

# CANADIAN IMMUNIZATION GUIDE

## PART 3

PROTECTING CANADIANS FROM ILLNESS



Public Health  
Agency of Canada

Agence de la santé  
publique du Canada

Canada 

**TO PROMOTE AND PROTECT THE HEALTH OF CANADIANS THROUGH LEADERSHIP, PARTNERSHIP,  
INNOVATION AND ACTION IN PUBLIC HEALTH.**

—Public Health Agency of Canada

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## PART 3

# IMMUNIZATION OF ADULTS

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Prevention of infection by immunization is not just for children; adults require immunization to address waning immunity against some vaccine preventable diseases and to establish immunity against other diseases more common in adults. In addition, immunization of adults prevents infection and, therefore, subsequent exposure of young children and others at increased risk of vaccine preventable diseases. For example, adults who are in contact with infants should be prioritized to receive pertussis and influenza vaccination to reduce the risk of transmission of these infections to infants who are too young to be fully protected. Some vaccines are needed by all adults and other vaccines may be required due to individual risk resulting from occupation, travel, underlying illness, lifestyle or age.

In recent years, new vaccines such as herpes zoster and human papillomavirus have become available for adults. Despite these advances, the vaccination rates of adults in Canada are low, resulting in many adults remaining vulnerable to vaccine preventable diseases.

Common reasons for incomplete immunization in adulthood include:

- lack of recognition of the importance of adult immunization
- lack of recommendation from health care providers
- lack of health care provider knowledge about adult immunization and recommended vaccines
- misrepresentation/misunderstanding of the risks of vaccine and benefits of disease prevention in adults
- lack of understanding of vaccine safety and efficacy
- missed opportunities for vaccination in health care providers' offices, hospitals and nursing homes
- lack of publicly-funded vaccine and reimbursement to vaccine providers
- lack of coordinated immunization programs for adults
- lack of regulatory or legal requirements
- fear of injections
- lack of availability of up-to-date records and recording systems

Adult immunization is an emerging issue that has seen an increasing emphasis in clinical care and health professional training programs.

## HEALTH CARE PROVIDER RESPONSIBILITIES

Health care providers have a responsibility to ensure that adults under their care have continuing and updated protection against vaccine preventable diseases through appropriate immunization. When considering immunization, the person's medical history will inform whether other immunizations are needed in addition to routinely recommended vaccines. Refer to [Immunization of Persons with Chronic Diseases](#) and [Immunization of Immunocompromised Persons](#) in Part 3 for further information on how health conditions may modify vaccine recommendations.

Health care providers should provide adults under their care with factual information about immunization, including:

- information about vaccines
- expert recommendations regarding the use of vaccines
- benefits and risks of vaccination
- cost of the vaccine if it is not publicly funded
- possible consequences of declining a vaccine
- where vaccine can be obtained if the health care provider is unable to provide the vaccine

When more than one dose of a vaccine is required for optimal protection, the health care provider should arrange follow-up to encourage completion of the vaccine series.

## STRATEGIES TO IMPROVE VACCINE UPDATE ADULTS

All adults should be counselled concerning their immunization status. Opportunities for general immunization counselling of adults include:

- new patient/client encounters
- periodic health examinations
- pregnancy and the immediate post-partum period
- visits for chronic disease management
- assessment of new immigrants
- parents attending their child's vaccination visits
- hospitalization, especially when diagnosed with a chronic disease
- management protocols on admission to nursing homes, long-term care institutions, and acute care institutions
- management protocols on admission to health professional training programs
- new employee assessments in day care, health care and health care-related facilities
- persons requesting specific vaccination(s)
- persons with evidence of risk taking behaviour, such as illicit drug use or a sexually transmitted infection
- individuals requesting advice concerning travel

Health care providers should regularly review individuals under their care to ensure that the person's immunization status is up to date and that they have been made aware of new vaccines. Practitioners should routinely audit immunization records during clinical encounters; scheduling record audits on a set birthday, for example, to coincide with a mid-decade birthday (i.e., 25, 35 years of age, etc.), is one effective reminder strategy. Health care institutions should have policies addressing immunization issues for patients/clients and personnel.

Strategies to increase the uptake of immunization by adults include: community education, patient/client reminders, incentives, patient/client-held records, legal or regulatory requirements, and programs that decrease costs. Educational programs for health care providers are also effective, as are organizational



changes, such as immunization clinics and the participation of non-physician staff in the execution of prevention strategies or immunization programs.

A sample adult immunization record and information resources for adult immunization are available on the [Immunize Canada](http://www.immunize.ca/en/specific-groups/adults.aspx) website (<http://www.immunize.ca/en/specific-groups/adults.aspx>).

## RECOMMENDED IMMUNIZATION FOR ADULTS

All adults in Canada without contraindications should be routinely immunized against vaccine preventable diseases. Routinely recommended adult immunizations are summarized in [Table 1](#). Recommended immunization schedules for adults who have no record or an uncertain immunization history, as well as for booster dosing of those who have completed a primary series are available in [Table 5](#) and [Table 6](#) in [Recommended Immunization Schedules](#) in Part 1.

**In addition to routinely recommended immunization, certain vaccines are recommended for adults in specific risk situations.** These recommendations are summarized in [Table 2](#). Health care workers and international travellers require assessment of immunization status, completion of routinely recommended vaccine series, and booster doses as necessary. [Table 7](#) in [Recommended Immunization Schedules](#) in Part 1 highlights recommended immunizations for adults considered at-risk. Refer to [Immunization of Travellers](#), [Immunization of Workers](#), [Immunization of Immunocompromised Persons](#), and [Immunization of Persons with Chronic Diseases](#) in Part 3; and vaccine-specific chapters in Part 4 for additional information.

### DIPHTHERIA, TETANUS

All adults in Canada should be immunized against diphtheria and tetanus. Booster doses of diphtheria and tetanus toxoid-containing vaccine are recommended every 10 years. Refer to [Diphtheria Toxoid](#) and [Tetanus Toxoid](#) in Part 4 for additional information.

### HERPES ZOSTER (SHINGLES)

Herpes zoster vaccine may be given to adults 50 to 59 years of age and is routinely recommended for adults 60 years of age and older. Adults aged 50 years and older who are known to be varicella zoster virus seronegative should receive two doses of varicella (chickenpox) vaccine rather than herpes zoster (shingles) vaccine. It should be that varicella zoster virus antibody is not usually measured in adults 50 years of age and older; therefore, most adults should be considered immune to varicella and offered herpes zoster vaccine as appropriate based on their age. Refer to [Herpes Zoster \(Shingles\) Vaccine](#) in Part 4 for additional information.

### HUMAN PAPILLOMAVIRUS

Bivalent or quadrivalent human papillomavirus (HPV) vaccine is recommended for women up to and including 26 years of age and may be given to those 27 years of age and older who are at ongoing risk of exposure. Quadrivalent HPV vaccine is recommended for men up to and including 26 years of age and may be administered to men 27 years of age and older who are at ongoing risk of exposure. Refer to [Human Papillomavirus Vaccine](#) in Part 4 for additional information.

### INFLUENZA

Seasonal influenza vaccine is encouraged annually for all adults and is recommended annually for adults 65 years of age and older as well as adults of all ages in specific risk situations, including healthy adults in close contact with children less than 5 years of age or other high-risk individuals (refer to [Table 2](#)). Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### MEASLES, MUMPS, RUBELLA

Combined measles-mumps-rubella vaccine (MMR) is recommended for vaccination of adults susceptible to one or more of these viruses. One dose is recommended for most susceptible adults born in or after 1970. Those who are at the greatest risk of measles or mumps exposure (travellers to destinations

outside of North America, health care workers, students in post-secondary educational settings, and military personnel) should receive 2 doses, at least 4 weeks apart. Adults born before 1970 can be assumed to have acquired natural immunity to measles and mumps and do not need vaccine unless: non-immune military personnel or health care workers (2 doses, at least 4 weeks apart) or non-immune travellers (1 dose) or non-immune students (consider 1 dose). Rubella-susceptible adults, regardless of age, should receive 1 dose. If rubella vaccine is indicated for a pregnant woman, it should be provided after delivery, preferably prior to discharge from hospital. Refer to [Measles Vaccine](#), [Mumps Vaccine](#) and [Rubella Vaccine](#) in Part 4 for additional information including criteria for determining susceptibility/immunity to measles, mumps and rubella.

### **MENINGOCOCCAL**

Healthy adults up to and including 24 years of age should receive meningococcal conjugate vaccine if not received in adolescence. Either monovalent or quadrivalent conjugate meningococcal vaccine may be used depending on local epidemiology and programmatic considerations. Adults with specific risk conditions (refer to [Table 2](#)) should receive two doses of quadrivalent conjugate meningococcal vaccine, 8 weeks apart, followed by booster doses every 5 years. Refer to [Meningococcal Vaccine](#) in Part 4 for additional information.

### **PERTUSSIS**

All adults (18 years of age and older) should receive one dose of acellular pertussis-containing vaccine (Tdap) if not previously received during adulthood. This can be administered regardless of the interval since the last dose of tetanus and diphtheria toxoid-containing vaccine. In particular, adults who have not previously received Tdap vaccine in adulthood, and who anticipate having regular contact with an infant, should be prioritized to receive a dose of Tdap vaccine, ideally administered at least 2 weeks before contact with the infant. Refer to [Pertussis Vaccine](#) in Part 4 for additional information.

### **PNEUMOCOCCAL**

A single dose of pneumococcal 23-valent polysaccharide vaccine (Pneu-P-23) is recommended for adults 65 years of age and older, and for younger adults with specific risk factors. (refer to [Table 2](#)) One lifetime re-immunization with Pneu-P-23 vaccine should be considered for those at highest risk of invasive pneumococcal disease.

Hematopoietic stem cell transplant (HSCT) recipients should receive a primary series of 3 doses of pneumococcal 13-valent conjugate vaccine (Pneu-C-13) starting 3 to 9 months after transplant, after discussion with transplant specialists, followed by a booster dose of Pneu-P-23 vaccine 12 to 18 months post-transplant (6 to 12 months after the last dose of Pneu-C-13 vaccine). For other immunosuppressed adults (including those with HIV; anatomic or functional asplenia; sickle cell disease or other hemoglobinopathies; congenital immunodeficiencies; malignant neoplasms including leukemia or lymphoma; who are on immunosuppressive therapies; or who are either a recipient or a candidate for solid organ or islet cell transplant), give 1 dose of Pneu-C-13 vaccine followed 8 weeks later by 1 dose of Pneu-P-23 vaccine. Refer to [Pneumococcal Vaccine](#) in Part 4 and [Immunization of Immunocompromised Persons](#) in Part 3 for additional information.

### **POLIO**

All adults in Canada should be immune to polio. For previously unimmunized adults, administer a primary series of inactivated poliomyelitis vaccine (IPV)-containing vaccine if a primary series of tetanus and diphtheria toxoid-containing vaccine is being given or if the adult is at increased risk for exposure to poliovirus (refer to [Table 2](#)). Otherwise administer IPV vaccine with routine tetanus and diphtheria toxoid-containing vaccine booster doses. A single lifetime booster dose of IPV-containing vaccine is recommended for adults previously immunized with polio vaccine who are at increased risk of exposure (refer to [Table 2](#)). Refer to [Poliomyelitis Vaccine](#) in Part 4 for additional information.

### **VARICELLA**

Two doses of univalent varicella vaccine are recommended for susceptible adults 18 to 49 years of age. Adults (under 50 years of age) who have received only one dose of varicella vaccine should be offered a second dose. Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information.

**Table 1: Adult Immunization – Recommendations for routine immunization in healthy adults at low risk<sup>1</sup>**

Vaccine	Recommendations for routine immunization
<b>Diphtheria Tetanus</b>	Primary series for previously unimmunized adults Booster dose every 10 years
<b>Herpes zoster (shingles)</b>	60 years of age and older – 1 dose 50 to 59 years of age – may be given 1 dose
<b>HPV</b>	Women up to and including 26 years of age – bivalent (HPV2) or quadrivalent (HPV4) vaccine Men up to and including 26 years of age – HPV4 vaccine
<b>Measles Mumps</b>	Susceptible adults born in or after 1970 – 1 dose Born before 1970 – consider immune
<b>Meningococcal conjugate</b>	Adults up to and including 24 years of age not immunized in adolescence – 1 dose
<b>Pertussis</b>	One dose of acellular pertussis-containing vaccine (Tdap) in adulthood Adults who will be in close contact with young infants should be immunized as early as possible
<b>Pneumococcal 23- valent polysaccharide (Pneu-P-23)</b>	65 years of age and older – 1 dose
<b>Polio</b>	Primary series for previously unimmunized adults when a primary series of tetanus and diphtheria toxoid-containing vaccine is being given or with routine tetanus and diphtheria-toxoid containing vaccine booster doses
<b>Rubella</b>	Susceptible adults – 1 dose If vaccine is indicated, pregnant women should be immunized after delivery
<b>Varicella (chickenpox)</b>	Susceptible adults up to and including 49 years of age – 2 doses; if previously received 1 dose should receive a second dose Known seronegative adults 50 years of age and older – 2 doses – routine testing is not advised

<sup>1</sup> Refer to vaccine-specific chapters in Part 4 for additional information. Refer to [Table 2](#) for recommendations for adults with risk factors.



