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## 1.0 INTRODUCTION

The authority for the Immunization Program is provided by the Public Health Act (2008). Under this Act, health authorities are required to ensure the provision of immunization programs designed to reduce or eliminate vaccine-preventable diseases in British Columbia. The Ministry of Health Services and Ministry of Healthy Living and Sport provide budgetary support for immunization programs and services. Recommended programs are based on an extensive consultative process led by Epidemiology Services, British Columbia Centre for Disease Control (BCCDC).

The British Columbia Communicable Disease Policy Committee (CD Policy) reviews the science associated with communicable disease prevention and control, and makes recommendations to the Minister and the Ministry of Health on matters pertaining to communicable disease control.

The British Columbia Immunization Sub-Committee (BCISC) is a subcommittee of CD Policy. BCISC analyzes the programmatic issues (e.g., feasibility and acceptability) associated with implementation of a new or revised vaccine program. In 2007, BCISC developed *Immunize BC - A Strategic Framework for Immunization* to guide and support health authorities and health system partners to deliver optimal immunization services across British Columbia. The Strategic Framework can be viewed at <http://www.health.gov.bc.ca/prevent/pdf/immunizebc.pdf>.

The scientific evidence and recommendations gathered by Epidemiology Services, CD Policy, BCISC, and the Ministry of Healthy Living and Sport are incorporated into the BCCDC Communicable Disease Control Manual.

The BCCDC Communicable Disease Control Manual, Chapter 2: Immunization Program provides best practice guidelines to direct the provision of immunization services. The BCCDC Communicable Disease Manual, Chapter 2: Immunization Program is available at <http://www.bccdc.ca/dis-cond/comm-manual/CDManualChap2.htm>.

The Immunization Program is updated regularly. It is the responsibility of Immunization Program users to ensure they are using the most current version of the program. This can be accomplished by checking the online version of the Immunization Program or the list of Administrative Circulars at <http://www.bccdc.ca/dis-cond/comm-manual/adminCirc.htm> for the list of recent revisions to the Immunization Program.

The *Canadian Immunization Guide*, available at <http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php>, is the key reference for the Immunization Program and can be used by immunization providers for additional background information when necessary. Recommendations in the *Canadian Immunization Guide* are made by the National Advisory Committee for Immunization (NACI).



The Immunization Program guidelines are in accordance with current provincial legislation as specified in the following acts: *Freedom of Information and Protection of Privacy; BC Public Health Act, Communicable Disease Regulations; Adult Guardianship Act; Infant and Child Act; School Act and School Act Ministerial orders; Health Care (Consent) and Care Facility (Admission) Act.*

## **2.0 IMMUNIZATION PROVIDER RESPONSIBILITIES**

### **2.1 Health Authority Responsibility**

Health Authorities are responsible for the planning, delivery and evaluation of preventive health services, including immunization. The provision of routine immunization programs and targeted immunization programs is an essential or “core” program that is delivered in each region of the province.

Health Authorities collaborate with BCCDC in carrying out vaccine management, surveillance, and evaluation.

#### **Health Authorities will:**

- Develop strategic plans to attain and maintain the provincial goals and objectives delineated in *Immunize BC – A Strategic Framework for Immunization*.
- Provide immunization against vaccine-preventable diseases of a serious health consequence to targeted high-risk populations.
- Facilitate immunization program delivery by trained service providers who follow BCCDC Immunization guidelines.
- Investigate incidents where BCCDC standards of practice are not followed.
- Have an Immunization Competency Program in place for their public health staff.
- Maintain a record in the Public Health Information System (iPHIS) or alternate system of persons immunized in the community.
- Provide an individual immunization record to the client.
- Submit reports of adverse events following immunization to BCCDC. This includes reports received from community vaccine providers.
- Submit reports to BCCDC for assessment of immunization coverage.
- Supply provincially funded vaccines to community vaccine providers who manage, monitor, report, and deliver safe and effective immunization services.

### **2.2 Community Vaccine Providers**

Community vaccine providers include physicians, pharmacists, Aboriginal communities and travel clinics where publicly funded vaccines are administered.



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**Community vaccine providers will:**

- Follow the BCCDC guidelines for immunization.
- Ensure that vaccine maintains potency (optimal transportation, storage, handling, and conservation), and report in a timely manner to the local health unit any cold chain incidents.
- Report in a timely manner to the local health unit regarding persons immunized.
- Report adverse events following any immunization to the local health unit. Refer to the following for more information regarding reporting adverse events:
  - [BCCDC Communicable Disease Control Manual, Chapter 2, Section 9](#) for more information regarding the definition / criteria, the cause / significance, the management, and the implications of adverse events
  - [BCCDC Communicable Disease Control Manual, Chapter 2, Section 10](#) for a chart describing adverse events following immunization – temporal criteria
  - [BCCDC website, Monitoring and Response, Adverse Event Following Immunization, Report of Adverse Event \(Reaction\) Following Immunization](#) for a copy of the reporting form to be printed and completed.

### **3.0 IMMUNIZATION COMPETENCY**

The purpose of the BCCDC Immunization Competency Program is to assist all health professionals who provide immunization to be knowledgeable vaccine providers, educators, and advocates for immunization. A vaccine provider should demonstrate the attitudes, knowledge, and clinical skills necessary to provide safe and effective immunization programs. BCCDC has developed an online Immunization Course that is available to Registered Nurses, Licensed Practical Nurses, and Pharmacists. Course content is based on the Immunization Competencies for BC Health Professionals, available at

<http://www.bccdc.ca/imm-vac/ForHealthProfessionals/ImmsCompetency.htm>

The resource “Immunization Competencies for BC Health Professionals” was adapted from the 2008 National Immunization Competencies for Health Professionals document published by the Public Health Agency of Canada, available at <http://www.phac-aspc.gc.ca/im/pdf/ichp-cips-eng.pdf>.

The online course includes a Basic Competency exam for all providers, and a Renewal of Competency exam developed by and for public health nurses working in the Health Authorities and in Aboriginal communities.



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#### 4.0 OPPORTUNITY FOR IMMUNIZATION IN ALL HEALTH CARE SETTINGS

The best way to reduce vaccine-preventable diseases is to have a highly immune population. Immunization programs in Canada have been very successful in decreasing the incidence of communicable diseases. Challenges remain, particularly in the areas of *missed opportunities for immunization* and improving immunization rates for subgroups of Canadians who are not being fully immunized.

A *missed opportunity for immunization* is a health care encounter in which a person is eligible to receive a vaccination but is not vaccinated or is incompletely vaccinated. Missed opportunities occur in all health care settings. Missed opportunities for immunization occur during adult and childhood visits to a health care provider and are just as likely to occur whether the visit is related to acute illness or chronic illness.

A significant portion of Canadian adults ( $\geq 18$  years of age) are vulnerable to vaccine-preventable diseases. In addition to the routine vaccines recommended for all individuals, there are also vaccines recommended for individuals with different risk factors arising from occupation, underlying illness, lifestyle, and age. Both adults and children may live in situations that make accessing immunizations at health units or physician's offices difficult.

Individuals may be seen in a variety of health care settings (e.g., emergency departments, hospital wards, walk-in clinics, physician offices, outpatient clinics, or specialized clinics). For patients without regular sources of care or those followed in specialized clinics, the only opportunities for immunization may be during visits to these settings. For example, chronic kidney disease clients are seen regularly at their renal clinic and it is recommended that they receive all recommended vaccines, including hepatitis B vaccine. Taking an immunization history from those seen in emergency or admitted to hospital provides an important opportunity to maintain up-to-date immunization for all patients.

