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Addressing immunization barriers, benefits, and risks

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Vaccines have been highly effective in eliminating or significantly decreasing the occurrence of many once-common diseases. Barriers to immunization are a significant factor in the rising incidence rates of some vaccine-preventable diseases. Cost, reduced accessibility to immunizations, increasingly complex childhood and adolescent/adult immunization schedules, and increasing focus on the potential adverse effects of vaccines all contribute to difficulty in meeting the 2010 immunization goals. Physicians must not only be knowledgeable about vaccines but they must incorporate systems in their offices to record, remind, and recall patients for vaccinations. They must also clearly communicate vaccine benefits and risks while understanding those factors that affect an individual's acceptance and perception of those benefits and risks.

Vaccines have almost eliminated or significantly reduced the incidence of many diseases, but tens of thousands of children and adults in the United States continue to develop vaccine-preventable diseases. Reported cases of pertussis have increased from a low of 1010 cases in 1976[1] to 25,827 in 2004,[2] with the majority of these cases occurring in adolescents and adults. Potential reasons for this include genetic changes in *Bordetella pertussis* (which make vaccines less effective), decreased potency of pertussis vaccines, greater awareness of pertussis, and improved diagnostic tests.[3] However, many of these cases are believed to be caused by waning immunity or inadequate immunization. In 2005, only 76.1% of US children aged 19 to 35 months had received all of the recommended doses of DTaP, Hib, hepatitis B, MMR, polio, and varicella vaccines, although rates of those who received most individual vaccines were higher.[4] A *Healthy People 2010* goal is to immunize 90% of young children and adolescents with age-appropriate vaccines.[5]

Barriers to immunization are grouped as systems barriers (eg, those involving the organization of the health care system and economics), health care provider barriers (eg, inadequate clinician knowledge about vaccines and contraindications to their use), and parent or patient barriers (eg, fear of immunization-related adverse events).[6] These barriers affect immunization rates and increase the burden of preventable disease in our society.

Systems Barriers to Immunization

Factors affecting the supply and distribution of vaccines are among the most noticeable systems barriers. The supply of influenza, conjugate pneumococcal, and, most recently, tetravalent conjugate meningococcal (MCV4) vaccines have been inadequate due to a lack of manufacturing capacity.[7] A misdistribution of vaccines has also occurred. Uninsured and Medicaid-insured children may qualify to receive vaccines through the Vaccines for Children program (VFC), but VFC does not provide funding to reimburse providers for the costs of administering those vaccines. Uninsured adults represent another major systems problem.

Provider Barriers to Immunization

Providers may lack knowledge about the indications for and contraindications to immunization. Expanded uses for current vaccines such as hepatitis A vaccine for children aged 12 months or older and new vaccines against rotavirus and zoster make it difficult for health care providers to stay current with immunization schedules. A study of California

practices found that knowledge deficits regarding immunization schedules, vaccine contraindications, and vaccine side effects were present among physicians and nonphysician office staff.[8]

One early study indicated that almost one half of nurses (as reported by physicians) were resistant to giving children 3 or more injections and that parents and physicians were also uncomfortable about this.[9] However, a later study at an inner-city pediatric clinic indicated that parents overwhelmingly complied with physicians' recommendations for immunizations.[10] Thus, the attitude the physician transmits to his or her staff about the importance of immunizations is crucial. Combination vaccines that decrease the number of shots administered at a single visit also enhance compliance.

Logistical barriers faced by health care providers include the cost of immunizations, vaccine storage or capacity, and lack of access to patients' prior immunization records. Vaccines with stringent storage requirements, such as varicella vaccine or live attenuated influenza vaccine, may present a challenge. Fragmentation of patient care makes it more likely that providers will not have complete immunization records for patients currently in their care. This can lead to incomplete immunization and overimmunization.

Missed visits and missed opportunities for immunization when necessary vaccines are not administered at a visit are also notable barriers to timely completion of immunization requirements. When health care providers have routinely assessed a patient's immunization status and notified patients and parents about vaccinations that were due (reminders) or overdue (recalls), immunization rates have improved. Reminder/recall systems can be time-consuming and cost-intensive, and they are used infrequently.[11] Greater use of electronic medical record systems should make reminder/recall systems more efficient.

