

## Relative Risks of Diseases and Immunization

Immunization programs are highly successful in reducing the incidence of vaccine preventable diseases. Because the vaccine-targeted diseases are less common, it is more difficult for people to compare the risks of these diseases to the risks of adverse events following immunization. Public and mass media concern has shifted to vaccine safety. A higher standard of safety is generally expected of vaccines compared to other medical interventions. As vaccines are given to healthy people, especially infants and children, there is a low tolerance for adverse events.

It is the responsibility of the health care provider to communicate effectively with parents and individuals regarding the benefits and risks of immunization.

### Principles of Benefit/Risk Communication

- Communicate current knowledge, taking into account what an individual already knows and the level of detail requested. Provide a variety of information formats (e.g., visual, audio, printed material, and websites). Provide guidance on how to assess website reliability.
- Respect differences of opinion about immunization. When an individual expresses reluctance or refusal to immunize themselves or their children, assess both the strength of their beliefs and the underlying reasons for their beliefs and actions.
- Represent the benefits and risks of vaccines fairly and openly. Compare the known and theoretical risks of a vaccine with the known risks associated with the vaccine preventable infection. (Refer to [Table 1: Relative Risks of Diseases and Immunization](#)). Remind clients that vaccine preventable diseases have not been eliminated.
- Adopt a client centered approach. Effective decision making is best done in partnership between the health care provider and the parent or client.
- Make the most of each opportunity to present clear, evidence-based messages regarding vaccines and immunizations. Encourage questions and discussion, address misinformation, and provide valid and appropriate resources, including appropriate websites, for those who want more information.

The [Immunization Communication Tool for Immunizers](#) assists providers in addressing many of the questions and concerns parents may have regarding immunization.

Consider the following websites when communicating with parents regarding immunization. Websites listed include information for both health professionals and parents, and include links to other reliable sources of information.

[ImmunizeBC](#)

[HealthLinkBC Files](#)

[Public Health Agency of Canada, Immunization and Vaccines](#)

[Immunize Canada](#)

[Canadian Immunization Guide](#)

[Canadian Pediatric Society](#)

[Centers for Disease Control and Prevention](#)

[Children's Hospital of Philadelphia Vaccine Education Center](#)

[Immunization Action Coalition](#)

[National Network for Immunization Information](#). Information for health professionals and parents (includes information regarding assessing website quality and reliability).

[World Health Organization](#) (lists websites with information related to vaccine safety that meets criteria related to credibility, content, accessibility, and design).

Dr. Paul Offit and colleagues have published 3 articles directly related to parent's concerns regarding immunization:

- [Addressing Parents' Concerns: Do Vaccines Contain Harmful Preservatives, Adjuvants, Additives, or Residuals?](#)
- [Addressing Parents' Concerns: Do Multiple Vaccines Overwhelm or Weaken the Infant's Immune System?](#)
- [Addressing Parents' Concerns: Do Vaccines Cause Allergic or Autoimmune Diseases?](#)

**Table 1: Relative Risks of Diseases and Immunization**

Disease	Risks Associated with Disease	Adverse Events Associated with Immunization
<b>Diphtheria</b>	<ul style="list-style-type: none"> <li>• Case fatality: 5-10%</li> <li>• Complications are caused by the toxin released by the diphtheria bacteria and include upper airway obstruction, pneumonia, heart failure, and paralysis</li> </ul>	<ul style="list-style-type: none"> <li>• Local reactions (redness, swelling and pain) increasing with age, the quantity of toxoid, and the number of doses received: 16% in children and 10% in adults</li> <li>• Fever and irritability occur less commonly</li> </ul>
<b>Tetanus</b>	<ul style="list-style-type: none"> <li>• Case fatality: 10%</li> <li>• Generalized rigidity and convulsive spasms of skeletal muscles</li> <li>• Severe spasms can cause fractures in the spine and long bones. Spasms in the larynx cause eating and breathing difficulties</li> </ul>	<ul style="list-style-type: none"> <li>• Local reactions (same as above)</li> <li>• Lymphadenopathy and fever may occasionally occur</li> <li>• Serum sickness, brachial plexus neuropathy, encephalomyelitis, and transverse myelitis rarely reported</li> <li>• Risk of Guillain-Barré Syndrome (GBS) following immunization with a tetanus-containing vaccine is 0.4 per million doses of vaccine</li> </ul>
<b>Pertussis</b>	<ul style="list-style-type: none"> <li>• 1-3 deaths each year in Canada, primarily in young infants.</li> <li>• Complications include:                             <ul style="list-style-type: none"> <li>○ Apnea</li> <li>○ Pneumonia: 5.2%</li> <li>○ Seizures: 0.8%</li> <li>○ Encephalopathy: 0.1%</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Mild fever in 3-5% of vaccine recipients</li> <li>• Local reactions (redness, swelling, and pain) increase with the number of doses received</li> <li>• Moderate to severe systemic events are reported rarely with acellular vaccines</li> </ul>
<b><i>Haemophilus influenzae</i> type b</b>	<ul style="list-style-type: none"> <li>• Meningitis: 55-65%</li> <li>• Meningitis case fatality rate: 5% (10-15% of Hib meningitis survivors have permanent neurologic sequelae and 15-20% have deafness.)</li> <li>• Epiglottitis, pneumonia, septic arthritis, and cellulitis</li> </ul>	<ul style="list-style-type: none"> <li>• Local reactions (pain, redness, and swelling): 5-30%. Symptoms are mild and resolve within 24 hours.</li> </ul>
<b>Polio</b>	<ul style="list-style-type: none"> <li>• Aseptic meningitis: 1% of polio infections</li> <li>• Paralytic polio: 1% (25% of these will have post poliomyelitis syndrome)</li> <li>• Death: 5-10% in paralytic polio infections (2-5% in children and 15-30% in adults)</li> </ul>	<ul style="list-style-type: none"> <li>• Local discomfort: 5%</li> <li>• No severe adverse events reported with IPV</li> </ul>

