (e.g., age and sex). This information is entered into a database. The individual who reported the adverse event then receives a confirmation letter by mail with a VAERS identification number that can be used if additional informa tion is submitted later. In selected cases of serious adverse reaction, the patient's recovery status may be followed up at 60 days and 1 year after vaccination. The FDA and the CDC have access to VAERS data and use this information to monitor vaccine safety and conduct research studies. VAERS data (minus personal information) are also available to the public. While the VAERS provides useful information on vaccine safety, this passive reporting system has important limitations. One is that events following vaccination are merely reported; the system cannot assess whether a given type of event occurs more often than

expected after vaccination. A second is that event reporting is incomplete and is biased toward events that are believed to be more likely to be due to vaccination and that occur relatively soon after vaccination. To obtain

more systematic information on adverse events occurring in both vac cinated and unvaccinated persons, the Vaccine Safety Datalink project was initiated in 1991. Directed by the CDC, this project includes 11 managed-care organizations in the United States; member databases include information on immunizations, medical conditions, demo graphics, laboratory results, and medication prescriptions. In addition to these systems, CDC, FDA, and other federal partners use multiple other systems and data sources to conduct comprehensive vaccine safety monitoring, including CDC's V-safe system, FDA's Biologics Effectiveness and Safety (BEST) system, CMS's Medicare claims data base, and the Department of Defense's Vaccine Adverse Event Clinical System. In addition, postlicensure evaluations of vaccine safety may be conducted by the vaccine manufacturer. In fact, such evaluations are often required by the FDA as a condition of vaccine licensure.

■ ■CONSUMER ACCESS TO AND DEMAND FOR IMMUNIZATION By removing barriers to the consumer or patient, providers and health care institutions can improve vaccine use. Financial barriers have tra ditionally been important constraints. Fortunately, some progress has been made to mitigate out-of-pocket costs for vaccination of adults. The Affordable Care Act enacted in 2010 requires that most private insurance plans provide coverage for immunizations that appear on the approved immunization schedules without deductibles or copays when administered by an in-network provider. In addition, as of 2023, the Inflation Reduction Act eliminated out-of-pocket costs for ACIPrecommended vaccines for patients with Medicare prescription drug coverage and requires state Medicaid programs to cover and pay for ACIP-recommended adult vaccines without cost-sharing. However, barriers to vaccination remain for uninsured adults. A comprehensive Vaccines for Adults program to provide vaccines to uninsured adults has been proposed but has not yet been authorized for funding. To help ensure access to COVID-19 vaccines for uninsured and underinsured adults, CDC launched the Bridge Access Program for COVID-19 vaccines in 2023; this program ended in 2024. CHAPTER 129 Immunization Principles and Vaccine Use In addition to removing financial barriers, other strategies that enhance patients' access to vaccination include extended office hours (e.g., evening and weekend hours) and scheduled vaccination-only clinics where waiting times are reduced. In recent years, pharmacies have become an increasingly important venue for adult vaccination and have helped improve equitable access to vaccines, given that the majority of the adult population lives within 5 miles of a pharmacy. Other locations outside the "medical home" (e.g., through occupa tional clinics, universities, and retail settings) also can expand access for adults who do not make medical visits frequently. Health promotion efforts aimed at increasing the demand for immunization are common. Direct-to-consumer advertising by phar maceutical companies has been used for some newer adolescent and adult vaccines. Efforts to raise consumer demand for vaccines have not increased immunization rates unless implemented in conjunction with other strategies that target strengthening of provider practices or reduction of consumer barriers. Attitudes and beliefs related to vacci nation can be considerable impediments to consumer demand. Many adults view vaccines as important for children but are less familiar with vaccinations targeting disease prevention in adults. Several vac cines are recommended for adults with certain medical risk factors, but self-identification as a high-risk individual is relatively rare. Com munication research suggests that adults are motivated to get vaccines to protect their own health and many would get vaccinated to protect loved ones. Adults

with chronic conditions are more likely to be aware that they need to protect their own health. ■ ■STRATEGIES FOR PROVIDERS AND HEALTH CARE FACILITIES Recommendation from the Provider Health care providers can have great influence on patients with regard to immunization. Studies repeatedly show that a health care provider is the most trusted source of vaccine information, and patients who receive a strong vaccine rec ommendation from a provider are more likely to get vaccinated than

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