**Table 2: Adult immunization – recommendations for specific risk situations<sup>1</sup>**

Vaccine	Recommendations for risk situations
<b>Bacille Calmette-Guérin (BCG)</b>	<p>Consider use for adults:</p> <ul style="list-style-type: none"> <li>• who may be repeatedly exposed to persons with untreated, inadequately treated or drug-resistant active tuberculosis (TB) in conditions where protective measures against infection are not feasible and if early identification and treatment of latent TB infection are not available</li> <li>• who are long-term travellers to high prevalence countries (in exceptional circumstances as noted above)</li> </ul>
<b>Cholera and travellers' diarrhea</b>	<p>Consider use for <b>cholera prevention</b> in adult travellers to cholera-endemic area(s) at high-risk of exposure, including those with occupational risk for exposure (e.g., health care or humanitarian workers in endemic countries)</p> <p>Consider use for <b>prevention of travellers' diarrhea</b> in adults:</p> <ul style="list-style-type: none"> <li>• with chronic diseases at risk for complications</li> <li>• at increased risk of acquiring travellers' diarrhea</li> <li>• who are immunosuppressed</li> </ul>
<b><i>Haemophilus influenzae</i> type b (Hib)</b>	<p>Recommended for adults with increased risk of invasive Hib disease:</p> <ul style="list-style-type: none"> <li>• congenital immunodeficiencies</li> <li>• malignant hematologic disorders</li> <li>• HIV</li> <li>• anatomic or functional asplenia</li> <li>• all transplant recipients</li> <li>• cochlear implant recipients</li> </ul> <p>Following HSCT adults should receive 3 doses of Hib vaccine at least 4 weeks apart starting 6 to 12 months post-transplant</p>
<b>Hepatitis A</b>	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>• travelling to hepatitis A (HA) endemic areas</li> <li>• who are immigrants from HA endemic areas</li> <li>• who are household or close contacts of children adopted from HA endemic countries</li> <li>• in communities or populations at risk of outbreaks or in which HA is highly endemic</li> <li>• who are household or close contacts of proven or suspected cases of HA</li> <li>• with occupational or lifestyle risk for exposure</li> <li>• with chronic liver disease from any cause, including those infected with hepatitis C</li> <li>• with hemophilia A or B receiving plasma-derived replacement clotting factors</li> <li>• for post-exposure or outbreak management</li> </ul>

Vaccine	Recommendations for risk situations
<b>Hepatitis B</b>	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>• who have immigrated to Canada from areas where there is a high prevalence of HB</li> <li>• who are household or sexual contacts of acute hepatitis B (HB) cases and HB carriers, including close contacts of children adopted from HB endemic countries if the adopted child is HBsAg positive</li> <li>• with occupational or lifestyle risk for exposure</li> <li>• travelling to HB endemic areas</li> <li>• in communities/populations in which HB is highly endemic</li> <li>• who are residents of institutions for the developmentally challenged or inmates of correctional facilities</li> <li>• with chronic liver disease, including those infected with hepatitis C</li> <li>• with chronic renal disease, including chronic dialysis</li> <li>• hemophiliacs and other people who receive repeated infusions of blood or blood products</li> <li>• who have undergone hematopoietic stem cell transplantation or are awaiting solid organ transplant</li> <li>• who have congenital immunodeficiencies</li> <li>• who are HIV-infected</li> <li>• for post-exposure management</li> </ul>
<b>HPV</b>	May be given to men and women 27 years of age and older at ongoing risk of exposure*
<b>Influenza</b>	<p>Recommended annually for adults:</p> <ul style="list-style-type: none"> <li>• at high risk of influenza-related complications</li> <li>• capable of transmitting influenza to individuals at high risk</li> <li>• who provide essential community services</li> <li>• in direct contact during culling operations with poultry infected with avian influenza</li> </ul>
<b>Japanese encephalitis</b>	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>• with occupational risk for exposure</li> <li>• travelling to endemic area(s) during transmission season with specified exposure risks</li> </ul> <p>Booster dose 12 months after primary immunization for persons at continuous risk</p>
<b>Measles Mumps</b>	<p>Recommended for adults born in or after 1970:</p> <ul style="list-style-type: none"> <li>• If susceptible and at increased risk of exposure (travellers to destinations outside of North America, health care workers, students in post-secondary educational settings, and military personnel) - 2 doses, at least 4 weeks apart.</li> </ul> <p>Recommended for adults born before 1970 if:</p> <ul style="list-style-type: none"> <li>• non-immune military personnel or health care workers - 2 doses, at least 4 weeks apart</li> </ul>

Vaccine	Recommendations for risk situations
	<ul style="list-style-type: none"> <li>• non-immune travellers - 1 dose</li> <li>• non-immune students - consider 1 dose</li> </ul> <p>Recommended for early post-exposure management of measles</p>
<b>Meningococcal quadrivalent conjugate</b>	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>• with occupational risk for exposure (i.e., laboratory workers and the military)</li> <li>• who are travellers for whom meningococcal vaccine is recommended or required, including travellers to sub-Saharan African and pilgrims to the Hajj in Mecca, Saudi Arabia</li> <li>• at high risk of meningococcal disease due to medical conditions:             <ul style="list-style-type: none"> <li>○ anatomic or functional asplenia (including sickle cell disease)</li> <li>○ congenital complement, properdin, factor D or primary antibody deficiencies</li> <li>○ acquired complement deficiency due to receipt of the terminal complement inhibitor eculizumab consider use for HIV-infected adults</li> </ul> </li> <li>• who are close contacts of a case of invasive meningococcal disease caused by a vaccine preventable serogroup</li> <li>• for management of an outbreak caused by a vaccine preventable serogroup</li> </ul> <p>Booster doses every 5 years if risk is ongoing</p>
<b>Pneumococcal 23-valent polysaccharide (Pneu-P-23)</b>	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>• who are residents of long-term care facilities</li> <li>• who are at increased risk of invasive pneumococcal disease (IPD) due to lifestyle factors:             <ul style="list-style-type: none"> <li>○ persons with alcoholism</li> <li>○ smokers</li> <li>○ persons who are homeless</li> </ul> </li> <li>• who are at high risk of IPD but without immunosuppression. Persons with:             <ul style="list-style-type: none"> <li>○ asthma requiring regular medical care</li> <li>○ chronic cerebral spinal fluid (CSF) leak</li> <li>○ chronic neurologic condition that may impair clearance of oral secretions</li> <li>○ cochlear implants (including those who are to receive implants)</li> <li>○ chronic cardiac or pulmonary disease</li> <li>○ diabetes mellitus</li> <li>○ chronic kidney disease, including nephrotic syndrome</li> <li>○ chronic liver disease (including hepatic cirrhosis due to any cause)</li> </ul> </li> <li>• who are at high risk of IPD AND are immunosuppressed. These persons should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine eight weeks later. Persons with:             <ul style="list-style-type: none"> <li>○ asplenia (functional or anatomic)</li> </ul> </li> </ul>

Vaccine	Recommendations for risk situations
	<ul style="list-style-type: none"> <li>○ sickle cell disease or other hemoglobinopathies</li> <li>○ congenital immunodeficiencies involving any part of the immune system, including B-lymphocyte (humoral) immunity, T-lymphocyte (cell) mediated immunity, complement system (properdin, or factor D deficiencies), or phagocytic functions</li> <li>○ HIV infection</li> <li>○ immunosuppressive therapy including use of long-term corticosteroids, chemotherapy, radiation therapy, post-organ transplant therapy, and biologic and non-biologic immunosuppressive therapies for rheumatologic and other inflammatory diseases</li> <li>○ malignant neoplasms including leukemia and lymphoma</li> <li>○ solid organ or islet cell transplant (candidate or recipient).</li> </ul> <p>Consider for individuals who use illicit drugs</p> <p>One lifetime booster dose for adults at highest risk of IPD.</p>
<b>Pneumococcal 13-valent conjugate (Pneu-C-13)</b>	<p>The following adults should receive 1 dose of Pneu-C-13 vaccine followed 8 weeks later by 1 dose of Pneu-P-23 vaccine. Adults with:</p> <ul style="list-style-type: none"> <li>● asplenia (functional or anatomic)</li> <li>● sickle cell disease or other hemoglobinopathies</li> <li>● congenital immunodeficiencies involving any part of the immune system, including B-lymphocyte (humoral) immunity, T-lymphocyte (cell) mediated immunity, complement system (properdin, or factor D deficiencies), or phagocytic functions</li> <li>● HIV infection</li> <li>● immunosuppressive therapy including use of long-term corticosteroids, chemotherapy, radiation therapy, post-organ transplant therapy, and biologic and non-biologic immunosuppressive therapies for rheumatologic and other inflammatory diseases</li> <li>● malignant neoplasms including leukemia and lymphoma</li> <li>● solid organ or islet cell transplant (candidate or recipient)</li> </ul> <p>Following HSCT, adults should receive 3 doses of Pneu-C-13 vaccine at least 4 weeks apart followed by a dose of Pneu-P-23 vaccine 6 to 12 months after the last Pneu-C-13 dose (refer to <a href="#">Immunization of Immunocompromised of Persons</a> in Part 3 for additional information)</p>
<b>Polio</b>	<p>Priority for adults who are:</p> <ul style="list-style-type: none"> <li>● travelling to, or receiving travellers from, areas where poliovirus is known or suspected to be circulating</li> <li>● health care workers who have close contact with patients who might be excreting wild type or vaccine type poliovirus</li> <li>● members of communities or specific population groups with disease caused by polio</li> <li>● people who come in close contact with those who may be excreting poliovirus (e.g., people working with</li> </ul>

Vaccine	Recommendations for risk situations
	<p>refugees, or the military and people on humanitarian missions in endemic countries)</p> <ul style="list-style-type: none"> <li>laboratory workers handling specimens that may contain poliovirus</li> <li>family or close contacts of internationally adopted infants who may have been or will be vaccinated with OPV vaccine</li> </ul> <p>For previously unimmunized adults - primary series of IPV-containing vaccine</p> <p>For previously immunized adults - one lifetime booster dose of IPV-containing vaccine</p>
<b>Rabies</b> (pre-exposure prophylaxis)	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>with occupational risk of exposure</li> <li>with lifestyle risk of exposure</li> <li>travelling to high-risk areas with specified exposure risks</li> </ul> <p>Booster doses if required</p>
<b>Smallpox</b>	<p>Recommended for adults with occupational risk of exposure</p>
<b>Typhoid</b>	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>travelling to endemic area(s) with specified exposure risks</li> <li>who have ongoing household or intimate exposure to an <i>S. typhi</i> carrier</li> <li>with occupational risk of exposure</li> </ul> <p>Booster doses if at ongoing risk</p>
<b>Yellow fever</b>	<p>Recommended for adults:</p> <ul style="list-style-type: none"> <li>less than 60 years of age travelling to areas where there is evidence of yellow fever transmission or if required for foreign travel</li> <li>with occupational risk of exposure</li> </ul> <p>Consider use for adults aged 60 years and over travelling to areas where risk of yellow fever is the highest</p> <p>Re-immunization recommended every 10 years for immunocompetent people, if indicated</p>

<sup>1</sup> Refer to vaccine-specific chapters in Part 4 and the [Immunization of Immunocompromised Persons](#) and [Immunization of Persons with Chronic Diseases](#) in Part 3 for additional information



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## PART 3

# IMMUNIZATION OF PERSONS WITH INADEQUATE IMMUNIZATION RECORDS

People may present to health care providers with inadequate or no immunization records. Vaccine providers should always attempt to obtain the person's immunization records from his or her previous health care provider.

Written or electronic documentation of immunization is preferred for both children and adults; however, in some instances, information obtained by telephone from the person's health care provider with the exact dates of immunization may be accepted. For children, parental recall of prior immunization, in the absence of documentation from the vaccine provider, correlates poorly with vaccines received and should not be accepted as evidence of immunization. One possible exception is seasonal influenza vaccine, due to the increased reliability of recall as to whether or not influenza vaccine was received less than one year previously.