Disease	Risks Associated with Disease	Adverse Events Associated with Immunization
<b>Measles</b>	<ul style="list-style-type: none"> <li>• Febrile convulsions: 2%</li> <li>• Pneumonia, otitis media: 10%</li> <li>• Thrombocytopenia: 1/300 cases</li> <li>• Encephalitis: 0.1% (1/1000 cases) (case fatality: 15%; neurologic sequelae: 25%)</li> <li>• Death: 0.05-0.3% (1/3000 cases)</li> <li>• Subacute sclerosing panencephalitis: 1/25,000 cases</li> </ul>	<p>MMR vaccine:</p> <ul style="list-style-type: none"> <li>• Malaise and fever, with or without a non-infectious rash: 5%</li> <li>• Parotitis: up to 1%</li> <li>• Swollen glands, stiff neck or joint pains: 5%</li> <li>• Transient arthralgia or arthritis more common in post-pubertal females (25% of post-pubertal females may experience arthralgia, and 10% may have arthritis-like signs and symptoms)</li> <li>• Encephalitis: 1 case per million doses</li> <li>• Transient thrombocytopenia: 1 in 30,000 doses</li> </ul>
<b>Mumps</b>	<ul style="list-style-type: none"> <li>• Parotitis: 30-40%</li> <li>• Orchitis: 20-30% in post pubertal males</li> <li>• Oophoritis: 5% in post pubertal females</li> <li>• Deafness: 0.5-5 per 100,000 cases</li> <li>• Encephalitis: 0.5%</li> </ul>	See MMR vaccine above.
<b>Rubella</b>	<ul style="list-style-type: none"> <li>• Acute arthralgia or arthritis: 50% of adolescents and adults</li> <li>• Encephalitis: 1/6,000 cases</li> <li>• Risk of Congenital Rubella Syndrome (CRS) is 85% in maternal infections in the first 10 weeks of pregnancy. CRS may include miscarriage, stillbirth, and fetal malformations such as congenital heart disease, cataracts, deafness, and mental retardation.</li> </ul>	See MMR vaccine above.
<b>Hepatitis B</b>	<ul style="list-style-type: none"> <li>• Death: 1-2% due to fulminant hepatitis</li> <li>• Risk of chronicity depends on age at time of infection:               <ul style="list-style-type: none"> <li>○ infants: 90-95%;</li> <li>○ children 1-5 years: 30-50%;</li> <li>○ adults: 5%</li> </ul> </li> <li>• Chronic carriers have an increased risk of hepatic cirrhosis and hepatocellular cancer (cause of up to 80% of hepatocellular carcinomas)</li> </ul>	<ul style="list-style-type: none"> <li>• Local reactions (tenderness, redness, swelling): 13-29% of adults and 3-9% of children</li> <li>• Fever (up to 37.7°C): 1% of adults and 0.4-6.4% of children</li> <li>• Mild systemic symptoms such as fatigue, headache, and irritability: 11-17% of adults and 0-20% of children</li> </ul>