At each hospital admission, the vaccination record should be reviewed and, before discharge from the hospital, all patients should receive the vaccines for which they are eligible based on age, health status, or lifestyle risk factors. If vaccines are not available at the health care setting, the client should be referred to the health unit or their immunization provider for immunization follow up.



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Immunizations frequently indicated in the hospital setting include:

- Routine immunization of infants in level 2 and 3 special care nurseries
- Routine immunization of long stay pediatric patients in pediatric units
- Td vaccine for individuals eligible for a booster dose of tetanus-diphtheria containing vaccine
- Influenza vaccine for all eligible individuals (e.g., those  $\geq 65$  years of age, those 6 to 24 months of age, those with chronic health conditions, pregnant women in their third trimester during the influenza season)
- Pneumococcal vaccine for unvaccinated patients  $\geq 65$  years of age and those with chronic health problems for which immunization is recommended
- MMR vaccine for post-partum women who are susceptible to rubella
- Varicella vaccine for post-partum women who are susceptible to varicella.

Residents of long term care facilities should receive all routine immunizations appropriate for their age and individual risk status. Annual influenza immunization is essential. All residents of intermediate or extended care facilities are eligible for pneumococcal immunization. Every resident should be assessed for prior pneumococcal immunization at time of admission. Those residents who have not received pneumococcal vaccine or who are eligible for a single booster dose should be immunized as soon as possible.

In both acute-care and long-term care settings, it is important that immunization planning be part of organized care plans within each department, with clear accountability for program planning, implementation, and evaluation.

The National Guidelines for Immunization Practices, developed by NACI, are available at <http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-03-eng.php>. These guidelines are intended to support optimal implementation of immunization programs in order to address ongoing challenges with immunization.



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## 5.0 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.

### 5.1 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 web sites). Provide guidance on how to assess web site 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 Disease and Immunization](#)) Remind clients that vaccine-preventable diseases have not been eliminated.
- Adopt a client centred 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 web sites, for those who want more information.

The *Immunization Communication Tool for Immunizers* available at <http://www.immunizebc.ca/ImmForHP/Reference+Materials.htm> assists providers in addressing many of the questions and concerns parents may have regarding immunization. A link to the 2007 Vaccine Risk/Benefit Communications Conference Webcast is available at <http://www.bccdc.ca>, under “Announcements.”



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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 at <http://www.immunizebc.ca/default.htm>

HealthLinkBC at <http://www.healthlinkbc.ca/healthfiles/index.stm>

Public Health Agency of Canada, Immunization and Vaccines at <http://www.phac-aspc.gc.ca/im/index-eng.php>

Canadian Coalition for Immunization Awareness and Promotion at <http://www.immunize.cpha.ca/en/default.aspx>

Canadian Immunization Guide, 7<sup>th</sup> edition, 2006 at <http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-04-eng.php>

Canadian Pediatric Society at <http://www.cps.ca/>

Centers for Disease Control and Prevention at <http://www.cdc.gov/vaccines/>

Children's Hospital of Philadelphia Vaccine Education Center at <http://www.chop.edu/consumer/jsp/microsite/microsite.jsp?id=75918>

Immunization Action Coalition at <http://www.immunize.org/>

National Network for Immunization Information. Information for health professionals at <http://www.immunizationinfo.org/healthProfessionals/recommendations.cfm> and information for parents at <http://www.immunizationinfo.org/parents/index.cfm> (includes information regarding assessing website quality and reliability)

World Health Organization at [http://www.who.int/immunization\\_safety/en/](http://www.who.int/immunization_safety/en/) (lists websites with information related to vaccine safety that meet criteria related to credibility, content, accessibility, and design)

Dr Paul Offitt 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 1.0 Relative Risks of Diseases and Immunization**

<b>Disease</b>	<b>Risks Associated with Disease</b>	<b>Adverse Events Associated with Vaccine</b>
<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>Haemophilus influenzae 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 reaction (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>	MMR vaccine : <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 - 5.0 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.



Disease	Risks Associated with Disease	Adverse Events Associated with Immunization
<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 - 5years: 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>
<b>Human Papillomavirus (HPV)</b>	<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>
<b>Influenza</b>	<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>



Disease	Risks Associated with Disease	Adverse Events Associated with Immunization
<b>Meningococcal Disease</b>	<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 vaccines:</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 vaccines:</b></p> <ul style="list-style-type: none"> <li>• Local reactions (pain and redness): up to 50%</li> </ul> <p>Fever: 5%, particularly in infants</p>
<b>Pneumococcal Disease</b>	<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>



Disease	Risks Associated with Disease	Adverse Events Associated with Immunization
<b>Varicella</b>	<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; 1year 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 reaction (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>



## 6.0 VACCINE IMMUNOGENICITY, EFFICACY, AND EFFECTIVENESS

**Immunogenicity** – the ability of an antigen (i.e., vaccine) to provoke an immune response in an individual.

**Efficacy** – the extent to which a vaccine provides a beneficial result under **ideal conditions**. The efficacy of a new vaccine is measured in phase III clinical trials by giving one group of people a vaccine and comparing the incidence of disease in that group to another group of people who do not receive the vaccine.

**Effectiveness** – the extent to which a vaccine provides a beneficial result under **real-life conditions**.

VACCINE	EFFECTIVENESS / EFFICACY / IMMUNOGENICITY
Diphtheria - Pertussis - Tetanus	<ul style="list-style-type: none"> <li>• Diphtheria: 99% of people immunized with complete primary series develop protective antibody levels (antitoxin titres of &gt; 0.1 IU/ml)</li> <li>• Tetanus: close to 100% (virtually all people immunized with full primary series achieve protective antitoxin levels)</li> <li>• Acellular Pertussis: estimated efficacy is approx. 85%</li> </ul>
Haemophilus <i>influenzae</i> type b	Clinical efficacy: 95 - 100%
Inactivated Polio	Close to 100% of vaccine recipients develop protective antibody levels after three doses
Hepatitis B	<ul style="list-style-type: none"> <li>• Children &lt; 2 years of age: 95% immune response rate</li> <li>• Children 5 - 19 years of age: 99% seroprotection</li> <li>• Adults ≥ 20 years of age: immune response declines with age (95% at 20 years of age and 50% - 70% at ≥ 60 years of age)</li> </ul>
Human Papillomavirus (HPV)	<ul style="list-style-type: none"> <li>• Seroconversion rates in adolescents &gt; 99% for all 4 HPV vaccine types (i.e., 6, 11, 16, and 18)</li> <li>• 99% efficacy against CIN 2/3 (cervical cancer precancerous lesions) due to HPV types 16 and 18</li> <li>• 99% efficacy against genital warts related to HPV types 6 and 11</li> </ul>