Routine serologic testing to determine immunity of children and adults without immunization records is generally not practical. The following approach is recommended: Children and adults lacking adequate documentation of immunization should be considered unimmunized and started on an immunization schedule appropriate for their age and risk factors unless known to be immune by serologic testing. Refer to *Table 3* and *Table 5* in the *Recommended Immunization Schedules* in Part 1 for additional information. Refer to *Canadian provincial/territorial immunization schedules* for infants and children. (<http://www.phac-aspc.gc.ca/im/is-vc-eng.php>)

The following considerations are of note:

- Adverse effects of repeated immunization with the following vaccines have not been demonstrated: combined measles-mumps-rubella with or without varicella, inactivated polio, *Haemophilus influenzae* type b, meningococcal, hepatitis A, hepatitis B, univalent varicella and influenza vaccines regardless of possible prior receipt of these vaccines.
- In general, local reactions are greatest after the first dose of a live vaccine and then subside with subsequent vaccinations. In contrast, local reactions tend to increase with each subsequent dose of an inactivated vaccine.
- Persons who develop a serious adverse injection site reaction after administration of vaccines – particularly tetanus, diphtheria and pertussis – should be individually assessed before they receive additional doses of these vaccines. The benefit of continuing the vaccine series needs to be weighed against the risk of further adverse reactions. Serologic testing, if available and appropriate, may guide the need for continued immunization. There are no established serologic correlates for protection against pertussis; diphtheria and tetanus serology may be used as a proxy.

Refer to *Immunization of Persons New to Canada* in Part 3 for additional information about immunization of people who have recently arrived in Canada.

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## PART 3

# IMMUNIZATION IN PREGNANCY AND BREASTFEEDING

- [Maternal Benefits](#)
- [Maternal Safety](#)
- [Benefits of Immunization in Pregnancy for the Fetus/Infant](#)
- [Safety of Immunization in Pregnancy for the Fetus/Infant](#)
- [Immunization During Pregnancy](#)
- [Immunization of Household Contacts of Pregnant Women](#)
- [Immunization During Breastfeeding](#)
- [Selected References](#)

Pregnancy provides an opportunity for evaluation of a woman's immunization status. Pregnant women are a vulnerable population. They have an altered immune response and, for some infections, are at increased risk of infection and at increased risk of severe outcomes once infected. Likewise the fetus, neonate and young infant are vulnerable.

One of the challenges of developing recommendations for pregnant and breastfeeding women is the lack of studies that would allow making evidence-based decisions. Only a few methodologically robust studies of vaccine administration in pregnant and breastfeeding women exist; most safety data available are derived from registries where outcomes are passively reported.

When considering vaccination for pregnant or breastfeeding women, it is important to distinguish between live and inactivated vaccines. There is no theoretical reason to suspect that inactivated vaccines would be associated with an increased risk of adverse events when administered during pregnancy or in breastfeeding women. Live vaccines, however, such as measles, mumps, rubella, varicella, and yellow fever, should generally not be given during pregnancy because of the theoretical risk of disease transmission to the fetus.

Ideally, the immunization status of women intending to become pregnant should be reviewed and vaccines updated as necessary prior to conception. Live vaccines, for example, can be given to non-pregnant women with the advice to avoid pregnancy for at least 28 days following immunization. In many instances, however, pregnancies are unplanned and immunization status will need to be assessed during the pregnancy.

## MATERNAL BENEFITS

The objective of vaccination during pregnancy is to protect the mother and, potentially, the fetus and newborn. Pregnant women respond adequately to vaccines even though pregnancy is an immunologically altered state. Clinical trials of tetanus toxoid and inactivated polio vaccine administered during pregnancy have demonstrated normal adult immunologic responses. Vaccines recommended for the protection of a pregnant woman's health include:

- inactivated influenza vaccine
- hepatitis B vaccine for a woman with ongoing exposure risks
- hepatitis A vaccine for a woman who is a close contact of a person with hepatitis A or if travelling to an endemic area
- tetanus toxoid and reduced diphtheria toxoid-containing vaccine if indicated
- meningococcal vaccine in an outbreak setting or post-exposure

- pneumococcal polysaccharide vaccine if in a high risk group due to underlying illnesses
- acellular pertussis-containing vaccine (Tdap) should be considered for pregnant women in the second half of pregnancy who have not previously received Tdap vaccine in adulthood, in situations where potential benefits outweigh risks, such as during a pertussis outbreak.

## MATERNAL SAFETY

Inactivated vaccines are generally safe in pregnancy. Reactions following vaccination with inactivated vaccines are usually limited to the injection site. No increase in anaphylactic reactions or events that might induce preterm labour has been observed. Vaccines that contain thimerosal are considered safe in pregnancy and the National Advisory Committee on Immunization (NACI) has concluded that there is no safety reason to avoid the use of thimerosal-containing vaccines for pregnant women.

## BENEFITS OF IMMUNIZATION IN PREGNANCY FOR THE FETUS/INFANT

The beneficial effects of maternal vaccination for the newborn have been well documented. Maternal vaccination protects the mother from a vaccine-preventable disease that she could transmit to her fetus or infant. In addition, protective concentrations of maternal antibodies are transferred to the fetus transplacentally, with the majority of transfer occurring during the third trimester. Maternal antibodies typically have a half-life of 3 to 4 weeks in the newborn, and progressively decrease during the first 6 to 12 months of life. Recommended infant immunization schedules take into consideration the potential effect that maternally transferred antibodies may have on infant vaccinations.

## SAFETY OF IMMUNIZATION IN PREGNANCY FOR THE FETUS/INFANT

There is no theoretical reason to suspect that adverse events will occur in the fetus/infant following maternal vaccination during pregnancy with inactivated vaccines. There are no published data indicating that currently authorized inactivated vaccines are teratogenic or embryotoxic, or have resulted in specific adverse pregnancy outcomes.

In general, live attenuated viral or bacterial vaccines are contraindicated in pregnancy, as there is a theoretical risk to the fetus; however, when benefits outweigh risks, vaccination with a live attenuated vaccine may be considered (e.g., yellow fever vaccine).

## IMMUNIZATION DURING PREGNANCY (refer to [table 1](#))

### RECOMMENDED VACCINES

#### Inactivated influenza vaccine

All pregnant women, at any stage of pregnancy, should be considered high priority for receiving inactivated influenza vaccine because of their increased risk of influenza-associated morbidity, evidence of adverse neonatal outcomes associated with maternal influenza, evidence that vaccination of pregnant women protects their newborns from influenza and influenza-related hospitalization, and evidence that infants born during the influenza season to vaccinated women are less likely to be premature, small for gestational age, and low birth weight. Live attenuated influenza vaccine should not be given to pregnant women.

There is good evidence demonstrating the safety of inactivated influenza vaccine during pregnancy. Active surveillance following influenza vaccination during pregnancy has not shown evidence of harm to the mother or fetus associated with influenza immunization. Although the cumulative sample size of

these studies is relatively small, particularly in the first trimester, passive surveillance has not raised any safety concerns despite widespread use of influenza vaccine in pregnancy over several decades. Surveillance following the use of both adjuvanted and unadjuvanted pH1N1 vaccine in more than 100,000 pregnant women in Canada and almost 500,000 pregnant women in Europe did not reveal any safety concerns.

Women who did not receive influenza vaccination during pregnancy should receive influenza vaccine post-partum before discharge from hospital if it is influenza season.

Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### **Hepatitis B vaccine**

All pregnant women should be routinely tested for hepatitis B surface antigen (HBsAg). A pregnant woman who has no markers of hepatitis B (HB) infection but who is at high risk of HB should be offered a complete HB vaccine series at the first opportunity during the pregnancy and should be tested for antibody response. HB vaccine can be used safely in pregnancy and should be administered when indicated, because acute HB in a pregnant woman may result in severe disease for the mother and chronic infection in the infant. The safety of combined hepatitis A-hepatitis B vaccine given during pregnancy has not been studied in clinical trials; however, there is no theoretical reason to suspect an increased risk of adverse events. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

## **VACCINES THAT MAY BE INDICATED**

### **Hepatitis A vaccine**

The efficacy and safety of hepatitis A vaccines given during pregnancy has not been studied in clinical trials, but there is no theoretical reason to suspect an increased risk of adverse events. Hepatitis A can cause severe disease in pregnancy, and the vaccine should be considered for pregnant women when potential benefits outweigh risks such as for post-exposure prophylaxis or for travel to high risk endemic area. Refer to [Hepatitis A Vaccine](#) in Part 4 for additional information.

### **Tetanus toxoid, diphtheria toxoid, acellular pertussis vaccines**

Susceptible pregnant women may receive tetanus toxoid-reduced diphtheria toxoid-containing vaccine (Td) if indicated. Follow-up data on pregnant women who have received tetanus toxoid-containing vaccine (often in the first trimester) have not revealed an increased risk of adverse events. There is no theoretical reason to suspect an increased risk of adverse events following the administration of Td vaccine.

The safety and efficacy data related to use of tetanus toxoid-reduced, diphtheria toxoid-reduced, acellular pertussis vaccine (Tdap) during pregnancy is currently under review by NACI. NACI's current recommendation for pregnant women who have not previously received Tdap vaccine in adulthood is that Tdap vaccine should be administered immediately post-partum to ensure pertussis immunity and reduce the risk for transmission to the newborn. In particular situations where potential benefits outweigh risks, such as during pertussis outbreaks, Tdap vaccine should be considered for pregnant women in the second half of pregnancy who have not previously received Tdap vaccine in adulthood. Refer to [Tetanus Toxoid](#), [Diphtheria Toxoid](#) and [Pertussis Vaccine](#) in Part 4 for additional information.

### **Poliomyelitis vaccine**

Inactivated poliomyelitis vaccine (IPV) may be considered for pregnant women who require immediate protection and are at increased risk of exposure to wild poliovirus. Limited data have not revealed an increased risk of adverse events associated with IPV vaccine administered to pregnant women. There is no theoretical reason to suspect an increased risk of adverse events following IPV administration. Refer to [Poliomyelitis Vaccine](#) in Part 4 for additional information.



### **Pneumococcal vaccine**

Pneumococcal polysaccharide 23-valent vaccine has been studied in pregnant women and found to be safe. However, a recent Cochrane review showed that there was insufficient evidence to support maternal pneumococcal immunization for the prevention of pneumococcal infection in the infant and protection of the infant is not an indication for maternal vaccination. Pneumococcal vaccine is recommended for pregnant women who, because of underlying medical conditions, are at high risk of invasive pneumococcal disease. Some experts suggest that a conjugate pneumococcal vaccine may be given as the initial dose followed by the Pneu-P-23 vaccine for adults less than 65 years of age at increased risk of IPD, as this may theoretically improve antibody response and immunologic memory. If this strategy is chosen, Pneu-C-13 vaccine should be administered first, followed at least 8 weeks later by Pneu-P-23 vaccine. Refer to [Pneumococcal Vaccine](#) in Part 4 and [Immunization of Immunocompromised Persons](#) and [Immunization of Persons with Chronic Diseases](#) in Part 3 for additional information.

### **Meningococcal vaccine**

Conjugate meningococcal vaccines have not been studied in pregnancy; however, there is no theoretical reason to suspect adverse events will occur and may be given in circumstances when the benefits outweigh the risks. Conjugate meningococcal vaccine should be considered for pregnant women in circumstances such as travel to a high risk area; post-exposure prophylaxis against a vaccine preventable strain if indicated; or during an outbreak if indicated. Refer to [Meningococcal Vaccine](#) in Part 4 for additional information.

### **Rabies vaccine**

If a pregnant woman has had a potential exposure to rabies, post-exposure prophylaxis should be given. If pre-exposure prophylaxis is indicated for work or travel purposes, in general, avoidance of risk should be considered and pre-exposure immunization delayed unless substantial risk of exposure remains. Refer to [Rabies Vaccine](#) in Part 4 for additional information.

### **Other inactivated vaccines**

Cholera and travellers' diarrhea vaccine and Japanese encephalitis vaccines have not been studied in pregnant women. Administration of either vaccine to pregnant women may be considered in high risk situations only after evaluation of the benefits and risks. Inactivated parenteral typhoid vaccine should be used in high risk situations if protection against typhoid is required. Refer to vaccine specific chapters in Part 4 for additional information.

## **VACCINES NOT RECOMMENDED**

### **Human papillomavirus vaccine (HPV)**

HPV vaccine is not recommended for use in pregnancy because data on efficacy and safety of HPV vaccination in pregnancy are limited. No adverse outcomes of pregnancy or adverse events to the developing fetus have been reported. Initiation of the HPV vaccine series should be delayed until after completion of pregnancy. If a woman is found to be pregnant after initiating the vaccination series, completion of the series should be delayed until after pregnancy. If a vaccine dose has been administered during pregnancy, there is no indication for any intervention. Refer to [Human Papillomavirus Vaccine](#) in Part 4 for additional information.