Disease	Risks Associated with Disease	Adverse Events Associated with Immunization
<p><b>Human Papillomavirus (HPV)</b></p>	<ul style="list-style-type: none"> <li>• HPV types 16 and 18 cause 70% of cervical cancer</li> <li>• HPV types 6 and 11 cause 90% of genital warts</li> <li>• HPV causes 36% of oropharyngeal cancer; 24% of oral cancer, and 24% of laryngeal cancer</li> <li>• Recurrent respiratory papillomatosis caused by HPV types 6 and 11 may be acquired from mother at birth or occur in adulthood</li> </ul>	<ul style="list-style-type: none"> <li>• Injection site reactions:                             <ul style="list-style-type: none"> <li>○ Pain 83.9%</li> <li>○ Swelling 25.4%</li> <li>○ Redness 24.6%</li> <li>○ Itching 3.1%</li> </ul> </li> <li>• Systemic reactions:                             <ul style="list-style-type: none"> <li>○ Fever 10.3%</li> <li>○ Nausea 4.2%</li> <li>○ Dizziness 2.8%</li> <li>○ Diarrhea 1.2%</li> </ul> </li> </ul>
<p><b>Influenza</b></p>	<ul style="list-style-type: none"> <li>• Viral and bacterial pneumonia</li> <li>• Death reported in 0.5-1 per 1000 cases; most deaths in persons ≥ 65 years of age</li> <li>• During epidemics, there may be increased mortality and morbidity among the elderly, the immunocompromised and those with chronic disease</li> </ul>	<ul style="list-style-type: none"> <li>• Local reactions (soreness at injection site): ≤ 7% of children &lt; 3 years of age</li> <li>• Fever: ≤ 12% of children 1-5 years of age</li> <li>• Headache, malaise, myalgia: &lt; 1%</li> <li>• Risk of GBS estimated to be 1 excess case per million doses of influenza vaccine</li> </ul>
<p><b>Meningococcal Disease</b></p>	<ul style="list-style-type: none"> <li>• Meningitis is the most common presentation of invasive disease</li> <li>• Meningitis case fatality: 5-10%</li> <li>• Septicemia: 5-20% of cases</li> <li>• Pneumonia: 5-15% of cases</li> <li>• Arthritis: 2% of cases</li> <li>• Otitis media and epiglottitis: &lt; 1% of cases</li> <li>• Sequelae occur in up to 20% of survivors and include hearing loss, neurologic damage, loss of limbs from gangrene, and kidney damage</li> </ul>	<p><b>Conjugate vaccine:</b></p> <ul style="list-style-type: none"> <li>• Local reactions (redness, tenderness, and swelling at injection site): up to 50%</li> <li>• Irritability: up to 80% of infants</li> <li>• Fever &gt; 39°C: up to 9% (when given at same time as other vaccines)</li> <li>• Headache and malaise: up to 10% of older children and adults.</li> <li>• Severe reactions: &lt; 0.01%</li> <li>• Risk of GBS associated with quadrivalent conjugate meningococcal vaccine continues to be monitored</li> </ul> <p><b>Polysaccharide vaccine:</b></p> <ul style="list-style-type: none"> <li>• Local reactions (pain and redness): up to 50%</li> <li>• Fever: 5%, particularly in infants</li> </ul>

Disease	Risks Associated with Disease	Adverse Events Associated with Immunization
<p><b>Pneumococcal Disease</b></p>	<ul style="list-style-type: none"> <li>• Pneumococcal pneumonia is an important cause of death in infants and the elderly</li> <li>• Case fatality rate is 5-7% overall (much higher among the elderly)</li> <li>• Most common cause of bacterial meningitis. Case fatality rate is 30% (up to 80% among the elderly)</li> <li>• Bacteremia: case fatality rate is 20% (up to 60% among the elderly)</li> <li>• Otitis media</li> </ul>	<p><b>Conjugate vaccine:</b></p> <ul style="list-style-type: none"> <li>• Local reactions (pain, swelling, or redness at injection site): 10-20%;</li> <li>• Fever: 15-24% (when vaccine administered at the same time as whole cell pertussis vaccine)</li> </ul> <p><b>Polysaccharide vaccine:</b></p> <ul style="list-style-type: none"> <li>• Local reactions: 30-50%</li> <li>• Fever: 2%</li> </ul> <ul style="list-style-type: none"> <li>• Irritability, drowsiness, restless sleep, decreased appetite, headache, malaise may occur with conjugate or polysaccharide vaccine</li> </ul>
<p><b>Varicella</b></p>	<ul style="list-style-type: none"> <li>• Secondary bacterial infections: 5-10%</li> <li>• Low platelets: 1-2%</li> <li>• Cerebellar ataxia: 1/4000 cases</li> <li>• Encephalitis: 1/5000 cases</li> <li>• Invasive group A Streptococcal infection: 5/100,000 cases</li> <li>• Death (per 100,000 cases):             <ul style="list-style-type: none"> <li>○ Adults: 30 deaths</li> <li>○ Infants &lt; 1 year old: 7 deaths</li> <li>○ Children 1-19 years old: 1-1.5 deaths</li> </ul> </li> <li>• Otitis media, bacteremia, pneumonia, osteomyelitis, septic arthritis, endocarditis, necrotizing fasciitis, toxic shock-like syndrome</li> <li>• Reactivation of varicella virus as Herpes Zoster (shingles) later in life: 20%</li> <li>• Congenital varicella syndrome: up to 2% of fetuses born to mothers infected at 13-20 weeks gestation</li> </ul>	<ul style="list-style-type: none"> <li>• Varicella-like rash at injection site: 3-5% after the first dose and 1% after a second dose</li> <li>• Small number of generalized varicella-like papules or vesicles: 5% after the first dose and 1% after a second dose</li> <li>• Fever: 10-15%</li> <li>• Local reactions (pain, swelling, and redness at injection site): 10-20%</li> <li>• Risk of zoster after vaccination: 2.6/100,000 vaccine doses</li> <li>• No deaths or congenital varicella have been attributed to vaccine</li> </ul>