VACCINE	EFFECTIVENESS / EFFICACY / IMMUNOGENICITY
Influenza	<ul style="list-style-type: none"> <li>• Effectiveness depends on age and immunocompetence of recipient and degree of similarity between virus strains included in the vaccine and circulating strains.</li> <li>• 70 - 90% efficacy in healthy children and adults.</li> <li>• Elderly: 56% effective in preventing respiratory illness; 50% effective in preventing hospitalization due to pneumonia; 68% effective in preventing death.</li> <li>• Facility residents: 30 - 40% effective against influenza illness; 50 - 60% effective against hospitalization and pneumonia; and 85 - 95% effective in preventing death.</li> <li>• Yearly vaccination is required.</li> </ul>
MMR	<ul style="list-style-type: none"> <li>• 85 - 95% of infants immunized with one dose of MMR at 12 - 15 months of age develop antibodies</li> <li>• Close to 100% with two doses of MMR</li> </ul>
Meningococcal C conjugate	<ul style="list-style-type: none"> <li>• Efficacy &gt; 90%.</li> <li>• Immunogenic in infants and young children.</li> <li>• Induces immunologic memory.</li> </ul>
Meningococcal quadrivalent conjugate	<ul style="list-style-type: none"> <li>• Immunogenicity: 80% - 100% depending on age of recipient.</li> <li>• Demonstrated ability to boost antibody response to Meningococcal C conjugate vaccine.</li> </ul>
Meningococcal quadrivalent polysaccharide	<ul style="list-style-type: none"> <li>• Efficacy for serogroups A and C 85 - 100% among children ≥ 4 years of age and adults.</li> <li>• Vaccine effectiveness of 87 - 94% has been observed in children ≥ 2 yrs.</li> </ul>
Pneumococcal conjugate	<ul style="list-style-type: none"> <li>• Protective efficacy of 89 - 97% observed against invasive disease due to vaccine serotypes.</li> <li>• Effective in infants and young children. Induces immunologic memory.</li> </ul>
Pneumococcal Polysaccharide	<ul style="list-style-type: none"> <li>• 60 - 70% effective in preventing invasive disease caused by serotypes in the vaccine (&gt; 80% in healthy young adults and 50 - 80% in the elderly and individuals with chronic illness)</li> </ul>
Varicella	<ul style="list-style-type: none"> <li>• Children 12 months to 12 years of age: 98% seroconversion rate at 4 - 6 weeks post-immunization</li> <li>• Adults and adolescents ≥ 13 years of age given 2 vaccine doses 4 to 8 weeks apart: 99% seroconversion rates at 4 - 6 weeks after the second dose</li> <li>• Vaccine effectiveness 70% - 90% in preventing varicella disease of any severity and 95% protection against severe varicella for at least 7 to 10 years after immunization.</li> </ul>



## 7.0 DEFINITIONS

**Acellular vaccine** –the vaccine is made only from purified specific antigenic parts of a bacterium rather than the whole killed bacterium (e.g., acellular pertussis).

**Adsorbed vaccine** – a vaccine containing an adjuvant to assist in the retention of the antigen at the injection site and enhance the immune response by degree or duration.

**Combination vaccine** –vaccine that has been developed to protect against more than one type of infection (e.g., INFANRIX hexa™, Quadracel®).

**Conjugate polysaccharide vaccine** – vaccine in which the polysaccharide is chemically combined with a protein molecule to increase efficacy and immunogenicity (e.g., Hib, pneumococcal, and meningococcal conjugate vaccines).

**Excipients:** inactive ingredients that are necessary for production of a finished pharmaceutical formulation. Adjuvants, preservatives, and other additives are excipients, essential components of vaccines.

**Live attenuated vaccine** – the vaccine contains whole, living bacteria or viruses that induce immunity by actively replicating within the host. Attenuated means the vaccine strains are weakened so infection is usually inapparent or very mild.

**Primary series** – an initial series of vaccinations designed to give a primary antibody response. The series may be followed by an additional booster dose(s) to give a secondary immune response. (e.g., first 3 doses of DTaP- HB - IPV- Hib Vaccine – INFANRIX hexa™ at 2, 4, and 6 months followed by the booster dose at 18 months).

**Pure polysaccharide vaccine** – vaccine produced from the polysaccharide (sugar) coating of an encapsulated bacterium (e.g., pneumococcal and meningococcal polysaccharide vaccines).

**Recombinant vaccine** – vaccine produced by genetic engineering technology (e.g., Hepatitis B vaccine is produced by the insertion of the segment of the viral gene that makes the surface protein of a hepatitis B virus into the gene of a yeast cell. The yeast cells are then instructed to make surface protein by the viral gene.)

**Toxoid** – a deactivated form of a bacterial toxin which has been chemically processed so that it is still immunogenic (e.g., tetanus toxoid). Once the toxin has been inactivated, it is called a toxoid.



## 8.0 IMMUNOGENIC COMPONENTS OF SELECTED VACCINES

Vaccine		Active Components
Diphtheria, Tetanus, acellular pertussis, HepatitisB, Inactivated Polio, conjugated <i>Haemophilus influenzae</i> type b	<b>INFANRIX hexa™</b>	Diphtheria toxoid 25 Lf Tetanus toxoid 10Lf Pertussis toxoid 25 µg Filamentous haemagglutinin (FHA) 25 µg Pertactin (69kDa membrane protein) 8µg Hepatitis B surface antigen 10µg Inactivated polio virus types 1, 2 & 3 Conjugate Hib capsular polysaccharide 10µg
Diphtheria, Tetanus, acellular Pertussis, Inactivated Polio, conjugated <i>Haemophilus influenzae</i> type b	<b>PEDIACEL®</b>	Diphtheria toxoid 15 Lf Tetanus toxoid 5 Lf Pertussis toxoid 20 µg Filamentous haemagglutinin (FHA) 20 µg Fimbriae (Types 2 + 3) 5 µg Pertactin (69kDa membrane protein) 3µg Inactivated polio virus types 1, 2 & 3 Conjugate Hib capsular polysaccharide 10µg
Diphtheria, acellular Pertussis, Tetanus, Inactivated Polio	<b>QUADRACEL®</b>	Diphtheria toxoid 15 Lf Pertussis toxoid 20 µg Filamentous haemagglutinin (FHA) 20 µg Fimbriae (Types 2 +3) 5µg Pertactin (69kDa membrane protein) 3 µg Tetanus toxoid 5 Lf Inactivated polio virus types 1, 2 & 3
Tetanus, Diphtheria, acellular pertussis	<b>ADACEL®</b>	Tetanus toxoid 5 Lf Diphtheria toxoid 2Lf Pertussis toxoid 2.5 µg Filamentous haemagglutinin (FHA) 5 µg Fimbriae (Types 2 + 3) 5 µg Pertactin (69kDa membrane protein) 3 µg
Tetanus, Diphtheria	<b>Td ADSORBED (sanofi pasteur)</b>	Tetanus toxoid 5 Lf Diphtheria toxoid 2 Lf
Tetanus, Diphtheria Inactivated Polio	<b>Td-IPV (sanofi pasteur)</b>	Tetanus toxoid 5 Lf Diphtheria toxoid 2 LF Inactivated polio virus types 1, 2 & 3
Polio	<b>Imovax® polio</b>	Type 1(Mahoney) 40 D antigen units Type 2 (MEF 1) 8 D antigen units Type 3 (Saukett) 32 D antigen units



Vaccine		Active Components
Hepatitis A	<b>Havrix®</b>	Adult presentation: 1440EL.U of viral antigen / 1.0 ml Pediatric presentation: 720EL.U of viral antigen / 0.5 ml
	<b>Vaqta®</b>	Adult presentation: 50 U hepatitis A virus protein / 1.0 ml Pediatric presentation: 25 U hepatitis A virus protein / 0.5ml
	<b>Avaxim™</b>	Adult presentation: 160 antigen units / 0.5 ml Pediatric presentation: 80 antigen units / 0.5 ml
Hepatitis B	<b>Engerix®-B</b>	Adult presentation: 20 µg / 1.0 ml Pediatric presentation: 10 µg / 0.5 ml
	<b>RecombivaxHB®</b>	Adult presentation: 10 µg / 1.0 ml Pediatric presentation: 5 µg / 0.5 ml
HPV	<b>Gardasil™</b>	HPV 6L1 protein 20 µg HPV 11L1 protein 40 µg HPV 16L1 protein 40 µg HPV 18L1 protein 20 µg
Meningococcal	<b>Meningitec™</b>	10 µg serogroup C oligosaccharide <i>N. Meningitidis</i> conjugated to 15 µg diphtheria
	<b>Neis Vac-C™</b>	10 µg meningococcal C polysaccharide conjugated to 10-20 µg diphtheria toxoid carrier
	<b>Menactra®</b>	4 µg each of meningococcal A, C, Y, and W-135 polysaccharides conjugated to approximately 48 µg diphtheria toxoid carrier
	<b>Menomune®</b>	50 µg <i>N. Meningitidis</i> group-specific polysaccharide antigens A, C, Y, and W-135
Pneumococcal	<b>Prevnar™</b>	2 µg of each saccharide for types 4, 9V, 14, 18C, 19F, and 23F and 4 µg of serotype 6B, individually conjugated to diphtheria CRM <sub>197</sub> protein
	<b>Pneumo 23™</b>	25 µg each of the following serotypes of <i>streptococcus pneumoniae</i> : 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, 33F
	<b>Pneumovax® 23</b>	Same as Pneumo 23™
Varicella	<b>Varivax® III</b>	1350 plaque forming units (PFU) of Oka / Merck varicella virus
	<b>Varilrix®</b>	≥ 10 <sup>3.3</sup> PFU Oka strain varicella virus