Immunization registries are computerized databases that consolidate vaccination data from multiple health care providers within a defined geographic area and can generate reminder and recall notices. Currently, 48% of children younger than 6 years old participate in an immunization registry.[12] One national health objective calls for a participation rate of 95% of children younger than 6 years old by the year 2010.[5]

Patient and Parent Barriers to Immunization

Patients or their parents or guardians may lack knowledge about immunizations, be fearful of vaccine safety, or lack transportation. They may be unaware of the threat of vaccine-preventable diseases or that safe and effective vaccines are available against these diseases. Complicated immunization schedules, fragmented care records, inconvenient clinic hours, long wait times for immunizations, transportation problems, and cost are other examples of logistical barriers to immunization. One study found that mothers in rural West Virginia were more likely to have fully immunized children if they felt that the clinic they attended was "supportive," which included variables such as staff who would clarify immunization schedules, convenient office hours, and limited wait time for immunizations.[6]

The VFC program has funded immunizations for uninsured and Medicaid-insured children since its inception in 1994, but not all underinsured children can visit their usual source of health care and receive these vaccines at no cost. Even low-income parents of children who qualify for immunizations through a VFC program at their usual source of care may not be aware of this program, and these parents continue to cite cost as a barrier to immunization.[13] Families who might qualify for free vaccinations may face other barriers such as transportation problems. To limit additional patient trips to health care providers, all eligible physicians should become VFC providers so that immunizations can be given at the child's medical "home." However, children who have health insurance that does not cover immunizations must continue to receive their vaccinations at public or federally funded health clinics.

Solutions

Despite the many barriers described above, research has shown that some interventions can—and do—improve immunization rates **(TABLE 1)**. In diverse adult populations, one of the strongest predictors of influenza immunization is a physician's recommendation to receive the vaccine.[14,15] In low-income pediatric populations, enrollment in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC)—which offers programs to educate parents about the importance of immunizations—improves immunization rates among both urban and nonurban pediatric populations.[13,16]

Educational resources for parents who decline vaccination because of antivaccine misinformation can be found both in print and on the Internet. Providers should tell parents about Web sites that present more balanced and useful information on the

TABLE 1

Barriers and solutions to vaccination

Barriers	Solutions
Knowledge deficits	
• Patients and families	• Education through WIC, community outreach, provider recommendation, Web sites
• Providers	• Recognized sources of information/guidelines (AAFP, AAP, and CDC Web sites, AAP *Red Book*, *Shots* software from www.ImmunizationEd.org)
Fragmented care	• Immunization registries
Vaccine shortages	• Improved vaccine infrastructure
	• Fair reimbursement for vaccines
Missed visits, missed opportunities	• Reminder/recall systems
	• Fair reimbursement for vaccination
	• Standing orders
	• Shared responsibility for identifying needed vaccines with nursing personnel during vital signs or through smart electronic records
	• Combination vaccines to decrease number of shots required at a visit

AAFP = American Academy of Family Physicians; AAP = American Academy of Pediatrics; CDC = Centers for Disease Control and Prevention; WIC = Special Supplemental Nutrition Program for Women, Infants and Children.

risks and benefits of vaccination as well as links to other sources. Among these Web sites are the following:

- American Association of Pediatrics (AAP): www.aap.org
- US Centers for Disease Control and Prevention (CDC): www.cdc.gov/nip
- Society of Teachers of Family Medicine's Group on Immunization Education (GIE): www.ImmunizationEd.org
- Vaccine Information Center at the Children's Hospital of Philadelphia: www.chop.edu
- Immunization Action Coalition (IAC): www.vaccineinformation.org

Parents opposed to immunizations are often distrustful of "official" sources but may be more willing to accept information from their personal physician who takes time to listen to their concerns and respond in a thoughtful manner.