## **GENERALLY CONTRAINDICATED VACCINES**

### **Measles-mumps-rubella vaccine**

Measles-mumps-rubella vaccine (MMR) (live attenuated vaccine) is generally contraindicated in pregnancy because there is a theoretical risk to the fetus. However, in some situations, potential benefits may outweigh risks such as during measles or rubella outbreaks, in which case vaccination may be considered. There is no evidence to date demonstrating a teratogenic or other risk from MMR vaccine. Inadvertent immunization with MMR vaccine is not a reason for pregnancy termination.

Pregnant women without documented evidence of prior immunization with a rubella-containing vaccine should be serologically screened for rubella antibodies. Those found to be non-immune serologically should be vaccinated with one dose of MMR vaccine in the immediate post-partum period, before discharge from hospital (unless they have received Rh immune globulin [RhIg] – refer to *Rh immune globulin and MMR vaccine*). Women who have been appropriately immunized post-partum do not need to be serologically screened for rubella antibodies either post-immunization or in subsequent pregnancies. Women who have been found to be serologically positive in one pregnancy do not need to be screened again in subsequent pregnancies.

Refer to [Measles Vaccine](#), [Mumps Vaccine](#), and [Rubella Vaccine](#) in Part 4 for additional information.

### Univalent varicella vaccine

Varicella vaccine (a live attenuated vaccine) is contraindicated in pregnancy because there is a theoretical risk to the fetus; however, there is a lack of evidence to demonstrate a teratogenic or other risk from varicella vaccine. Inadvertent immunization with varicella vaccine is not a reason for pregnancy termination.

Pregnant women without documented evidence of prior immunization with 2 doses of varicella vaccine or evidence of varicella disease should be serologically screened for varicella antibodies. Those found to be non-immune to varicella should receive 2 doses of a univalent varicella vaccine, 6 weeks apart; the first dose should be given in the immediate post-partum period, before discharge from hospital (unless they have received Rh immune globulin [RhIg] – refer to *Rh immune globulin*). Once appropriately immunized, there is no need for serological confirmation of immunity.

Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information, including post-exposure prophylaxis with varicella zoster immune globulin for pregnant women exposed to varicella.

### Other live attenuated vaccines

The use of other live attenuated vaccines during pregnancy must be evaluated on the basis of the individual risk and benefit. Live attenuated oral typhoid vaccine is contraindicated in pregnancy because of the lack of data on safety or efficacy; inactivated typhoid vaccine should be used if indicated. Live attenuated intranasal influenza vaccine should not be given to pregnant women; inactivated influenza vaccine should be used if indicated. Live oral polio vaccine (OPV) should not be administered to pregnant women; inactivated polio vaccine should be used if indicated. In addition, OPV is not available in Canada. BCG vaccine has not been studied in pregnant or breastfeeding women. BCG vaccine should not be given during pregnancy although no harmful effects of BCG vaccination on the fetus have been observed.

The use of other live attenuated vaccines during pregnancy must be evaluated on the basis of the individual risk and benefit. For instance, if a pregnant woman must travel to an area at high risk of yellow fever transmission and a high level of mosquito protection is not feasible, yellow fever (YF) vaccine may be administered when the risk of exposure is high and the travel cannot be postponed. In one study of women exposed to YF vaccine early in pregnancy there was slight increased risk noted for minor malformations (mainly skin) in the babies; no increased risk of major malformations was found. Since seroconversion rates following YF vaccine are lower during pregnancy; post-immunization serology should be considered. Inadvertent immunization with YF vaccine is not a reason for pregnancy termination.

Smallpox vaccine may be considered for a pregnant woman following high risk exposure.

Refer to [vaccine specific chapters](#) in Part 4 for additional information.

### LIVE ATTENUATED VACCINES AND RH IMMUNE GLOBULIN

A risk benefit assessment is needed for post-partum women who have received Rhlg and require MMR or varicella vaccine. Immune globulin administration may impair the efficacy of live attenuated vaccines, such as MMR and varicella, as measles, rubella, and varicella antibodies may be present in the Rhlg preparation. The risk of lowered vaccine efficacy needs to be weighed against the need for protection. To optimize response to vaccine, rubella-, measles- or varicella-susceptible women who receive Rhlg in the peri-partum period should generally wait 3 months before being vaccinated with MMR or varicella vaccine.

However, if there is a risk of exposure to rubella, measles, or varicella, a risk of recurrent pregnancy in the 3-month post-partum period, or a risk that vaccines may not be given later, MMR and/or univalent varicella vaccines may be given prior to discharge. In that context, serologic testing for rubella and varicella should be done 3 months later and non-immune women should be revaccinated. In the event that a post-partum woman receives MMR and/or varicella vaccines prior to receiving Rhlg, serologic testing for rubella should be done 3 months later and the woman revaccinated if non-immune.

### BIOLOGIC PRODUCTS DURING PREGNANCY

There is no known risk to the fetus or pregnant woman from administration of immune globulin for passive immunization. Immune globulin products should be administered to pregnant women as required.

In general, women should not receive immune modulators, such as infliximab or rituximab, during pregnancy. IgG immunoglobulins are known to pass the placental barrier and there is a risk that this treatment could deplete B-cells in both pregnant women and their fetus. It is particularly important not to administer live vaccines to pregnant women who receive monoclonal antibodies, such as TFN inhibitors. Refer to *Immunization of breastfed infants* for additional implications for the infant.

## IMMUNIZATION OF HOUSEHOLD CONTACTS OF PREGNANT WOMEN

A pregnant household member is not a contraindication for routine vaccination of household contacts. Pregnancy should be used as an opportunity to update immunization of susceptible household contacts. MMR and varicella-containing vaccines should be administered when indicated to children and other household contacts of pregnant women. Infants living in households with a pregnant woman can be vaccinated with rotavirus vaccine, as indicated. The risk of infection and disease from rotavirus vaccine virus is low because most women of childbearing age have pre-existing immunity to rotavirus through natural exposure and rotavirus infection during pregnancy is not known to pose a risk to the fetus.

Extreme precautions should be taken for unvaccinated pregnant household and other close contacts of persons receiving smallpox vaccine in order to eliminate viral transfer to these contacts. Such precaution can include isolation of the vaccinee from his/her pregnant household contacts until the vaccine scab falls off.

## IMMUNIZATION DURING BREASTFEEDING (refer to [table 1](#))

### IMMUNIZATION OF BREASTFEEDING WOMEN

In general, routinely recommended vaccines may be safely administered to breastfeeding women. There are limited data available regarding the effects of maternal vaccination on breastfed infants; however, there have been no reported adverse events thought to be vaccine-related. There is no evidence that immunization during breastfeeding will adversely influence the maternal or infant immune response.

Annual influenza vaccination is recommended for breastfeeding women. Live attenuated influenza vaccine has a similar or lower immune response than inactivated influenza vaccine in adults; inactivated vaccine is preferred if the breastfeeding woman has a chronic health condition.

Women who are breastfeeding can be vaccinated with Td, Tdap, pneumococcal, meningococcal, hepatitis A, hepatitis B, IPV, rabies, typhoid, MMR, varicella and cholera vaccines if indicated. HPV vaccine may be administered to breastfeeding women.

Japanese encephalitis (JE) vaccine has not been studied in breastfeeding women. Administration of JE vaccine to breastfeeding women who must travel to areas where the risk of JE infection is high should be immunized only if the risk of disease outweighs the unknown risk of vaccination to the woman and/or her breastfeeding infant.

There are a few instances when vaccination is not recommended during breastfeeding. Probable transmission of yellow fever vaccine strain virus from a mother to her infant through breastfeeding has been reported; therefore, breastfeeding mothers should not generally be vaccinated with yellow fever vaccine. It is not known whether BCG vaccine is excreted in human milk. Because live vaccine may be excreted in human milk, caution should be exercised when considering BCG vaccine while breastfeeding. Smallpox vaccine is not recommended for breastfeeding women because of the theoretical risk for contact transmission from mother to infant. If smallpox vaccine is used as post-exposure prophylaxis for a breastfeeding woman, breastfeeding and other close contact with the baby should be avoided until the scab has separated from the vaccination site.

Refer to [vaccine specific chapters](#) in Part 4 for additional information.

### **IMMUNIZATION OF BREASTFED INFANTS**

In general, infants who are breastfed should receive all recommended vaccines according to the routine immunization schedule. In developed countries, there is no evidence that transfer of antibodies in human milk can affect the efficacy of live attenuated vaccines in breastfed infants.

The one exception to this recommendation is for breastfeeding women who are on immune modulators, such as monoclonal antibodies (such as infliximab or rituximab), or who were on these drugs during pregnancy. These drugs affect IgGs that can pass through the placental barrier. There is a potential for immunosuppression in the infant that persists after birth. Because human IgG is excreted in human milk, women should be advised to discontinue nursing until circulating drug levels are no longer detectable. Infants who have been exposed to monoclonal antibodies, either during pregnancy or from breastfeeding, should not receive BCG vaccine at birth and should have B-cell enumeration. B cell enumeration should be normal before vaccination with BCG or live vaccines. Consultation with an immunologist is advised

**Table 1: Summary of recommendations for immunizing susceptible pregnant or breastfeeding women**  
(Vaccines are listed in alphabetical order)

VACCINE	USE IN PREGNANCY	USE IN BREASTFEEDING	COMMENTS
<b>INACTIVATED VACCINES</b>			
<b>Cholera and travellers' diarrhea</b>	Use if indicated in high risk situations <sup>1</sup>	Use if indicated	<ul style="list-style-type: none"> <li>No data on use during pregnancy or breastfeeding</li> </ul>
<b>Hepatitis A</b>	Use if indicated in high risk situations <sup>1</sup>	Use if indicated	<ul style="list-style-type: none"> <li>No data on efficacy and safety during pregnancy Hep A vaccine should be considered for pregnant women when potential benefits outweigh risks such as for post-exposure prophylaxis or for travel to high risk endemic area</li> </ul>
<b>Hepatitis B</b>	Use if indicated <sup>1</sup>	Use if indicated	<ul style="list-style-type: none"> <li>HB vaccine can be used safely in pregnancy and during breastfeeding</li> </ul>
<b>Human papillomavirus (HPV)</b>	Currently not recommended	Use if indicated	<ul style="list-style-type: none"> <li>Limited data on use during pregnancy and breastfeeding</li> </ul>
<b>Influenza (inactivated)</b>	Recommended	Recommended	
<b>Japanese encephalitis</b>	Use if indicated in high risk situations <sup>1</sup>	Use if indicated in high risk situations <sup>1</sup>	<ul style="list-style-type: none"> <li>No data on safety or efficacy during pregnancy or breastfeeding</li> </ul>
<b>Meningococcal conjugate</b>	Use if indicated <sup>1</sup>	Use if indicated	<ul style="list-style-type: none"> <li>No data on use during pregnancy. Should be considered for pregnant women in circumstances such as travel to a high -risk area; post-exposure prophylaxis against a vaccine preventable strain; or during an outbreak.</li> <li>Refer to <a href="#">Meningococcal Vaccine</a> in Part 4 for a listing of high risk conditions.</li> </ul>



VACCINE	USE IN PREGNANCY	USE IN BREASTFEEDING	COMMENTS
<b>Pneumococcal conjugate 13-valent (Pneu-C-13)</b>	Use if indicated for high risk conditions	Use if indicated for high risk conditions	<ul style="list-style-type: none"> <li>No data on use during pregnancy</li> <li>Refer to <a href="#">Pneumococcal Vaccine</a> in Part 4 for a listing of high risk conditions.</li> </ul>
<b>Pneumococcal polysaccharide (Pneu-P-23)</b>	Use if indicated for high risk conditions	Use if indicated for high risk conditions	<ul style="list-style-type: none"> <li>Lack of evidence of risk to fetus or pregnancy</li> <li>Refer to <a href="#">Immunization of Persons with Chronic Diseases</a> and <a href="#">Immunization of Immunocompromised Persons</a> in Part 3</li> </ul>
<b>Polio</b> (inactivated)	Use if immediate protection needed and at increased risk of exposure to wild poliovirus	Use if indicated	<ul style="list-style-type: none"> <li>Lack of evidence of risk to fetus or pregnancy</li> </ul>
<b>Rabies</b>	Use if indicated for post-exposure prophylaxis Delay pre-exposure immunization unless substantial risk of exposure	Use if indicated	
<b>Tetanus-reduced diphtheria (Td)</b>	Use if indicated	Use if indicated	<ul style="list-style-type: none"> <li>Lack of evidence of risk to fetus or pregnancy</li> </ul>
<b>Tetanus-reduced diphtheria reduced acellular pertussis (Tdap)</b>	Consider use in second half of pregnancy if pertussis is circulating locally and Tdap vaccine not previously received in adulthood	Recommended - administer as early as possible post-partum if Tdap vaccine not previously received in adulthood	<ul style="list-style-type: none"> <li>Lack of evidence of risk to fetus or pregnancy</li> <li>Use Tdap vaccine during pregnancy is currently under review by NACI</li> </ul>
<b>Typhoid</b> (inactivated)	Use if indicated in high risk situations <sup>1</sup>	Use if indicated	<ul style="list-style-type: none"> <li>No data on use during pregnancy or breastfeeding</li> </ul>