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## 9.0 NON-IMMUNOGENIC COMPONENTS OF VACCINES

### Adjuvants:

- Any substance added to a vaccine to enhance the immune response by degree or duration making it possible to reduce the amount of antigen per dose or the total number of doses needed to achieve immunity.
- The only adjuvants used in vaccines in Canada are aluminum salts (e.g., aluminum hydroxide, aluminum phosphate, or potassium aluminum sulfate)..
- Adjuvants containing aluminum are found in many vaccines, including INFANRIX hexa™, PEDIACEL®, Prevnar®, and ADACEL®.

### Preservatives:

- Chemicals added to multidose, killed, or subunit vaccines to prevent serious secondary infections as a result of bacterial or fungal contamination of the vaccine. [e.g., thimerosal (found only in some influenza vaccines and adult preparations of hepatitis B vaccine); 2 phenoxyethanol in PEDIACEL®; phenol in Pneumo-23™].

### Antibiotics❶:

- to prevent contamination during viral cell culture (e.g., neomycin in MMR II™; polymyxin B in TdP)

### Egg/yeast proteins, glycerol, serum, amino acids, and enzymes❶:

- needed for growth of viruses

### Formaldehyde❶:

- to inactivate viruses and protein toxins (e.g., in PEDIACEL®, Td, IPV). The amount of formaldehyde remaining in a vaccine after the completion of the manufacturing process is less than that found naturally (continuously present in the blood, or turned over in a day) in the human body.

### Stabilizers:

- to help protect the vaccine during the manufacturing process (i.e., to control acidity (pH); stabilize antigens through necessary steps in the manufacturing process; and prevent antigens from sticking to the sides of glass vials) (e.g., gelatin in MMR II™, Polysorbate 20 and 80 in INFANRIX hexa™, potassium or sodium salts, lactose, human serum albumin, and a variety of animal proteins such as gelatin and bovine serum albumin)

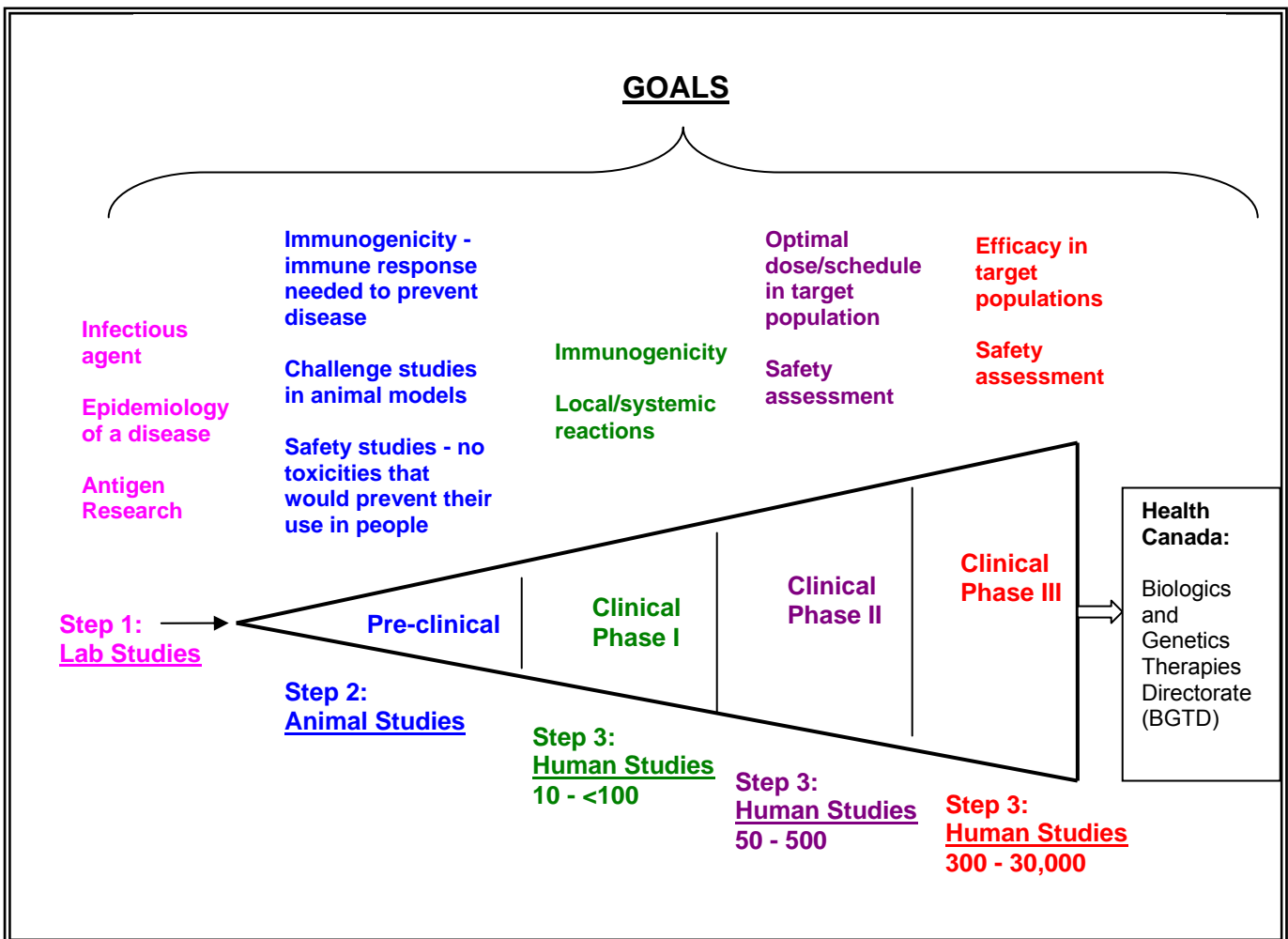
❶ *Most of these reagents are removed during the manufacturing process but “minute” amounts may remain in the final product.*

## 10.0 VACCINE DEVELOPMENT AND LICENSING

### 10.1 Vaccine Development

- Vaccines must be thoroughly tested before they can be called safe and effective for human use.
- It can take up to 10 years to test and develop a vaccine.
- Table 2.0 describes the stages of vaccine development from the lab to Health Canada approval.