Immunization registries are being developed in all states and in the District of Columbia.[17] In 2002, 43% of all US children had at least 2 immunizations recorded in a registry. However, about 40% of children in the registries had incomplete or missing data on administered doses of vaccine.[17] Lack of time or staff to enter data as well as possible transcription errors may make some physicians hesitant to use these systems; however, they save time when immunization records are requested for school or camp forms and improve immunization rates.[18] Another study also showed that complete computerization of paper immunization records saved both time and money.[19]

The Task Force on Community Preventive Services recommended or strongly recommended implementation of the following measures to increase immunization rates[20]:

- Reminder/recall systems for patients, families, and providers
- Requirement of vaccination as a prerequisite for enrollment in school and childcare
- Decreases in out-of-pocket costs for patients/families
- Assessment of—and collection of feedback regarding—immunization rates for individual providers
- Issuance of standing orders for adult immunization
- Provision of immunization services in homes and WIC settings
- Implementation of multicomponent interventions that expand access to services and provide education to target populations.

Interventions tailored to the culture of a provider's practice and its patients should increase immunization rates. A study of tailored standing orders, reminders, and express vaccination services in inner-city clinics found that these measures led to an increase in influenza immunization rates.[21]

Communicating the Benefits and Risks of Vaccines

The benefits of immunization are often obvious to health care providers; however, patients, parents, and the general public may have questions or concerns.

As knowledge of the devastation caused by many vaccine-preventable diseases fades from public memory, attention shifts to the occasionally serious adverse events that may follow immunization. The dissemination of (mis)information and anecdotal reports of alleged vaccine reactions by the media, the Internet, and antivaccine groups causes parents, patients, and even some health care providers to question the justification for immunizations.[22] Some physicians may be reluctant to administer immunizations because of liability concerns. An Ohio study demonstrated that liability concerns influenced the decisions of 9% of family physicians and 23% of pediatricians in their choice of polio vaccines.[23] Consequently, vaccines have become victims of their own success. If a loss of confidence in the vaccine develops, then an outbreak of disease may ensue, resulting in resumption of vaccine use.[24]

Public Perceptions of Vaccine Safety

Parents of incompletely immunized British children were likely to report that immunization was riskier for their child than was nonimmunization due to concerns about vaccine-related side effects, the belief that their child was not at risk for the disease, or the belief that the disease was not serious.[16] In the United States, concerns about vaccine safety are more common among parents of underimmunized children, but many parents of fully immunized children have also expressed such concerns.[25] Most family physicians and almost all pediatricians reported at least 1 vaccine refusal from parents during the year 2000.[26] A Canadian study found that most mothers would accept a 1:100,000 to 1:1,000,000 risk for a severe vaccine side effect; however, 14% would not tolerate any serious risk.[27]

Common Misconceptions About Vaccines

Most parents support immunizations for their children, but misconceptions do exist. Some parents believe that the administration of too many immunizations will weaken their child's immune system[28] or cause chronic diseases such as asthma, autism, diabetes mellitus (DM), or multiple sclerosis (MS).[29] Some believe that vaccine-preventable diseases had already begun to disappear prior to the use of vaccines or that there are "hot lots" of vaccines that have a greater frequency and/or severity of adverse events.[29] Others believe that vaccines are not "natural" and thus prefer disease-induced immunity. Individuals often use cognitive shortcuts or heuristics to simplify complex decisions and judgments.[30] Parents who are nonvaccinators may believe they can control their child's susceptibility to disease, have doubts about the reliability of vaccine information, prefer errors of omission over errors of commission, or rely on herd immunity to protect their child.[31] **TABLE 2** summarizes heuristic factors that affect vaccine-related risk perception.[30]

Multiple Vaccines and the Immune System

Almost 25% of parents believe that "children get more immunizations than are good for them."[28] However, most parents and many providers may not realize that the actual number of antigens in these vaccines has decreased. For example, the older whole-cell pertussis vaccine had approximately 3000 antigens compared with 2 to 7 for newer acellular pertussis vaccines.[32] Rather than weakening the immune system, vaccines may prevent infections that predispose individuals to serious diseases. For example, varicella is often complicated by necrotizing group A beta-hemolytic streptococcal fasciitis in children or by pneumonia in adults.[32]

Explaining Vaccine Benefits and Risks

Physicians serve as the primary source of immunization information for most parents and patients. In one national survey, 84% of respondents indicated that they received immunization information from a doctor.[28] Physicians must accurately portray the benefits of immunization while acknowledging that vaccines are not always effective and—in rare cases—may be accompanied by serious adverse events. Providers should inform patients that vaccines are biologic agents intended to stimulate immunity and commonly cause local reactions such as redness, swelling, and soreness at the injection site.