VACCINE	USE IN PREGNANCY	USE IN BREASTFEEDING	COMMENTS
<b>LIVE VACCINES</b>			
<b>Bacille Calmette-Guérin (BCG)</b>	<b>Contraindicated</b>	Generally should not be used May be considered in high risk situations	<ul style="list-style-type: none"> <li>Lack of evidence of risk to fetus</li> <li>No data on use in pregnancy or breastfeeding</li> </ul>
<b>Influenza</b> (intranasal)	<b>Should not be used</b>	Use if indicated	<ul style="list-style-type: none"> <li>Live attenuated influenza vaccine has a similar or lower efficacy than inactivated influenza vaccine in adults; inactivated influenza vaccine is preferred if chronic health condition.</li> <li>No data on use during pregnancy</li> </ul>
<b>Measles-mumps-rubella</b>	<b>Generally contraindicated</b> Immunize rubella-susceptible women immediately post-partum	Recommended if not immune	<ul style="list-style-type: none"> <li>No known fetal effects; theoretical risk</li> <li>Inadvertent immunization is not a reason for pregnancy termination</li> </ul>
<b>Smallpox</b>	<b>Generally contraindicated</b> Consider use in high risk situations (e.g., post-exposure, outbreak) <sup>1</sup>	<b>Generally should not be used</b> <b>May be considered in high risk situations</b> (e.g., post-exposure, outbreak) <sup>1</sup>	<ul style="list-style-type: none"> <li>May cause fetal infection</li> <li>Suspend breastfeeding until scab falls off</li> <li>Close contacts who are vaccinated should be isolated from pregnant women as well as lactating women and their newborn until scab falls off</li> </ul>
<b>Typhoid</b> (oral)	<b>Contraindicated</b>	Use inactivated vaccine if indicated	<ul style="list-style-type: none"> <li>Although there are no data, it is reasonable to assume that either Typh-I vaccine could be used safely in lactating mothers.</li> </ul>
<b>Varicella</b>	<b>Contraindicated</b> Immunize varicella-susceptible women immediately post-partum	Recommended if not immune	<ul style="list-style-type: none"> <li>No known fetal effects; theoretical risk</li> <li>Inadvertent immunization is not reason for pregnancy termination</li> </ul>

VACCINE	USE IN PREGNANCY	USE IN BREASTFEEDING	COMMENTS
<b>Yellow fever</b>	<b>Generally contraindicated</b> unless travel to area at high risk of transmission is unavoidable and high level of mosquito protection is not feasible	<b>Generally contraindicated</b> unless travel to area at high risk of transmission is unavoidable and high level of mosquito protection is not feasible	<ul style="list-style-type: none"> <li>• Seroconversion rates lower during pregnancy; post-immunization serology recommended</li> <li>• Limited data on fetal safety</li> <li>• Inadvertent immunization is not reason for pregnancy termination</li> <li>• Probable transmission of vaccine strain of yellow fever virus to the infant via breastfeeding has been reported</li> </ul>

<sup>1</sup> when benefits outweigh risks

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## PART 3

# IMMUNIZATION OF INFANTS BORN PREMATURELY

- [Best Practices](#)
- [Hepatitis B Vaccine](#)
- [Pneumococcal Vaccine](#)
- [Rotavirus Vaccine](#)
- [Monoclonal Anti-Respiratory Syncytial Virus \(RSV\) Antibody \(palivizumab\)](#)
- [Selected References](#)

## BEST PRACTICES

Premature infants (defined as infants born before 37 weeks of gestational age) in stable clinical condition (regardless of birth weight) should be immunized with age-appropriate doses of vaccine at the same chronological age and according to the same schedule as full-term infants, with some exceptions as outlined below. Healthy premature infants generally tolerate immunizations well, with rates of adverse events similar to the low rates of full-term infants.

Passive transfer of maternal antibodies occurs after the 28<sup>th</sup> week of gestation. Therefore, premature infants born after 28 weeks of gestation will have maternally derived antibodies but at lower concentrations and for a shorter duration than full-term newborns. Premature infants of less than 28 weeks gestation are not expected to have significant amounts of maternal antibody. Thus, premature infants may experience increased frequency and severity of vaccine preventable illnesses and should be protected from vaccine preventable disease through timely immunization.

Antibody response to immunization is generally a function of chronological age. Some studies showed that premature infants seem to have lower antibody responses to vaccines than full-term infants. However, vaccine efficacy in premature infants remains high. Therefore, immunization of premature infants should not be delayed. Neonatal intensive care units and other hospital areas where premature infants may remain hospitalized for prolonged periods should have immunization programs in place.

Premature infants, especially those weighing less than 1,500 grams at birth are at higher risk of apnea and bradycardia following vaccination compared to full-term infants. Any increase or recurrence of apnea and bradycardia following vaccination of a premature infant is generally self-limited, subsides within 48 hours, and does not alter the infant's overall clinical progress. Hospitalized premature infants should have continuous cardiac and respiratory monitoring for 48 hours after their first immunization.

## HEPATITIS B VACCINE

### PREMATURE INFANTS OF MOTHERS WHO ARE HBSAG-NEGATIVE

The response to hepatitis B (HB) vaccine may be diminished in premature infants with birth weight less than 2,000 grams. In jurisdictions where the first dose is routinely given at birth, routine HB immunization of infants should be delayed until the infant reaches 2,000 grams or upon hospital discharge if discharge occurs before the infant has 2000 grams.

### PREMATURE INFANTS OF MOTHERS WHO ARE HBSAG-POSITIVE

All premature infants, regardless of weight, born to women who are HBsAg-positive should receive HB immune globulin (HBIG) and monovalent HB vaccine within 12 hours of birth.

Premature infants weighing **2,000 grams or more** at birth should receive three doses of HB vaccine, given at birth, 1 and 6 months of age. Monovalent HB vaccine should be given for the doses at birth and 1 month; DTaP-HB-IPV-Hib vaccine can be used for the 6-month dose. Premature infants weighing **less than 2,000 grams** at birth should receive four doses of HB vaccine, given at birth, 1, 2 and 6 months of age. The final dose in the vaccine series should not be administered before 24 weeks of age. Monovalent HB vaccine should be given for the doses at birth and 1 month; DTaP-HB-IPV-Hib vaccine can be used for the 2 and 6-month doses.

All premature infants of HBsAg-positive mothers should have an assessment of the anti-HBs titre 4 weeks after their series of HB vaccine has been completed to assess the success of immunoprophylaxis. If HBsAg is present, the child will likely become a chronic hepatitis B carrier. If the infant is negative for both HBsAg and anti-HBs (i.e., a non-responder), additional doses of HB vaccine (up to a second full course) should be given with repeated serologic testing for antibody response.

### PREMATURE INFANTS OF MOTHERS WITH UNKNOWN HBSAG STATUS

If maternal HBsAg status is not available within 12 hours of delivery, consideration should be given to administering HB vaccine and HBIG to the infant while the results are pending, *taking into account the mother's risk factors* and erring on the side of providing vaccine and HBIG if there is any suspicion that the mother could be infected.

Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

## PNEUMOCOCCAL VACCINE

Prematurity is associated with an increased risk of chronic lung disease. Children with chronic lung disease are at increased risk of invasive pneumococcal disease. A 4-dose conjugate pneumococcal vaccine schedule (at 2, 4, 6 and 15 to 18 months of age) is recommended for premature infants with chronic lung disease or other conditions resulting in high risk of invasive pneumococcal disease. The first dose of conjugate pneumococcal vaccine should be given at 2 months of age, even if the infant is still hospitalized. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

## ROTAVIRUS VACCINE

Available data indicate that rotavirus vaccine is safe and effective in preterm infants. Given the potential complications of rotavirus infections in premature infants and the benefits of vaccination, rotavirus vaccines are recommended for premature infants starting at 6 weeks of chronological age, with the first dose administered no later than 14 weeks of chronological age. Rotavirus vaccine may be considered for hospitalized infants, after discussion with infection control services and neonatologists. The vaccination series should be completed by 8 months of chronological age. Refer to [Rotavirus Vaccine](#) in Part 4 for additional information.

## MONOCLONAL ANTI-RESPIRATORY SYNCYTIAL VIRUS (RSV) ANTIBODY (PALIVIZUMAB)

To decrease the likelihood of serious RSV infection requiring hospitalization and supplemental oxygen therapy, palivizumab (SYNAGIS<sup>®</sup>, Abbott Laboratories Ltd.) should be recommended for:

- all infants born prematurely at 32 weeks gestation or earlier who are 6 months of chronological age or younger at the start of the RSV season
- selected infants born prematurely between 32 and 35 weeks gestational age who are less than 6 months of age at the start of the RSV season
- selected infants and children 24 months of age and younger with chronic lung disease or hemodynamically significant congenital heart disease

Refer to [Palivizumab](#) in [Passive Immunizing Agents](#) in Part 5 for additional information and definition of selected infants.

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## PART 3

## IMMUNIZATION OF PATIENTS IN HEALTH CARE INSTITUTIONS

- [Acute Care Institutions](#)
  - [Pregnant women](#)
  - [Newborns](#)
  - [Post-partum women and other close contacts of newborns](#)
  - [Children and adolescents](#)
  - [Adults](#)
  - [The elderly](#)
- [Long Term Care Institutions](#)
- [Selected References](#)

In both acute and long term health care settings, it is important that immunization efforts be part of organized care plans within each department, with clear accountability for program planning, implementation and evaluation. There is good evidence that the use of health care provider reminders and standing orders or medical directives, as well as evaluation of vaccine coverage with feedback to health care providers improves vaccine uptake. Immunization programs or increased uptake of available vaccines has been associated with decreased antibiotic usage. Antibiotic usage reductions ranged from 5% to 10% in randomized controlled trials to relative reductions of 64% in observational studies.

Recommended vaccination schedules differ among the provinces and territories; therefore, immunization schedule differences may need to be considered when discharging a patient to another jurisdiction. When transferring a patient, information about the patient's immunization status should be provided to the receiving institution.

## ACUTE CARE INSTITUTIONS

Admission to hospital as well as visits to outpatient clinics or the emergency department provide important opportunities for health care providers to evaluate immunization status and offer vaccination to patients of all ages. For patients without regular sources of health care or those followed in specialized clinics, the only opportunities for immunization may be during clinic visits or hospitalization.

Special considerations are needed when administering live vaccines in a hospital setting. In addition to routine practices, further infection control precautions may be indicated when giving rotavirus vaccine or live attenuated influenza virus (LAIV) vaccine in the hospital setting. For example, if a rash occurs following vaccination with a varicella-containing vaccine, the rash may need to be covered. There may be some viral shedding following rotavirus vaccination; this could pose a risk if there was potential contact with a severely immunocompromised patient. Consultation with the hospital's Infection Control experts is advised. Live vaccines are generally not administered to immunocompromised patients; refer to [Immunization of Immunocompromised Persons](#) in Part 3 for information about vaccination of immunocompromised people.

Protocols for reporting adverse events following immunization should be in place in acute care institutions. Patients may be admitted to hospital for a serious adverse event following immunization. In addition, patients who receive a vaccine in hospital may experience an adverse event. Any adverse event following immunization that results in hospital admission or prolongs hospitalization is considered a serious adverse event and needs to be reported. Refer to [Vaccine Safety](#) in Part 2 for additional information about reporting adverse events following immunization.

## PREGNANT WOMEN

The immunization status of any pregnant woman admitted to hospital should be assessed and arrangements made to optimize her immunization status. Offering inactivated influenza vaccine during pregnancy is particularly important as pregnant women are at increased risk of serious illness, complications, and hospitalization from influenza infection. Influenza vaccination during pregnancy also protects the newborn infant from infection. Pregnant women who have not previously received Tdap vaccine in adulthood should be vaccinated immediately post-partum. During an outbreak, the use of tetanus-reduced diphtheria-reduced acellular pertussis (Tdap) vaccine in pregnancy may be considered in the second half of pregnancy for those not previously vaccinated in adulthood. Pertussis vaccine in pregnancy is currently under National Advisory Committee on Immunization (NACI) review. Live vaccines are generally contraindicated during pregnancy; if live vaccines, such as rubella-containing vaccines, are needed, plans should be put in place to provide the vaccines post-partum. Refer to [Immunization in Pregnancy and Breastfeeding](#) in Part 3 for additional information.

## NEWBORNS AND INFANTS

Newborns of hepatitis B infected women should receive post-exposure prophylaxis (hepatitis B vaccine and hepatitis B immune globulin) within 12 hours of birth. As well, administration of the first dose of hepatitis B vaccine to other newborns at high risk of exposure to hepatitis B virus may be considered before discharge. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

Neonatal intensive care units (NICU) should have immunization programs in place for infants who remain in the NICU for two months or longer. In general, premature infants should receive routine vaccines according to their chronologic age. Refer to [Immunization in Pregnancy and Breastfeeding](#) and [Immunization of Infants Born Prematurely](#) in Part 3 for additional information.