**Table 2.0 Stages of Vaccine Development**

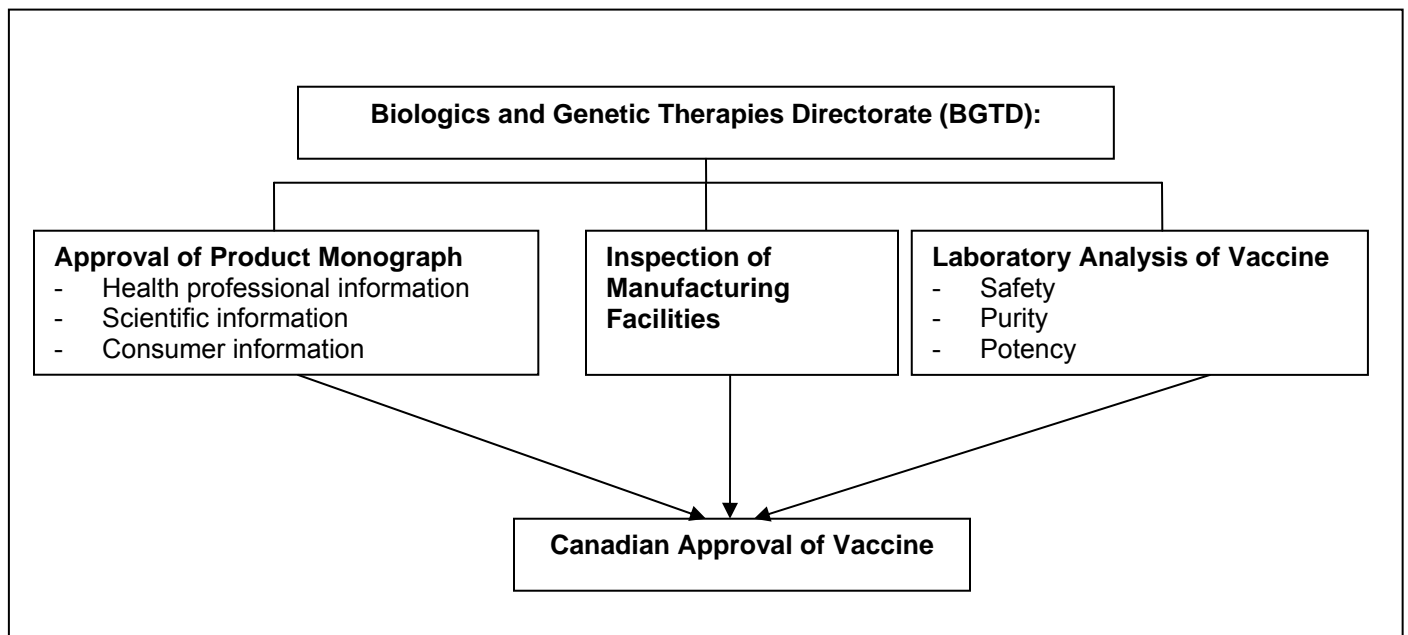


## 10.2 Canadian Vaccine Licensing

When the pharmaceutical company has successfully conducted the lab studies, animal studies, and human studies, the vaccine must meet Canadian licensing standards before the vaccine can be considered for use in Canada.

The Biologics and Genetic Therapies Directorate (BGTD) under Health Canada is the Canadian authority that regulates biological drugs (products derived from living sources) for human use.

**Table 3.0 Canadian Vaccine Licensing**



## 11.0 HISTORY OF IMMUNIZATION IN BC

SCHOOL IMMUNIZATION PROGRAMS		
VACCINE	YEAR	GROUP
Rubella	1974 - 1985	Grade 5 girls (Birth year cohort 1964 – 1975)
Measles/Mumps/Rubella (MMR)	1986	Catch up program for all children from Kg to Grade 12
Hepatitis B	1992 - present	Grade 6 (Birth year cohort 1981)
Measles/Rubella (MR)	1996	Elementary through post-secondary school students (Birth year cohort 1979 – 1991)
Hepatitis B	1997	Grade 12 (Birth year cohort 1980)
Hepatitis B (2 dose schedule)	2001 - present	Grade 6 (Birth year cohort 1990)
Hepatitis B (Thimerosal free)	2003 - present	Grade 6 (Birth year cohort 1992)
Meningococcal C conjugate	2003 - present	Grade 6 (Birth year cohort 1992)
Meningococcal C conjugate	2004 – 2006	Grade 9 (Birth year cohort 1990-1991)
Tetanus, diphtheria, acellular pertussis (Tdap - ADACEL™)	2004 - present	Grade 9 (replaced Td booster) (Birth year cohort 1989)
Varicella	2004 - present	Susceptible children at school entry and Grade 6 (Birth year cohorts 1999 and 1993)
Meningococcal C conjugate	2005 - 2007	Grade 12 (Birth year cohorts 1988 – 1989)
Human papillomavirus (HPV)	2008 - present	Grade 6 girls (Birth year cohort 1997)
Human papillomavirus (HPV)	2008 - 2011	Grade 9 girls (Birth year cohort 1994) <ul style="list-style-type: none"> <li>Program planned for three school years only (i.e., 2008/09, 2009/10 and 2010/11)</li> </ul>

**Indications/Comments** in the following tables refer to new groups added to those for whom the vaccine is already indicated, unless otherwise stated.



<b>DIPHTHERIA, TETANUS, PERTUSSIS, AND POLIO CONTAINING VACCINES</b>		
<b>VACCINE</b>	<b>YEAR</b>	<b>INDICATIONS / COMMENTS</b>
Diphtheria toxoid	1929	
TAB vaccine	1937	Typhoid, Paratyphoid A and B
TABT vaccine	1943	Tetanus toxoid, typhoid, and paratyphoid A and B
DPT	1948	Diphtheria, pertussis, and tetanus
Diphtheria (40 LF) and tetanus (DT)	1948	Primary immunization only
DPT Polio	1959	Diphtheria, pertussis, tetanus, and inactivated polio vaccine (IPV)
DT-IPV	1960	Diphtheria, tetanus, and polio
Tetanus / IPV	1960	Tetanus and polio
Diphtheria (10 LF) and tetanus (DT)	1965	Reinforcing immunization
DPT, DT, and Td	1981	Contained thimerosal
Td-IPV	1993	Tetanus, diphtheria and polio
Pentavalent vaccine (DPT-IPV-Hib)	1994	<ul style="list-style-type: none"> <li>Diphtheria, tetanus, pertussis, polio, and haemophilus influenzae type B</li> <li>Did not contain thimerosal</li> </ul>
Td-IPV	1995	Bone marrow transplant recipients
Acellular combination vaccines (PENTACEL® and QUADRACEL®)	1997	<ul style="list-style-type: none"> <li>PENTACEL® = Pentavalent (DaPT-IPV-Act-HIB)</li> <li>QUADRACEL® = Quadrivalent (DaPT-IPV)</li> <li>Acellular pertussis component</li> </ul>
Tetanus	Dec 31, 2000	<ul style="list-style-type: none"> <li>sanofi pasteur stopped manufacturing monovalent tetanus vaccine</li> </ul>
Tdap (ADACEL®)	2004	<ul style="list-style-type: none"> <li>Tetanus, diphtheria, and acellular pertussis</li> <li>Replaced Td booster for Grade 9 students (birth cohort 1989)</li> </ul>
Tdap	2006	<ul style="list-style-type: none"> <li>Replaced Td for immunization of unimmunized adults <math>\geq 19</math> years of age</li> <li>Available for all those <math>\geq 7</math> years of age</li> </ul>
Pentavalent vaccine (PEDIACEL®)	2007	<ul style="list-style-type: none"> <li>Replaced PENTACEL®</li> <li>IPV component manufactured with vero cell technology</li> </ul>