Physicians or other providers must provide the current Vaccine Information Statement (VIS) each time they administer a vaccine covered under the National Vaccine Injury Compensation Program (www.hrsa.gov/vaccinecompensation/table.htm) or purchased through a CDC grant.[33] They must record in each patient's medical record the date of administration, the vaccine manufacturer, the lot number, and the name and business address of the provider, along with the edition of the VIS that was given to the patient and the date on which the vaccine was administered.[33] Copies of each VIS can be obtained from the CDC at www.cdc.gov/nip/publications/vis or the Immunization Action Coalition at www.immunize.org. Because physi-

TABLE 2

Factors or heuristic processes that affect vaccine acceptance

Factors or Processes That May Decrease Vaccine Acceptance

Factor	Comment
Compression	Overestimate frequency of rare risks (eg, vaccine reactions) and underestimate frequency of common risks (eg, morbidity and mortality from vaccine-preventable diseases).
Omission (not taking action) bias versus commission (action) bias	May lead to vaccine refusal by parent who thinks, "If my child gets a vaccine reaction, it's my fault; if my child gets a disease, it's an act of God or Nature." The parent feels less liable or guilty from an act of omission than from an act of commission.
Ambiguity aversion	Known risks may be more acceptable than unknown risks of lesser magnitude, eg, risks of disease vs new vaccine.
Voluntary, controllable risks	More acceptable than involuntary risks, eg, some oppose mandatory immunizations, citing lack of choice.
Natural risks	More acceptable than man-made risks, eg, risk for natural disease is more acceptable than man-made vaccine-related risk.
Frightening or memorable risks	Frightening risks are less acceptable than less frightening or memorable risks, eg, dying from a shark attack is more frightening than an automobile accident.
Availability	An event that is available (accessible or easily remembered) can lead to overestimation of its frequency, eg, sensationalized media reports alleging vaccine injury.
Freeloading	Vaccine refusers rely on high vaccination rate and herd immunity to protect their unvaccinated loved ones. However, this increases the risk for everyone.

Factors or Processes That May Increase Vaccine Acceptance

Factor	Comment
Bandwagoning	Vaccinate because everyone else is.
Altruism	Accept personal risk to benefit community or society.

Ball LK, et al. *Pediatrics.* 1998;101:453-458.

cians and nurses cite time as the most common barrier to communicating with patients about vaccine risks and benefits,[34] providing the appropriate VIS before a visit or while a patient and his or her parent(s) are waiting may facilitate subsequent discussions.

Addressing Parents' Concerns

Parents who refuse immunization for their children may have personal, cultural, religious, or experiential reasons for their refusal. Physicians should acknowledge parents' concerns and respectfully try to correct any misinformation. Allowing parents to express their concerns will increase their willingness to listen to the physician's views. In some cases, parents may be willing to accept partial vaccination or to allow the physician to gradually administer vaccinations if they are provided slowly over several visits. If a patient or his/her parents continue to refuse vaccination, then the physician should document the discussion in the medical record. Some physicians may wish to have parents (or children if they are legally able to give consent) sign a statement acknowledging that vaccinations were refused. A sample form can be obtained from www.cispimmunize.org/pro/pdf/RefusaltoVaccinate_2pageform.pdf. The CDC pamphlet *Six Common Misconceptions About Vaccination and How to Respond to Them* can be obtained from www.cdc.gov/nip/publications/6mishome.htm.

When parents exhibit omission bias **(TABLE 2)**, the physician may reframe the issue from the child's point of view. One investigator found that "individuals opposed to vaccination could be persuaded to vaccinate if they placed themselves in the child's position and then asked themselves whether they preferred a greater or lesser chance of death, and whether it mattered if the outcome occurred as the result of someone's act or omission."[30] Parents may subsequently acknowledge that, from the child's point of view, it would not matter whether injury resulted from a naturally occurring disease or a vaccine injury.