In areas of high tuberculosis rates and lack of access to detection and treatment services, BCG vaccine may be indicated. Refer to [Bacille Calmette-Guerin \(BCG\) Vaccine](#) in Part 4 for additional information.

## POST-PARTUM WOMEN AND OTHER CLOSE CONTACTS OF NEWBORNS

Women susceptible to rubella and/or varicella should receive vaccine post-partum before discharge. Arrangements should be made for varicella-susceptible women to receive a second dose of univalent varicella vaccine at least 6 weeks after the first dose. Women who did not receive influenza vaccination during pregnancy should receive influenza vaccine before discharge if it is influenza season. Arrangements should be made for household and other close contacts to receive influenza vaccine, and for parents (as well other adults who anticipate having regular contact with an infant) who have not previously received acellular pertussis-containing vaccine in adulthood, to receive a dose of Tdap vaccine as soon as possible. Adolescents who anticipate having regular contact with a newborn should receive Tdap vaccine if they have not already received an adolescent booster dose. Refer to [Pertussis vaccine](#) in Part 4 and [Immunization in Pregnancy and Breastfeeding](#) in Part 3 for additional information.

## CHILDREN AND ADOLESCENTS

Hospitalization may be an ideal opportunity to ensure catch up of routine childhood immunizations. Recommendations may need to be modified depending on the underlying condition leading to hospitalization. Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for additional information regarding children and adolescents who may be hospitalized with immunodeficiency disorders, or undergoing chemotherapy for malignant hematologic disorders. Refer to [Immunization of Persons with Chronic Diseases](#) in Part 3 for additional information about hospitalized children and adolescents who have chronic conditions.

## ADULTS

There is an increasing number of vaccines recommended for adults (refer to [Immunization of Adults](#) in Part 3 for additional information). Despite the growing list of recommended adult immunizations, young and middle-aged adults (especially men) tend to have fewer contacts with the health care system than



either children or the elderly; therefore, opportunistic immunization of adults during hospitalization is very important.

Many immunosuppressive or chronic disorders are associated with increased susceptibility to complications of vaccine-preventable diseases in adults. Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for additional information on adults who may be hospitalized with HIV or other immunodeficiency disorders. Refer to [Immunization of Persons with Chronic Diseases](#) in Part 3 for additional information on hospitalized adults who have chronic conditions. .

## THE ELDERLY

The admission of elderly patients to hospital is an opportunity to optimize their immunization status. Effective programs to vaccinate elderly patients before discharge or while attending a clinic will guarantee that they do not miss influenza immunization in the community during the limited influenza vaccination period. It is also a useful time to assess whether a tetanus and diphtheria toxoid-containing (Td) vaccine booster dose or Tdap vaccine is needed. Zoster and pneumococcal vaccine should also be considered. Refer to [Immunization of Persons with Chronic Diseases](#) in Part 3 for additional information on those with cardiac, renal, hepatic, metabolic and endocrine or pulmonary conditions.

## LONG TERM CARE INSTITUTIONS

Residents of long term care facilities, including children, should receive all routine immunizations, as appropriate for their age and risk status. The following vaccines are particularly important to consider: Herpes zoster (in those 60 years of age and older), pneumococcal, and influenza. Td vaccine is recommended every 10 years for adults, and this may be an opportunity to also provide polio or pertussis vaccine in the previously unimmunized or under-immunized population.

Annual seasonal influenza immunization is essential for nursing home or chronic and continuing care facility residents of any age. Programs and strategies should be implemented to ensure that annual influenza immunization occurs. Residents in long term care facilities that have standing order programs for influenza are more likely to be immunized. Patients and/or their surrogate decision makers should be advised of the facility's immunization policy on admission and every effort made to obtain informed consent before the influenza season.

Refer to [Immunization of Immunocompromised Persons](#) and [Immunization of Persons with Chronic Diseases](#) in Part 3 for additional information on immunization recommendations for residents with specific disorders.

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## PART 3

# IMMUNIZATION OF PERSONS WITH CHRONIC DISEASES

- [Asplenia or Hyposplenia](#)
- [Chronic Renal Disease/Dialysis](#)
- [Neurologic Disorders](#)
- [Chronic Lung Disease](#)
- [Chronic Heart Disease](#)
- [Chronic Liver Disease](#)
- [Endocrine and Metabolic Diseases](#)
- [Non-malignant Hematologic Disorders](#)
- [Chronic Inflammatory Diseases](#)
- [Other conditions](#)
  - [Cancer](#)
  - [Dermatologic conditions](#)
  - [Chronic salicylate therapy in children](#)
  - [Cochlear implants](#)
- [Co-morbidities](#)
- [Close Contacts](#)
- [Selected References](#)

Chronic diseases may increase a person's risk of infection and/or increase a person's risk of more severe disease should infection occur. There is also an increased risk of nosocomial exposure to vaccine preventable diseases due to the increased likelihood of prolonged hospitalization and frequent outpatient visits associated with chronic disease. Therefore, it is important that people with chronic diseases who are immunocompetent be immunized with both live and inactivated vaccines according to routine immunization schedules. Vaccines may be less immunogenic in this population and additional vaccines, additional doses, or higher dosages of vaccines may be required to provide adequate protection. Ideally, vaccination is best accomplished early in the disease when the response is likely to be similar to other persons of a similar age with no chronic medical condition. If a disease progresses and immunosuppressive therapy is required, vaccine requirements and recommendations may change. Refer to Table 1 for a summary of recommendations for vaccination of persons with chronic diseases. Refer to Immunization of Immunocompromised Persons in Part 3 for information about vaccination of people who are immunosuppressed.

## ASPLENIA OR HYPOSPLENIA

Asplenic or hyposplenic people have absent or defective splenic function. This can occur as a result of congenital absence of the spleen, surgical removal of the spleen, or medical conditions that result in poor or absent splenic function (e.g., sickle cell disease, thalassemia major). All people, regardless of age, who have absent or defective splenic function are at increased risk of fulminant bacteremia which is associated with a high mortality rate. Risk is highest in the first two years following splenectomy but remains elevated for life.

Careful attention should be paid to immunization status when "elective" surgical splenectomy is planned so that all of the necessary vaccines are administered at least 2 weeks before surgery. In the case of an emergency splenectomy, vaccines are best given 2 weeks after the splenectomy for optimal vaccine responses. If the person is discharged earlier and there is a concern that he/she might not return, vaccines should be given before discharge.

There are no contraindications to the use of any vaccine for people known to be asplenic or hyposplenic. Such persons should receive all routine vaccinations. Particular attention should be paid to ensuring that asplenic or hyposplenic individuals of all ages receive *Haemophilus influenzae* type b (Hib), meningococcal and pneumococcal vaccines according to recommended schedules, as these individuals are highly susceptible to encapsulated bacteria. Influenza vaccine is recommended annually. Hepatitis A and Hepatitis B vaccines are indicated for those who require repeat transfusions (e.g., sickle cell anemia). For children, some routine vaccinations, such as varicella vaccine, are given on a different schedule than the routine age-based recommendation.

### HAEMOPHILUS INFLUENZAE TYPE B (HIB) VACCINE

All people with asplenia or hyposplenia should receive Hib vaccine:

- Children (less than 5 years of age) should receive an age appropriate primary series of Hib vaccine.
- People 5 years of age and older, including adults, should receive a single dose of Hib vaccine, regardless of previous Hib immunization, and at least 1 year after any previous dose.

Refer to [Haemophilus influenzae type b Vaccine](#) in Part 4 for additional information.

### HEPATITIS A AND HEPATITIS B VACCINES

People with sickle cell anemia that results in functional asplenia may require repeat transfusions. People receiving repeated transfusions of blood or blood products are considered to be at higher risk of contracting hepatitis A and hepatitis B and should be offered hepatitis A and hepatitis B vaccines.

### INFLUENZA VACCINE

Asplenic or hyposplenic people should receive yearly influenza vaccine as appropriate for age. Influenza vaccination lowers the risk of secondary bacterial infections. For children with chronic health conditions, there is insufficient evidence to recommend live attenuated influenza vaccine (LAIV) preferentially over trivalent inactivated influenza vaccines (TIV). For adults with chronic health conditions, there is insufficient evidence to recommend the use of LAIV, particularly given the evidence suggesting better immune response to TIV in this age group. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### MENINGOCOCCAL VACCINE

All people with asplenia or hyposplenism should receive quadrivalent conjugate meningococcal vaccine (Men-C-ACYW-135). The schedule for those who are previously unimmunized is as follows:

- Children aged 2 to 11 months should receive 2 or 3 doses of Menveo™ given 8 weeks apart (with another dose given between 12 to 23 months of age and at least 8 weeks from the previous dose) and booster doses as outlined below.
- Children aged 12 to 23 months should receive 2 doses of Menveo™ vaccine given at least 8 weeks apart and booster doses as outlined below.
- People aged 2 to 55 years should receive 2 doses of a Men-C-ACYW-135 vaccine (either Menactra® or Menveo™) 8 weeks apart and booster doses as outlined below.
- Adults aged 56 years and over should receive 2 doses of a Men-C-ACYW-135 vaccine (either Menactra® or Menveo™) 8 weeks apart and booster doses as outlined below. Men-C-ACYW-135 vaccines are not authorized for use in people 56 years of age and over; however, based on limited evidence and expert opinion, Men-C-ACYW-135 vaccine use is considered appropriate.

If only one dose of Men-C-ACYW-135 vaccine was previously given, give another dose at the earliest opportunity and proceed with booster doses as outlined below based on the interval from the second dose.

A booster dose of Men-C-ACYW-135 vaccine should be given every 3 to 5 years for those last vaccinated at 6 years of age and younger, and every 5 years after the last dose for those last vaccinated at 7 years

of age and older. There is no role for meningococcal polysaccharide vaccine. Refer to [Meningococcal Vaccine](#) in Part 4 for additional information.

## PNEUMOCOCCAL VACCINE

### Infants and children

Asplenic or hyposplenic infants should receive a primary series of 4 doses of pneumococcal conjugate 13-valent vaccine (Pneu-C-13) given at age 2, 4, 6, and 12 to 15 months of age. Children between 12 and less than 24 months of age should get 2 doses of Pneu-C-13 vaccine, at least 8 weeks apart. Children (24 months of age and older) need only one dose of Pneu-C-13 vaccine. Even if a child received all recommended doses of Pneu-C-7 or Pneu-C-10 vaccine in the past, they should be given Pneu-C-13 vaccine as soon as possible.

Pneu-C-13 vaccine primes the immune system and should be followed by the broader spectrum, though less immunogenic, pneumococcal polysaccharide 23-valent vaccine (Pneu-P-23) for supplemental protection. One dose of Pneu-P-23 vaccine should be given at or after 24 months of age and at least 8 weeks after all doses of Pneu-C-13 vaccine required for age have been given. A single re-immunization with Pneu-P-23 after 5 years is recommended in persons who were 11 years of age or over at the time of initial immunization with Pneu-P-23 vaccine. A single re-immunization with Pneu-P-23 after 3 years is recommended for those who were 10 years of age or younger at the time of initial immunization with Pneu-P-23 vaccine. No more than two lifetime doses of Pneu-P-23 vaccine (initial dose and booster dose) are recommended.

### Adults

For adults with asplenia or hyposplenia, one dose of Pneu-C-13 vaccine followed at least 2 months later by one dose of Pneu-P-23 vaccine is recommended. One lifetime booster dose of Pneu-P-23 vaccine is recommended 5 years after the initial dose of Pneu-P-23 vaccine.

Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

## VARICELLA VACCINE

Susceptible hyposplenic or asplenic individuals should receive two doses of univalent varicella vaccine, at least 3 months apart (instead of 6 weeks apart as routinely recommended for adolescents and adults). Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information.

## CHRONIC RENAL DISEASE/DIALYSIS

Bacterial and viral infections are a major cause of morbidity and mortality in people with renal disease or who are undergoing chronic dialysis (hemodialysis or peritoneal dialysis). People with chronic renal disease and dialysis may have mild defects in T cell function and may experience a less than optimal response to vaccine. In people with nephrotic syndrome, urinary loss of antibody may occur. These persons are also in frequent contact with the health care system and may be exposed to respiratory diseases. They are at greater risk for complications from respiratory viruses and pneumococcal disease. Rare transmissions of viral hepatitis B and/or C may also occur.

In addition to routine immunization, hepatitis B, influenza and pneumococcal vaccines are recommended in people with chronic renal disease or who are undergoing dialysis. Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for additional information about renal transplant candidates and recipients.