<b>DIPHTHERIA, TETANUS, PERTUSSIS, AND POLIO CONTAINING VACCINES (cont'd)</b>		
Tdap and Td-IPV	2007	Hematopoietic stem cell transplant (HSCT) and solid organ transplant candidates or recipients
Tdap	2007	<ul style="list-style-type: none"><li>• Adults who have not been immunized and immigrants of unknown immunization status are to receive one dose of Tdap, followed by 2 doses of Td</li><li>• ADACEL® approved for use in individuals <math>\geq</math> 4 years of age</li></ul>
Tdap and Td-IPV	2008	Clarification that HSCT and solid organ transplant candidates and recipients from $\geq$ 7 years of age are recommended to receive one dose of Tdap, followed by 2 doses of Td-IPV
Hexavalent vaccine DTaP-HB-IPV-Hib (INFANRIX hexa™)	Feb 2009	Replaces PEDIACEL® for infants and children <7 years of age starting their primary series



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<b>HAEMOPHILUS INFLUENZAE TYPE B (HIB) VACCINE</b>		
<b>VACCINE</b>	<b>YEAR</b>	<b>INDICATIONS / COMMENTS</b>
Hib (PRP)	1986	Children 2 to 5 years of age
Hib Conjugate (PRP)	1988	Children 18 months to 5 years of age
Hib 3 <sup>rd</sup> generation conjugate	1992	Children 2 months to 5 years of age
Pentavalent vaccine (DPT-IPV-Act Hib®)	1994	Children 2 months to 5 years of age
Hib Conjugate (Act HIB®)	1995	Bone marrow transplant recipients
Hib Conjugate (Act HIB®)	2002	Cochlear transplant candidates and recipients
Hib Conjugate (Act HIB®)	2005	Islet cell transplant recipients
Hib Conjugate (Act HIB®)	2007	Asplenics >5 years of age, regardless of previous Hib immunization history



<b>HEPATITIS A VACCINE</b>	
<b>YEAR</b>	<b>INDICATIONS / COMMENTS</b>
1994	Individuals with hemophilia A or B receiving plasma-derived factors and testing negative for anti-HAV
1998	<ul style="list-style-type: none"><li>• Illicit drug users</li><li>• Anti-HCV positive persons who are anti-HAV negative</li></ul>
2001	<ul style="list-style-type: none"><li>• Men who have sex with men</li><li>• Anti-HAV negative individuals chronically infected with hepatitis B virus</li><li>• Anti-HAV negative individuals with other chronic liver disease (including cirrhosis)</li></ul>
2001	Ig indicated for 2 new groups of contacts of case of hepatitis A: drug sharing contacts and co-workers when the case is a food handler
2002	Vaccine replaced Ig as treatment of choice for contacts of case of hepatitis A
2003	Liver transplant candidates and recipients
2004	HIV positive individuals eligible for 3 dose series of hepatitis A vaccine
2005	Bone marrow and HSCT clients
2006	Chronic (lifelong) blood transfusions
2008	Hemochromatosis



HEPATITIS B IMMUNE GLOBULIN	
YEAR	INDICATIONS / COMMENTS
1993	Infants $\leq$ 12 months of age when mother or primary caregiver is HBsAg positive
1994	<ul style="list-style-type: none"><li>• Newborns 0 to 7 days of age when mother is a chronic hepatitis B carrier</li><li>• Newborns and infants &lt; 1 year of age when mother, father, or primary caregiver has acute hepatitis B infection</li></ul>
1996	Sexual partners of a person diagnosed with acute hepatitis B infection
2001	Newborns when mother is at high risk for hepatitis B infection and her infectious status is unknown or negative
2007	Infant < 12 months of age whose mother has acute hepatitis B
2008	<ul style="list-style-type: none"><li>• Sex with a person who has acute or chronic hepatitis B infection</li><li>• Should be given as soon as possible after exposure but it may be given up to 7 days following percutaneous exposure and up to 14 days following permucosal or sexual exposures</li></ul>



<b>HEPATITIS B VACCINE</b>		
<b>VACCINE</b>	<b>YEAR</b>	<b>INDICATIONS / COMMENTS</b>
Heptavax	1984	Plasma derived hepatitis B vaccine provided by Canadian Red Cross to neonates of HBsAg positive mothers
Recombinant	1987	Available in Canada
Recombinant	1990	<ul style="list-style-type: none"> <li>Sexual contacts and household contacts (<math>\leq 12</math> years of age) of HBsAg positive persons</li> <li>At risk “street people”</li> </ul>
Recombinant	1992	<ul style="list-style-type: none"> <li>All grade 6 students (birth cohort 1981)</li> <li>Students in selected health care programs, STD clients, sex trade workers, individuals with multiple sexual partners, users of illicit IV drugs, and all household and sexual contacts of HBsAg positive individuals</li> </ul>
Recombinant	1993	<ul style="list-style-type: none"> <li>Pre-dialysis, hemodialysis, and peritoneal dialysis patients</li> <li>Long-term inmates (<math>\geq 6</math> months) of provincial correctional institutions</li> <li>Additional groups of health care students</li> </ul>
Recombinant	1995	Bone marrow transplant recipients
Recombinant	1996	Prophylaxis for sexual assault exposure
Recombinant	1997	<ul style="list-style-type: none"> <li>All Grade 12 students (birth cohort 1980)</li> <li>Persons who are anti-HCV positive and anti-HBc and HBsAg negative</li> </ul>
Recombinant	2001	<ul style="list-style-type: none"> <li>Infants whose mother or primary caregiver has risk factors for hepatitis B infection and their infectious state is unknown or negative</li> <li>Individuals with chronic liver disease (including cirrhosis) who do not have past or current evidence of hepatitis B infection</li> </ul>
Recombinant	March 2001	All infants at 2-4-6 months of age (infants born on or after January 1, 2001)



HEPATITIS B VACCINE (cont'd)		
Recombinant Thimerosal free	June 2001	<ul style="list-style-type: none"> <li>All infants and children &lt; 7 years of age who qualify for free vaccine</li> <li>Children &lt; 7 years of age whose families have immigrated to Canada from areas of high hepatitis B infectivity</li> <li>Children <math>\geq 7</math> to <math>\leq 12</math> years of age whose family has immigrated to Canada within the past year</li> </ul>
Recombinant (RecombivaxHB®) Merck Frosst	2001	2 dose series for Grade 6 students (birth cohort 1990)
Recombinant	2002	<ul style="list-style-type: none"> <li>Staff and residents of community group homes for the developmentally disabled</li> <li>Previously unimmunized children and staff in childcare settings where there is a child infected with hepatitis B</li> <li>Previously unimmunized teachers and classroom contacts of developmentally challenged known hepatitis B carriers whose behavior or medical condition increases risk to others</li> </ul>
Recombinant Thimerosal free	2003	Grade 6 students
Recombinant	2003	Liver transplant candidates and recipients
Recombinant	2005	HIV positive individuals
Recombinant	2007	Household contacts of internationally adopted children (who are chronic carriers or have unknown hepatitis B status)
Recombinant	2008	Hemochromatosis



<b>HUMAN PAPILLOMAVIRUS VACCINE</b>		
<b>VACCINE</b>	<b>YEAR</b>	<b>NEW INDICATIONS / COMMENTS</b>
Gardasil™	Sept 2008	<ul style="list-style-type: none"><li>• Girls in Grade 6 and 9 (birth year cohorts 1994 and 1997)</li><li>• Program for Grade 9 girls is to continue for two more school years only (i.e., 2009/10 and 2010/11)</li></ul>
Gardasil™	Sept 2010	<ul style="list-style-type: none"><li>• Extended dose schedule for girls in grade 6 (2 doses in grade 6 and the 3<sup>rd</sup> dose in grade 11)</li></ul>