Parents who refuse immunization because they believe that immunization of other children protects their child ("freeloading") should be informed that such action actually increases the risk for disease with respect to not only their child but also others' vaccinated children. A Colorado study demonstrated that children exempted from vaccines were at least 22 times more likely to acquire measles and almost

6 times more likely to develop pertussis than were vaccinated children.[35]

Common Vaccine Risks

Pain, swelling, and redness at the injection site are common local reactions following immunization. Sterile abscesses occasionally occur after injection of inactivated vaccines.[33] Fever and irritability are common systemic reactions that may be attenuated by giving acetaminophen. More reports of fever, redness, swelling, and pain at the injection site have been made after the fourth dose than the first dose of each of the licensed DTaP vaccines. Swelling of the entire thigh or upper arm that lasts for a mean of 4 days has occurred in 2% to 3% of children after their fourth or fifth dose of the same DTaP.[36] However, local reactions to vaccines or their components usually are not considered contraindications for vaccine administration.

Uncommon Vaccine Risks

Allergic reactions occur infrequently after immunizations. For example, the rate of anaphylaxis after hepatitis B vaccine is 1 in 600,000.[33] Yeast proteins may cause this reaction.[37] Gelatin, a vaccine stabilizer, is used in the production of the MMR and varicella vaccines. However, persons with a history of food allergy to gelatin rarely develop anaphylaxis after vaccine administration.[33] The MMR vaccine—but not the influenza vaccine—may be given to persons with egg allergy. Neomycin is used in the production of the MMR, varicella, inactivated poliovirus vaccines, and some combination vaccines (eg, HAV/HBV and DTaP/IPV/HBV) and may cause a delayed-type local hypersensitivity reaction 48 to 96 hours after administration.[33]

Febrile seizures, persistent crying that lasts 3 hours or more, and hypotonic-hyporesponsive episodes have been reported very rarely after DTaP.[38]

TABLES 3 AND 4 compare the risks for wild measles, mumps, rubella, and varicella disease with the risks for adverse events reported after administration of the MMR and varicella vaccines.[33,39-51] The temporal relation of adverse events to vaccine administration does not prove causation. **TABLES 3 AND 4** also cite the efficacy of the vaccines in preventing disease.

Controversial and Unproven Risks

Chronic diseases such as autism often are attributed to vaccines because immunizations are given at a time in children's lives when the signs and symptoms of those diseases first become apparent. Parents are understandably frustrated by the lack of an identifiable cause of their child's autism and, in their search for answers, may allege that vaccines caused their child's illness because of the temporal relationship between immunization and disease manifestation.

Well-controlled studies have not documented a causal relation between administration of the MMR vaccine and development of autism. A study by Wakefield et al of 12 children with gastrointestinal diseases and developmental regression hypothesized that such a causal relation might exist.[52] However, Taylor et al conducted a study that included 498 autistic children in the North Thames health district of the United Kingdom and found no causal association between MMR vaccine and autism.[53] Patja et al did not identify any cases of autism associated with almost 3 million doses of MMR vaccine given to 1.8 million individuals in Finland over 14 years.[44] Madsen et al compared the records of more than 400,000 Danish children who received MMR vaccine with those of more than 90,000 unvaccinated children.[54] The investigators did not find any increase in the relative risk for autistic disorder in vaccinated children over that for unvaccinated children.[54]

Allegations also have been made that hepatitis B vaccine causes chronic fatigue syndrome, MS, or other autoimmune disorders.[55] The Nurses' Health Study in the United States evaluated more than 200,000 women and did not find an association between hepatitis B vaccine and MS.[56] A European study found that administration of the tetanus, hepatitis B, or influenza vaccines did not increase the risk for short-term relapse in MS patients.[57]

Vaccines have not been shown to increase the risk for type 1 DM.[58,59] A Swedish study found that vaccination against tuberculosis, smallpox, tetanus, pertussis, rubella, or mumps did not increase the risk for type 1 DM.[60] A Vaccine Safety Datalink project of the CDC did not find an increased risk for type 1 DM with any of the routinely recommended childhood vaccines, including those for DTaP, hepatitis B, Hib, MMR, and varicella.[61] A Danish study did not find any significant association of type 1 DM with Hib, DTaP, MMR, or oral polio vaccines.[60]