## HEPATITIS B VACCINE

There is a poor response to hepatitis B vaccine in people with chronic renal disease or who are undergoing dialysis and the antibody to hepatitis B surface antigen (anti-HBs) concentration declines

rapidly. Therefore, immunization with a higher dosage of hepatitis B vaccine (e.g., 40 micrograms for adult) is recommended. Post-immunization serologic testing within 1 to 6 months of completion of the vaccine series is recommended with re-immunization with a second series if anti-HBs antibody titres are less than 10 IU/L. For those who respond to the vaccine, the anti-HBs concentration should be evaluated yearly and booster doses (using a higher vaccine dosage) should be given as necessary. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

### INFLUENZA VACCINE

In general, immunogenicity of influenza vaccine is reduced in persons with chronic renal disease. For children with chronic health conditions, there is insufficient evidence to recommend LAIV preferentially over TIV. For adults with chronic health conditions, there is insufficient evidence to recommend the use of LAIV, particularly given the evidence suggesting better immune response to TIV in this age group. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### PNEUMOCOCCAL VACCINE

Children with chronic renal disease should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine at 2 years of age or older. Adults should receive Pneu-P-23 vaccine. One lifetime re-immunization with Pneu-P-23 vaccine is recommended. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

### VARICELLA VACCINE

Susceptible individuals over 12 months of age with chronic renal disease or who are undergoing dialysis should receive two doses of univalent varicella vaccine at least 3 months apart (instead of 6 weeks apart as routinely recommended for adolescents and adults). Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information on dosing intervals according to age.

## NEUROLOGIC DISORDERS

Neurologic disorders appear at different ages and, therefore, will affect immunization decisions. Disorders that usually begin during infancy, such as cerebral palsy, spina bifida, seizure disorder, neuromuscular diseases and inborn errors of metabolism, may have symptom onset before the receipt of the vaccines routinely recommended in infancy. Other conditions, such as autism spectrum disorders, acute demyelinating encephalomyelitis, Guillain-Barré syndrome (GBS), transverse myelitis and multiple sclerosis are known to be diagnosed in childhood and adulthood over the same time period as routine vaccines are administered and may occur before or after the administration of vaccines.

People with pre-existing neurological disorders should receive all routinely recommended immunizations without delay (with the exception of repeat doses of any vaccine given within 6 weeks of the onset of an episode of GBS). Adults who have a history of myelitis or fibromyalgia should be reassured that routine immunization is recommended for its protective effects and poses no concern with respect to their condition. In addition to routine immunization, people with neurological conditions that compromise the management of respiratory secretions and are associated with an increased risk of aspiration should receive influenza vaccine; those with chronic cerebrospinal fluid (CSF) leak or neurologic conditions that may impair clearance of oral secretions should receive pneumococcal vaccines.

### INFLUENZA VACCINE

Adults and children 6 months of age and older with neurological conditions that compromise the management of respiratory secretions and are associated with an increased risk of aspiration should receive yearly influenza vaccination. For children with chronic health conditions, there is insufficient evidence to recommend LAIV preferentially over TIV. For adults with chronic health conditions, there is insufficient evidence to recommend the use of LAIV, particularly given the evidence suggesting better immune response to TIV in this age group. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### PNEUMOCOCCAL VACCINE

People with chronic CSF leak or chronic neurologic conditions that may impair clearance of oral



secretions and place them at risk of aspiration should receive pneumococcal vaccines. Children with these conditions should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine at 2 years of age or older. Adults should receive Pneu-P-23 vaccine. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

## CHRONIC LUNG DISEASE

Individuals with chronic lung diseases such as asthma, chronic obstructive pulmonary diseases (COPD), or cystic fibrosis are at increased risk of complications of influenza and pneumococcal infection. Those with cystic fibrosis are also at increased risk of complications from varicella infection. In more severe chronic lung disease, many of these persons may have bacterial colonization due to poor mucociliary clearance and bronchiectasis and defects in pulmonary macrophage function. Smoking also impairs mucociliary clearance and predisposes to pneumococcal disease. In addition to routine immunization, people with chronic lung disease should receive influenza and pneumococcal vaccines. Additionally, those with cystic fibrosis should receive varicella vaccine.

### INFLUENZA VACCINE

Adults and children with chronic lung disorders (including bronchopulmonary dysplasia, cystic fibrosis and asthma) should receive seasonal influenza vaccine yearly. Individuals with severe asthma (defined as currently on high dose inhaled or oral glucocorticosteroids, or active wheezing) should receive TIV, as LAIV should not be administered to individuals with severe asthma or those with medically attended wheezing in the 7 days prior to vaccination. For children with chronic health conditions, there is insufficient evidence to recommend LAIV preferentially over TIV. For adults with chronic health conditions, there is insufficient evidence to recommend the use of LAIV, particularly given the evidence suggesting better immune response to TIV in this age group. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### PNEUMOCOCCAL VACCINE

People with chronic pulmonary disease (including adults with asthma requiring regular medical care) and adult smokers should receive pneumococcal vaccine. Children with chronic lung diseases should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine at 2 years of age or older. Adults should receive Pneu-P-23 vaccine. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

### VARICELLA VACCINE

Susceptible people with cystic fibrosis are a priority for varicella immunization because varicella disease may cause a transient worsening of lung function. Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information.

Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for additional information about vaccination of lung transplant candidates and recipients.

## CHRONIC HEART DISEASE

Persons with chronic heart disease have mild defects in T cell function. Viral and bacterial infections may precipitate cardiac decompensation and lead to hospitalization. In addition to routine immunization, people with cardiac disorders should receive influenza vaccine annually. Those with chronic heart disease should receive pneumococcal vaccines.

### INFLUENZA VACCINE

People with congenital heart disease, coronary artery disease, and congestive heart failure are at high risk of influenza-related complications and should receive seasonal influenza vaccine annually. There are some data to suggest that those with congestive heart failure may have a weaker response to the influenza vaccine and are, therefore, at higher risk particularly when exposed to new influenza strains. There is evidence that giving influenza vaccine to those with coronary artery disease has some protective

effect on subsequent cardiac events. For children with chronic health conditions, there is insufficient evidence to recommend LAIV preferentially over TIV. For adults with chronic health conditions, there is insufficient evidence to recommend the use of LAIV, particularly given the evidence suggesting better immune response to TIV in this age group. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### **PNEUMOCOCCAL VACCINE**

People with heart disease are at increased risk of invasive pneumococcal disease and should receive pneumococcal vaccines. Children with cardiac disease should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine at 2 years of age or older. Adults should receive Pneu-P-23 vaccine. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

## **CHRONIC LIVER DISEASE**

Persons with chronic liver disease have impaired phagocyte function and defects in opsonizing antibody. They may also have splenic dysfunction if the liver disease is severe. Hepatic encephalopathy or chronic alcohol consumption may lead to aspiration pneumonia. Alcoholism is also a risk factor for invasive pneumococcal disease. Newly acquired hepatitis A or hepatitis B in persons who already have chronic liver disease from another cause could lead to rapid hepatic decompensation. Those with ascites have an altered immunoglobulin production and distribution. People with HIV who are on antiretroviral therapy may also have liver disease.

In addition to routine immunization, people with chronic liver disease should receive influenza, pneumococcal, hepatitis A, and hepatitis B vaccines. Vaccination should be completed early in the course of liver disease for optimal immunogenicity.

### **HEPATITIS A VACCINE**

Hepatitis A vaccine is recommended for non-immune persons with chronic liver disease, including those infected with hepatitis B or C, because they are at risk of more severe disease if infection occurs. Vaccination should be completed early in the course of the disease, as the immune response to vaccine is suboptimal in advanced liver disease. Refer to [Hepatitis A Vaccine](#) in Part 4 for additional information.

### **HEPATITIS B VACCINE**

Hepatitis B vaccine is recommended for non-immune persons with chronic liver disease, including those infected with hepatitis C, because they are at risk of more severe disease if infection occurs. Vaccination should be completed early in the course of the disease, as the immune response to vaccine is suboptimal in advanced liver disease. Anti-HBs titre testing may be used to document hepatitis B vaccine response. For people with advanced liver disease, including disease caused by hepatitis C, seroconversion should be assessed after hepatitis B vaccination and consideration given to revaccinating with a higher dose hepatitis B vaccine for those who did not respond to the first series (i.e., who do not achieve an anti-HBs titre of at least 10 IU/L). Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

### **PNEUMOCOCCAL VACCINE**

People with chronic liver disease (including hepatic cirrhosis due to any cause) or alcoholism are at increased risk of invasive pneumococcal disease and should receive pneumococcal vaccines. Children with chronic liver disease should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine at 2 years of age or older. Adults should receive Pneu-P-23 vaccine. One lifetime re-immunization with Pneu-P-23 vaccine is recommended. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for additional information about vaccination of hepatic transplant candidates and recipients, and HIV-infected people.

## **ENDOCRINE AND METABOLIC DISEASES**

Routine immunization is recommended for persons with endocrine and metabolic disorders. It is generally

not expected that vaccines would interfere with insulin levels or glucose control. People with diabetes mellitus, however, have defects in phagocytic and neutrophil function. In addition, they often have complications of diabetes such as cardiovascular, neurovascular, renal and other end-organ dysfunction. They are also at greater risk of complications from infection, such as influenza. In addition to routine immunization, people with diabetes should receive influenza and pneumococcal vaccines. Persons with morbid obesity (Body Mass Index of 40 or higher) are also at high risk of influenza-related complications and annual influenza vaccine is recommended.

### HEPATITIS B VACCINE

The National Advisory Committee on Immunization (NACI) is reviewing evidence related to the use of hepatitis B vaccine for adults with diabetes mellitus (type 1 and type 2).

### INFLUENZA VACCINE

Influenza immunization reduces hospitalization and deaths in persons with diabetes mellitus and is recommended annually. Vaccination is also recommended for individuals with other metabolic diseases, such as thyroid disorders. For children with chronic health conditions, there is insufficient evidence to recommend LAIV preferentially over TIV. For adults with chronic health conditions, there is insufficient evidence to recommend the use of LAIV, particularly given the evidence suggesting better immune response to TIV in this age group. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### PNEUMOCOCCAL VACCINE

People with diabetes should also receive pneumococcal vaccines. Diabetic children should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine at 2 years of age or older. Adults should receive Pneu-P-23 vaccine. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

## NON-MALIGNANT HEMATOLOGIC DISORDERS

Non-malignant hematologic disorders include anemias and hemoglobinopathies, as well as bleeding disorders. For further discussion on vaccines recommended for people with anemia due to sickle cell disease, refer to *Asplenia or hyposplenia*.

### ANEMIAS, HEMOGLOBINOPATHIES

People with anemia may be at increased risk of complications from vaccine preventable diseases; routine immunization is recommended. People with anemias or hemoglobinopathies should receive influenza vaccine annually, pneumococcal vaccines and if there is a need for repeat transfusions, hepatitis A and hepatitis B vaccines.

#### Influenza vaccine

People with anemias or hemoglobinopathies are at high risk of influenza-related complications and should receive influenza vaccine annually. For children with chronic health conditions, there is insufficient evidence to recommend LAIV preferentially over TIV. For adults with chronic health conditions, there is insufficient evidence to recommend the use of LAIV, particularly given the evidence suggesting better immune response to TIV in this age group. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

#### Pneumococcal vaccine

People with hemoglobinopathies are at increased risk of invasive pneumococcal disease and should receive pneumococcal vaccines. Children with hemoglobinopathies, should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine. One lifetime re-immunization with Pneu-P-23 vaccine is recommended. Refer to [Pneumococcal Vaccine](#) in Part 4 for additional information.

#### Hepatitis A hepatitis B vaccine

People with hemoglobinopathies, such as some thalassemias, who are receiving repeated infusions of blood or blood products are considered to be at higher risk of contracting hepatitis A and hepatitis B and should be offered hepatitis A and hepatitis B vaccines.

## BLEEDING DISORDERS

People with bleeding disorders may differ from the normal population with respect to the risk of hematoma formation from intramuscular (IM) injections and the potentially increased risk of infection as a result of their disease and exposure to blood products. Before beginning immunization of any child, vaccine providers should ensure that there are no symptoms or signs compatible with an undiagnosed bleeding disorder. If such indicators are present, a diagnosis should be established before commencing immunization. For example, in any male child who has a history of an intramuscular hematoma following an intramuscular injection, an undiagnosed bleeding disorder, such as hemophilia, should be considered. If a disorder is present, it should be optimally managed prior to immunization to minimize the risk of bleeding.

### Hepatitis A vaccine

Hemophiliacs and people receiving repeated infusions of blood or blood products are considered to be at higher risk of contracting hepatitis A and should be offered hepatitis A vaccine. If hepatitis B vaccine is also indicated, both vaccines can be given as a combination vaccine.