INFLUENZA VACCINE		
VACCINE	YEAR	INDICATIONS / COMMENTS
Trivalent, whole virus	Early 1970's	<ul style="list-style-type: none"> <li>Residents of community care facilities</li> <li>High risk individuals</li> </ul>
Trivalent, inactivated, split-virus	2000/01	<ul style="list-style-type: none"> <li>First responders (police, firefighters, ambulance attendants)</li> <li>Independent health care practitioners and their staff</li> </ul>
Fluviral® (from GSK)	2004/05	<ul style="list-style-type: none"> <li>Infants 6 - 23 months, their household contacts, and their child care providers</li> </ul>
Fluviral®	2005/06	<ul style="list-style-type: none"> <li>Adults and children with any condition that can compromise respiratory function or the handling of respiratory secretions, or that can increase the risk of aspiration</li> <li>Inmates of provincial correctional facilities</li> <li>People working with poultry and/or swine</li> </ul>
Influvac™	2005/06	<ul style="list-style-type: none"> <li>Thimerosal free vaccine available on case by case basis for persons with history of anaphylactic reaction to thimerosal</li> </ul>
Vaxigrip® (from sanofi-pasteur) (Thimerosal-reduced)	2005/06	<ul style="list-style-type: none"> <li>Children 6 - 23 months of age</li> <li>Pregnant or breastfeeding women in high risk groups</li> <li>Pregnant women in their third trimester who are expected to deliver during the influenza season</li> </ul>
Fluviral® Vaxigrip®	2006/07	<ul style="list-style-type: none"> <li>People working with <b>live</b> poultry or swine</li> <li>Thimerosal free vaccine not available this season</li> </ul>
Fluviral® Vaxigrip®	2007/08	<ul style="list-style-type: none"> <li>Pregnant women in the third trimester now in "people at high risk" group</li> <li>Household contacts (including children) of people at high risk whether or not they have been immunized</li> <li>Added to routine schedule for infant 6-23 months of age during influenza season</li> </ul>
	Feb 2008	<ul style="list-style-type: none"> <li>Individuals with severe rheumatoid arthritis requiring immunosuppressive therapy</li> <li>Clarification that HCW groups include those in community settings, as well as staff in health care facilities</li> </ul>
Fluviral® Vaxigrip®	2008/09	<ul style="list-style-type: none"> <li>Those who provide care or service in potential outbreak settings housing high risk persons (e.g., crew on ships)</li> </ul>



INFLUENZA VACCINE		
VACCINE	YEAR	NEW INDICATIONS / COMMENTS
Pandemic Influenza H1N1: Adjuvanted: <ul style="list-style-type: none"> <li>• Arepanrix™ (GSK)</li> </ul> Non-adjuvanted: <ul style="list-style-type: none"> <li>• 2009 pandemic monovalent (GSK)</li> <li>• Clinical formulation (GSK)</li> </ul>	2009/10	<ul style="list-style-type: none"> <li>• &gt;95% of the pandemic influenza H1N1 formulation distributed was adjuvanted; non-adjuvanted vaccine was available in limited amounts for pregnant women. Vaccine was provided free to all BC residents but the limited supply initially required priority sequencing.</li> <li>• Seasonal vaccine was delayed until after pandemic H1N1 vaccine became available, except for the elderly who could receive the vaccine whenever available.</li> <li>• Simultaneous pandemic H1N1 and seasonal vaccine administration was permitted.</li> <li>• Seasonal vaccine was provided to the usual eligible groups.</li> </ul>
Fluviral® - 80% of supply Vaxigrip® - 20 % of supply	2010/11	<ul style="list-style-type: none"> <li>• adults who are morbidly obese (BMI ≥ 40)</li> <li>• aboriginal peoples (on and off reserve) for the 2010-2011 season only</li> </ul>



<b>MEASLES, MUMPS, AND RUBELLA VACCINES</b>		
<b>VACCINE</b>	<b>YEAR</b>	<b>INDICATIONS / COMMENTS</b>
Measles	1969	Measles (rubeola) live vaccine recommended for infants at 12 months of age, preschool, and susceptible school children
Rubella	1970	<ul style="list-style-type: none"> <li>• Rubella vaccine recommended for infants and children 12 months to 11 years of age</li> <li>• Mass immunization program carried out by health units</li> </ul>
Rubella	1974	Rubella vaccine provided free of charge to all young women
MMR	1981	Combined measles, mumps, rubella vaccine provided for all children $\geq$ 12 months of age
Rubella	1986	Rubella vaccine for Grade 5 girls discontinued
MMR	1986	Catch-up program for all children from Kg to Grade 12
MR	1996	<ul style="list-style-type: none"> <li>• Measles, rubella vaccine provided to all children 19 months of age and older (toddlers, preschool children, elementary, secondary, and post-secondary students) in province wide campaign. Second dose was for measles protection.</li> <li>• A second dose of MMR vaccine introduced at 18 months as part of the routine schedule</li> </ul>
Measles	1998	A second dose of measles-containing vaccine recommended for persons $\geq$ 18 months to 18 years of age
Rubella	Dec. 1998	sanofi pasteur stopped manufacturing monovalent rubella vaccine
Measles	March 31 2001	sanofi pasteur stopped manufacturing monovalent measles vaccine
MMR	2005	A second dose of MMR provided to HCWs and child care workers born after 1956
MMR	2006	<ul style="list-style-type: none"> <li>• A second dose of MMR provided free for women of childbearing age who are susceptible to rubella</li> <li>• A dose of MMR recommended for HCWs and child care workers who lack proof of one dose of mumps vaccine, or physician diagnosed disease or lab confirmation of immunity</li> </ul>
MMR	2007	Post secondary students and military recruits (2 doses recommended)



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MMR	2008	A second dose of MMR recommended 6 – 12 months after the first dose for hematopoietic stem cell transplant recipients
MMR	2009	Provided free for all individuals who are susceptible to measles, mumps, or rubella: <ul style="list-style-type: none"><li>• Measles: 2 doses of a measles-containing vaccine are recommended for all individuals born on or after January 1, 1957 who do not have a history of lab-confirmed measles disease</li><li>• Mumps: 2 doses of a mumps-containing vaccine are recommended for all individuals born on or after January 1, 1970; one dose is recommended for all individuals born January 1, 1957 to December 31, 1969 who do not have evidence of immunity to mumps disease</li><li>• Rubella: one dose of a rubella-containing vaccine is recommended for all individuals who do not have evidence of rubella immunity. One dose is considered evidence of immunity to rubella.</li></ul>



<b>MENINGOCOCCAL VACCINE</b>		
<b>VACCINE</b>	<b>YEAR</b>	<b>INDICATIONS / COMMENTS</b>
Quadrivalent Polysaccharide	1994	Individuals $\geq$ 2 years of age with anatomic or functional asplenia
Quadrivalent Polysaccharide	1995	Bone marrow transplant recipients
Men C Conjugate	April 1 2003	<ul style="list-style-type: none"> <li>High risk individuals</li> </ul>
Men C Conjugate	July 1 2003	<ul style="list-style-type: none"> <li>All infants at 12 months of age (born on or after July 1, 2002)</li> </ul>
Men C Conjugate	Sept 2003	<ul style="list-style-type: none"> <li>Students in grade 6 (birth year cohort 1992) starting in 2003/04 school year</li> </ul>
Meningococcal C conjugate and polysaccharide	2003	Solid organ transplant recipients
Men C Conjugate	Sept 2004 to June 2006	Students in grade 9 starting in 2004/05 school year (birth year cohort 1990-1991)
Men C Conjugate	June 2005	2 dose series (at 2 months and 12 months of age) recommended for all infants born on or after April 1, 2005
Men C Conjugate	March 2005 to June 2007	Students in grade 12 (birth year cohort 1988-1989)
Men C Conjugate and Polysaccharide	2005	Islet cell transplant recipients
Men C Conjugate	April-Nov 2006	Men who have sex with men due to outbreak among this population
Men C Conjugate	2007	Preferred for prophylaxis of contacts of invasive Men C disease
Meningococcal quadrivalent conjugate	2007	<ul style="list-style-type: none"> <li>Medically high risk (including candidates or recipients of solid organ or islet cell transplant or cochlear implant)</li> <li>Contacts of invasive meningococcal disease</li> <li>Control of outbreaks of invasive meningococcal disease</li> </ul>