Concern also has been expressed that thimerosal, an ethyl mercury-containing vaccine preservative, might lead to greater mercury exposure in infants receiving multiple thimerosal-containing vaccines. However, multiple epidemiologic studies have not found a causal association between autistic-

TABLE 3

Measles, mumps, and rubella disease and vaccine fact sheet

Risks and Sequelae	Measles Disease	Mumps Disease	Rubella Disease	Measles, Mumps, Rubella Vaccine
Risk of acquiring disease				
Highest number of US cases	894,134 in 1941[1]	152,209 in 1968[1]	12 million in 1964-1965[1]; 57,686 in 1969 (20,000 cases of congenital rubella in 1964-1965)[1]	No cases of congenital rubella reported after immunization of pregnant women, but the theoretical maximum risk is 2% vs at least 30% risk after wild rubella infection in first trimester[5]
Recent number of US cases	66 in 2005[2]	314 in 2005[2]	11 in 2005[2] (1 case of congenital rubella in 2005)[2]	
Transmission route	Droplet spray	Direct contact, airborne droplets, and fomites[1]	Direct contact, nasopharyngeal droplet contact, or transplacental	
Rate of transmission to susceptible household contacts	90%[1]		50%-60% of susceptible family members and almost 100% in closed populations[1]	
Risk of sequelae				
Case-fatality rate	1-3 deaths/1000 measles cases[1,3]	1.6-3.8 per 10,000 cases[3] 2% fatality if patient develops encephalitis[1]	1 death per 30,000 cases due to 20% fatality from encephalitis[1]	1 death not attributed to vaccine.[8] Fatal measles pneumonitis in one 21-year-old man with advanced HIV[7]
Encephalitis	1-2 cases/1000 measles cases[1]	2.5 cases per 1000 mumps cases[1]	1/5000-1/6000 rubella cases[1,5]	<1 case/million doses[3]
Subacute sclerosing panencephalitis	8.5 cases/1 million measles cases[4]		20 total cases of progressive rubella panencephalitis since 1974[1]	0-0.7 cases/million doses[1]
Pneumonia	1%-6%[3]			2 cases/million doses[6]
Thrombocytopenia			1/3000 rubella cases[1,5]	0.5-40 cases/million recipients[3]
Orchitis		14%-35% adolescent and adult men[1]		0.3 case/million doses[6]
Anaphylaxis				5 cases/million doses; none were fatal[6]
Vaccine efficacy				95% with single dose at 12 months of age >99% if receive 2 doses separated by at least 4 weeks and first dose given ≥12 months of age[3]

[1]Maldonado Y. In: Behrman et al, eds. *Nelson Textbook of Pediatrics*. Philadelphia, Pa: WB Saunders Co; 2004; [2]Centers for Disease Control and Prevention. *MMWR Morb Mortal Wkly Rep*. 2006:55;883-903; [3]Pickering LD, ed. *Red Book: 2003 Report of the Committee on Infectious Diseases*. Elk Grove Village, Ill: American Academy of Pediatrics; 2003; [4]Feikin DR, et al. *JAMA*. 2000;284:3145-3150; [5]Gershon A. In: Mandell et al, eds. *Principles and Practice of Infectious Diseases*. Philadelphia, Pa: Churchill Livingstone; 2000; [6]Patja A, et al. *Pediatr Infect Dis J*. 2000;19:1127-1134; [7]Baum SG, Litman N. In: Mandell et al, eds. *Principles and Practice of Infectious Diseases*. Philadelphia, Pa: Churchill Livingstone; 2000.

spectrum disorders and thimerosal-containing vaccines.[62,63] The Institute of Medicine concluded that "the evidence favors rejection of a causal relationship between thimerosal-containing vaccines and autism."[64] Common childhood vaccines now contain either no thimerosal or trace amounts of it. Hepatitis B vaccines, Hib vaccine, and all brands of DTaP vaccine have formulations that are available for infants that contain either no thimerosal or trace amounts of it. There is no thimerosal in the inacti-

TABLE 4

Varicella disease and vaccine fact sheet

Risks and Sequelae	Varicella Disease	Varicella Vaccine
Risk of acquiring disease		
Average number of US cases/year	3.7 million (1980-1990)[1]	
Rate of transmission to susceptible contacts	90%[1]	3 confirmed cases secondary to transmission in immunocompetent persons[3,6]
Transmission route	Direct contact or airborne spread respiratory tract secretions; transplacental passage	
Risk of sequelae		
Localized rash		3%-5%[3]
Generalized varicella-like rash	100%	3%-5%[3]
Invasive group A streptococcal disease	5.2/100,000 with varicella vs 0.09/100,000 without varicella[2]	1 case from 1995-1998 in VAERS[6]*
Anaphylaxis		30 nonfatal cases in VAERS[6]*
Herpes zoster (children <20 years old)	68/100,000 person-year[3]	2.6/100,000 doses[3]
Thrombocytopenia	1%-2%[4]	0.3/100,000 doses in VAERS[6]*
Arthropathy		0.5/100,000 doses in VAERS[6]*
Cerebellar ataxia	1/4000 cases[5]	0.4/100,000 doses in VAERS[6]*
Encephalitis	0.1%-0.2%[5]	0.3/100,000 doses in VAERS[6]*
Pneumonia	1/400 adult cases[5]	0.2/100,000 doses in VAERS[6]*
Congenital varicella syndrome	0.4% between 0 and 12 weeks[1] 2% between 13 and 20 weeks	
Deaths	2-3/100,000 cases[4]	14 from 1995-1998 in VAERS[6]* Vaccine not confirmed as cause
Vaccine effectiveness		70%-85% against mild infection[3] >95% against moderate to severe disease[3]

*VAERS is the Vaccine Adverse Event Reporting System, a passive surveillance system. **Data from VAERS do not prove association of an adverse event with the vaccine, but may prompt further investigation.** The VAERS reporting rate is adverse event per estimated vaccine doses sold.[6]

[1]ACIP. *MMWR Recomm Rep.* 1996;45(RR-11):1-36; [2]Laupland KB, et al. *Pediatrics.* 2000;105:e60; [3]Pickering LD, ed. *Red Book: 2003 Report of the Committee on Infectious Diseases.* Elk Grove Village, Ill: American Academy of Pediatrics; 2003; [4]Myers MG, et al. In: Behrman et al, eds. *Nelson Textbook of Pediatrics.* Philadelphia, Pa: WB Saunders Co; 2004; [5]Whiteley RJ. In: Mandell et al, eds. *Principles and Practice of Infectious Diseases.* Philadelphia, Pa: Churchill Livingstone; 2000; [6]Wise RP, et al. *JAMA.* 2000;284:1271-1279.

vated poliovirus, MMR, varicella, pneumococcal conjugate, or MCV4 vaccines. Pediatric and adult influenza vaccines that contain trace amounts of thimerosal are now available in unit doses.

Reporting Vaccine Adverse Events

Manufacturers, state health coordinators, health care providers, and parents may submit reports of adverse events to the Vaccine Adverse Event Reporting System (VAERS) by calling 800-822-7967, visiting the VAERS Web site (http://vaers.hhs.gov), or using a form found in the *Physicians' Desk Reference.* Definitions of injuries that may merit compensation and further information regarding eligibility and documentation of claims may be obtained from the National Vaccine Injury Compensation Program at 800-338-2382 or at www.hrsa.gov/vaccinecompensation/.

Conclusion

All physicians who provide vaccinations should assess and develop approaches to increase immunization rates in their own practices. They should educate themselves and other health care providers in their practices about current vaccine recommendations (including contraindications) and educate patients and families about the benefits and risks of immunizations. In this age of information and disinformation, the importance of properly communicating the benefits and risks of vaccines cannot be overstated. Physicians should not dismiss parents' concerns out of hand. Exploring the reasons for these concerns and sharing accurate information can go a long way toward alleviating parental anxiety. Providing basic immunization information is not only good medicine, but the appropriate VIS must be provided each time a vaccine is administered.

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