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Men C Conjugate	2008	<ul style="list-style-type: none"><li>• Infant who receives last dose of Men C Conjugate vaccine before 12 months of age requires 1 additional dose at <math>\geq</math> 12 months of age</li><li>• Children <math>\geq</math> 2 months to &lt; 12 months of age who are at high risk medically or close contacts of a case of invasive Meningococcal group C disease require 3 doses of any MCC vaccine</li></ul>
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<b>PNEUMOCOCCAL VACCINE</b>		
<b>VACCINE</b>	<b>YEAR</b>	<b>INDICATIONS / COMMENTS</b>
Polysaccharide	1996	Bone marrow transplant recipients and those with functional or anatomic asplenia
Polysaccharide	1997	All residents of extended and intermediate care facilities
Polysaccharide	1998	All persons $\geq$ 65 years of age
Polysaccharide	2001	Persons 2 to 64 years of age at high risk of invasive pneumococcal disease
Conjugate	April 1 2003	<ul style="list-style-type: none"> <li>• High risk infants and children 2 to 59 months of age</li> <li>• Aboriginal infants and children 2 to 59 months of age</li> <li>• 4 dose schedule (at 2, 4, 6, and 18 months of age)</li> </ul>
Conjugate	Sept 1 2003	All infants starting at 2 months of age (All infants born on or after July 1, 2003)
Polysaccharide	2003	<ul style="list-style-type: none"> <li>• Solid organ transplant recipients</li> <li>• Hepatitis C</li> </ul>
Conjugate and polysaccharide	2005	Islet cell transplant recipients
Conjugate and polysaccharide	2006	<ul style="list-style-type: none"> <li>• Cystic fibrosis</li> <li>• Asthma excluded unless management involves ongoing high dose oral corticosteroid therapy</li> </ul>
Conjugate	January 2007	<ul style="list-style-type: none"> <li>• Schedule change: 3 doses recommended for healthy infants; 4 doses recommended for medically high risk infants.</li> <li>• Aboriginal infants schedule is “healthy” infant schedule</li> </ul>
Conjugate and polysaccharide	2007	<ul style="list-style-type: none"> <li>• Solid organ transplant candidates and recipients</li> <li>• Islet cell transplant candidates and recipients</li> </ul>
Polysaccharide	2008	Homelessness and / or illicit drug use
Conjugate	July 2008	All infants in B.C. who are 2 to 59 months of age are eligible as the first infants born in July 2003 are now 59 months old



<b>POLIO VACCINE</b>		
<b>VACCINE</b>	<b>Year</b>	<b>INDICATIONS / COMMENTS</b>
Inactivated polio vaccine (IPV) (Salk)	1955	Field trials
IPV	1957	Routine protection between 6 months and 40 years of age
DPT Polio	1959	Diphtheria, pertussis, tetanus, and inactivated polio vaccine (IPV)
DT-IPV	1960	Diphtheria, tetanus, and polio
Tetanus-IPV	1960	Tetanus and polio
Oral polio vaccine (OPV) (Sabin)	1962	One dose recommended in community wide programs for all ages
OPV	1964	<ul style="list-style-type: none"> <li>Province wide campaign</li> <li>Recommended for primary and reinforcing immunization for all age groups</li> </ul>
OPV	1965	3 doses recommended after 3 months of age after 3 doses of IPV
OPV	1967	3 doses recommended for routine immunization without previous IPV
OPV	1984	Discontinued doses at 6 months and 14 years of age
Enhanced injectable polio (e-IPV)	1990	Replaced previously used IPV
OPV	1994	Discontinued use
IPV (vero cell origin)	2007	Replaced previous IPV product of human diploid cell origin
IPV	2008	<ul style="list-style-type: none"> <li>One dose of IPV recommended for children <math>\geq 7</math> years of age who have not received a polio booster on or after their 4<sup>th</sup> birthday</li> <li>children and adults who may be exposed to wild polio viruses (including HCWs)</li> </ul>
IPV	2009	<ul style="list-style-type: none"> <li>All HCWs who have not received a complete primary series of polio vaccine should complete a primary series of IPV</li> <li>All HCWs who previously completed a primary series of polio vaccine should be offered a single booster dose of IPV</li> </ul>



VARICELLA VACCINE		
VACCINE	YEAR	INDICATIONS / COMMENTS
Varivax® III	2002	Varivax® III, the third generation of the Merck Frosst varicella vaccine made available. It is refrigerator stable at 2- 8°C until lot expiry.
Varilrix®	2004	<ul style="list-style-type: none"> <li>• High risk and immunocompromised clients</li> <li>• Household contacts of immunocompromised individuals</li> <li>• Health care workers and health care students</li> <li>• Susceptible children at school entry and Grade 6 (birth year cohorts 1993 and 1999)</li> </ul>
Varivax® III	2005 (January)	Susceptible infants at 12 months of age (infants born on or after January 1, 2004)
Varilrix®	2005	Sickle cell disease
Varivax® III	2005 (April)	Catch up program for susceptible children 18 months to 48 months of age
Varivax® III	2006 (April)	<ul style="list-style-type: none"> <li>• <b>Active</b> catch up program for susceptible children 18 to 47 months of age</li> <li>• Susceptible children, adolescents, and adults at opportune health encounters (i.e., “universal varicella program”)</li> </ul>
Varilrix®	2007	Susceptible immunocompromised: “receiving inhaled or topical steroids” removed (included under susceptible children, adolescents and adults, including health care workers)
Varivax® III  Varilrix®	2007 (August)	<ul style="list-style-type: none"> <li>• A person who experienced varicella disease before 12 months of age is considered susceptible</li> <li>• Opportunistic immunization of children who did not receive varicella vaccine at 12 months of age because of previous varicella disease</li> <li>• Adult and child candidates for solid organ transplant (kidney, lung, liver, heart), providing they are not receiving immunosuppressive treatment at the time of immunization</li> </ul>
Varilrix®	2008	Adult and child hematopoietic stem cell transplant recipients (with specialist’s approval only) – use Varilrix® vaccine only



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Varilrix®	2009	<ul style="list-style-type: none"><li>• Individuals <math>\geq</math> 12 months of age with mildly symptomatic or asymptomatic HIV infection</li><li>• All candidates for solid organ transplant</li><li>• Chronic kidney disease/dialysis</li><li>• <math>\geq</math> 1 month after completion of high doses (<math>&gt;</math> 2mg/kg or <math>&gt;</math> 20 mg daily) oral corticosteroid therapy more than 14 days duration</li></ul>
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OTHER	
1907	Smallpox vaccine available
1931	Scarlet fever vaccine available
1944	Cholera and typhus vaccines available
1948	Yellow fever vaccine available from the Federal Department of Immigration
1975	Small pox vaccine no longer part of the routine schedule, as a result of WHO eradication program
Late 1970's	BCG discontinued for health care workers. No specific date on record.
1980	Smallpox vaccine no longer administered
1993	<ul style="list-style-type: none"><li>• Botulism antitoxin, diphtheria antitoxin, Rabies Immune Globulin (RIG) and rabies vaccine provided without charge when authorized by Emergency Biologicals program</li><li>• Live attenuated oral typhoid vaccine available</li></ul>
2003	BCG discontinued in First Nations communities

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