### Hepatitis B vaccine

Hemophiliacs and people receiving repeated infusions of blood or blood products are considered for pre-immunization testing if they have had repeated exposure to blood products. In an unvaccinated individual with a bleeding disorder in whom passive immunization with hepatitis B immune globulin (HBIG) may be indicated due to an exposure, it is recommended to give clotting factor concentrates prior to giving HBIG. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

### Vaccine administration

For people with bleeding disorders, special measures need to be considered before administering vaccine. Any bleeding disorder should be optimally controlled. For example, hemophiliacs may receive clotting factor concentrates to optimize their clotting factor level before they receive a parenteral vaccine.

Generally there is no evidence of increased risk of bleeding in those with bleeding disorders following IM versus subcutaneous injections. There is some evidence to suggest that IM administration may generally be safe when given with a small gauge needle (23 gauge or smaller) and firm pressure is applied to the injection site for 5-10 minutes. One study assessing immunization by the subcutaneous route for vaccine intended for intramuscular administration identified this was associated with more local reactogenicity and a diminished immune response compared to the IM route.

## ANTICOAGULATION

Individuals receiving long-term anticoagulation with either warfarin or heparin are not considered to be at higher risk of bleeding complications following immunization and may be safely immunized through either the IM or subcutaneous route as recommended without discontinuation of their anticoagulation therapy. Two studies of immunization of people on anticoagulant therapy showed no significant increase in bleeding complications with the IM route. There is a paucity of evidence on whether there is an increased risk of bleeding complications following immunization with the newer types of anticoagulants, such as antiplatelet agents.

## CHRONIC INFLAMMATORY DISEASES

This population includes persons with inflammatory arthropathies (e.g., systemic lupus erythematosus [SLE], rheumatoid or juvenile arthritis etc.), inflammatory dermatologic conditions, and inflammatory bowel disease (Crohn's disease, ulcerative colitis). Infections are one of the most common causes of morbidity,

hospitalization and death in people with SLE. People with inflammatory arthritis are also at increased risk of vaccine preventable infections. This risk is thought to be due to both an altered immune response associated with the autoimmune condition itself and to the immunosuppressive nature of the treatments required to control the underlying inflammatory condition. Respiratory tract infections are the most common infectious cause of hospital consultation in immunosuppressed people with rheumatic diseases. Influenza and *Streptococcus pneumonia* infections are common. At least one study has shown that children with rheumatic disease have lower antibody concentrations and seroprotection rates than healthy controls against mumps, rubella, diphtheria and tetanus (but not measles). Inflammatory bowel disease rates have increased globally over the past few years and there appears to be some alteration of immune receptors and an increased risk of opportunistic infections with inflammatory bowel disease, including vaccine preventable diseases, such as influenza.

### CHRONIC INFLAMMATORY DISEASES NOT TREATED WITH IMMUNOSUPPRESSIVE DRUGS

Individuals with autoimmune disease **not being treated with immunosuppressive drugs** are not considered significantly immunocompromised and can receive routine immunization including live vaccines following consultation with their physician. The nature of the person's underlying disease and treatment should be considered. Rheumatic disease modifying agents such as hydroxychloroquine, sulfasalazine, or auranofin are not generally identified as immunosuppressive. Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for a list of immunosuppressive medications.

### CHRONIC INFLAMMATORY DISEASES TREATED WITH IMMUNOSUPPRESSIVE THERAPIES

#### Monoclonal antibody therapy

Monoclonal antibodies (MAB) – which may be called anti-TNF agents or biologics – are biological drugs that may be used to treat inflammatory bowel disease, rheumatoid arthritis, psoriatic arthritis and spondyloarthropathies as well as some dermatologic conditions, such as psoriasis. Common MAB include infliximab and adalimumab. MAB can be used singly or in combination with other immunosuppressive therapies.

#### Recommended immunization prior to monoclonal antibody therapy

The immunization status of people anticipated to receive MAB should be optimized prior to initiation of therapy due to their increased risk of opportunistic infections. Vaccination with Pneu-P-23 vaccine is recommended and hepatitis B vaccination may be considered in seronegative patients. Annual influenza vaccination with TIV is indicated. Varicella vaccination (if varicella susceptible) or herpes zoster vaccination may be considered.

#### Immunization while monoclonal antibody therapy is ongoing

The safety and efficacy of live vaccines during treatment with MABs is unknown. There have been reported cases of reactivation of latent tuberculosis infection and predisposition to other opportunistic infections. Therefore, until additional information becomes available, avoidance of live vaccines during MAB therapy is prudent. Annual influenza vaccine with TIV is indicated for people receiving MAB. Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for additional information about vaccination of people receiving MAB and other immunosuppressive therapies.

Monoclonal antibodies taken during pregnancy will be transferred to the fetus and their effects may persist after birth. Refer to [Immunization in Pregnancy and Breastfeeding](#) in Part 3 for additional information.

## OTHER CONDITIONS

### CANCER

People with cancer have a higher risk of contracting infectious diseases and a higher risk of developing complications likely because many cancers and their treatments affect the immune system. Therefore, it is important that children and adults with cancer receive protection from vaccine preventable diseases



whenever possible. Generally, cancer alone is not sufficient to make someone immunocompromised such that he/she cannot receive live vaccines. Because chemotherapy may lead to an immunocompromised state, immunization should be completed before beginning chemotherapy if possible.

Recommended vaccines will depend on the type of cancer and the type of treatment. For hematologic cancers or for people on immunosuppressive therapies, refer to [Immunization of Immunocompromised Persons](#) in Part 3. For patients with cancer treated with monoclonal antibodies, refer to *Monoclonal Antibody Therapy*. It is important to assess and optimize the vaccination status of anyone close to people with cancer to reduce the risk of exposure to vaccine preventable diseases. Refer to *Close Contacts* for additional information.

## DERMATOLOGIC DISORDERS

Inflammatory dermatologic disorders may include psoriasis, severe atopic dermatitis and eczema. Treatment is generally topical anti-inflammatories. Vaccines should be given as per the routine schedule. Care should be taken to not administer vaccine into affected areas, as this may exacerbate the condition.

## CHRONIC SALICYLATE THERAPY IN CHILDREN LESS THAN 18 YEARS OF AGE

Individuals receiving low doses of salicylate therapy (e.g., acetylsalicylic acid [e.g., aspirin, ASA]) are not considered to be at increased risk of bleeding complications following immunization. However, for children and adolescents on chronic salicylate therapy, special consideration must be given when administering live influenza and varicella vaccines as outlined below.

### Influenza vaccine

Children and adolescents with conditions treated for long periods with ASA are at high risk of influenza-related complications and should receive influenza vaccine annually. Live attenuated influenza vaccine (LAIV) should not be administered to children currently receiving ASA because of the theoretical risk of Reye's syndrome with ASA and wild-type influenza infection. Reye's syndrome, which causes damage to the brain and liver, is a rare complication that most commonly occurs in children taking ASA who develop a viral infection. ASA-containing products should be delayed for four weeks after receipt of LAIV in children less than 18 years of age. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### Varicella vaccine

Varicella-susceptible children and adolescents receiving chronic salicylate therapy (e.g., ASA) are a priority for varicella immunization because of an association between wild-type varicella disease, salicylate therapy and the risk of Reye's syndrome. Varicella-containing vaccine manufacturers recommend avoidance of salicylate therapy for 6 weeks after varicella immunization because of an association between wild-type varicella, salicylate therapy and Reye's syndrome. Health care providers should weigh the theoretical risks associated with varicella vaccine against the known risks associated with wild-type varicella infection. Because adverse events have not been reported with the use of salicylates after varicella immunization, people with conditions requiring chronic salicylate therapy should be considered for immunization, with close subsequent monitoring. Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information.

## COCHLEAR IMPLANTS

Children who have received a cochlear implant are at increased risk for meningitis from some pathogens and otitis media. People with cochlear implants or those who are receiving cochlear implants should receive all age appropriate vaccinations, including Pneu-C-13, Hib, and influenza vaccines. Children 24 months and older should also receive a single dose of Pneu-P-23 vaccine.

## CO-MORBIDITIES

Guidance on immunization for those with more than one chronic condition is an emerging area of inquiry; evidence to inform guidance on immunization of people with co-morbidities is lacking. There is some evidence that co-morbidities may have additive risk for complications from vaccine-preventable diseases, such as influenza. As a general principle, when considering immunization of people with co-morbidities, all conditions and medications should be considered in relation to the indications, precautions and contraindications for each vaccine.

## CLOSE CONTACTS

Up-to-date routine immunizations, including annual influenza vaccine, are recommended for household members and other close contacts, including health care workers, of people with chronic diseases. Refer to [\*Immunization of Workers\*](#) and [\*Immunization of Immunocompromised Persons\*](#) in Part 3 for additional information.

### Table 1: Vaccination of persons with chronic diseases

(Refer to text and vaccine-specific chapters in Part 4 for additional information)

[illegible]

Vaccine	Chronic disease								
	Asplenia/ hyposplenism	Renal diseases/ dialysis	Neurologic disorders	Lung disease	Liver disease	Endocrine /metabolic diseases	Heart disease	Chronic inflammatory diseases	Non-malignant hematologic disorders <sup>1</sup>
Meningococcal quadrivalent conjugate	Recommended for all ages <sup>7</sup>	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use
Pertussis	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use
Pneumococcal conjugate 13- valent	Recommended for all ages	Children: recommended	Children: recommended	Children: recommended	Children: recommended	Children: recommended	Children: recommended	Recommended if immunosuppress ed	Children and adults with hemoglobinopathies: recommended
Pneumococcal polysaccharide 23- valent	Recommended for children 2 years of age and older and adults <sup>8</sup>	Recommended for children 2 years of age and older and adults <sup>8</sup>	Recommended for children 2 years of age and older and adults	Recommended for children 2 years of age and older and adults	Recommended for children 2 years of age and older and adults <sup>8</sup>	Recommended for those with diabetes	Recommended for children 2 years of age and older and adults	Recommended if immunosuppress ed <sup>8</sup>	Recommended for children 2 years of age and older and adults with hemoglobinopathies
Polio (inactivated)	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use
Rabies	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated
Tetanus	Routine use	Routine use	Routine use <sup>10</sup>	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use
Typhoid (inactivated)	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated
Live vaccines									
BCG	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated if no immune suppression	Use if indicated

Vaccine	Chronic disease								
	Asplenia/ hyposplenism	Renal diseases/ dialysis	Neurologic disorders	Lung disease	Liver disease	Endocrine /metabolic diseases	Heart disease	Chronic inflammatory diseases	Non-malignant hematologic disorders <sup>1</sup>
<b>Herpes zoster</b>	Use if indicated	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Use if indicated if no immune suppression	Routine use
<b>Influenza (LAIV)</b>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>	TIV preferred <sup>11</sup>
<b>Measles-mumps- rubella</b>	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use if no immune suppression	Routine use
<b>Rotavirus</b>	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use if no immune suppression	Routine use
<b>Smallpox</b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Contraindicated in non-outbreak situation	Contraindicated in non-outbreak situation for people with dermatologic conditions	Use if indicated
<b>Typhoid (live)</b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated if no immune suppression	Use if indicated
<b>Varicella (univalent)</b>	Routine use <sup>12</sup>	Routine use <sup>12</sup>	Routine use	Routine use <sup>13</sup>	Routine use	Routine use	Routine use	Use if indicated if no immune suppression	Routine use
<b>Yellow fever<sup>14</sup></b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated if no immune suppression	Use if indicated

1. Consider optimizing control of bleeding disorders prior to receipt of parenteral vaccine. Note: For people with sickle cell disease, refer to Asplenia section.

2. Vaccine recommended for conditions requiring repeated transfusions (e.g., sickle cell disease).

3. Higher dosage recommended; post-immunization serology recommended with re-immunization if hepatitis B surface antigen (anti-HBs) less than 10 IU/L; periodic monitoring of anti-HBs titre recommended.

4. Vaccinate early in course of hepatic disease; post-immunization serology may be used; for people with advanced liver disease, assess seroconversion and consider re-immunization with increased antigen content vaccine if anti-HBs less than 10 IU/L.
5. For people with neurologic conditions that compromise the management of respiratory secretions and are associated with an increased risk of aspiration.
6. Except people known to have developed GBS within 6 weeks of previously receiving an influenza vaccine.
7. Periodic re-immunization with meningococcal quadrivalent conjugate vaccine also recommended. Refer to [Meningococcal Vaccine](#) in Part 4.
8. One lifetime re-immunization with Pneu-P-23 vaccine also recommended.
9. For people with chronic CSF leak or chronic neurologic conditions that may impair clearance of oral secretions.
10. Except people known to have developed GBS within 6 weeks of previously receiving a tetanus-toxoid containing vaccine.
11. LAIV can be used in children with chronic conditions, but not preferentially. TIV is recommended for adults with chronic conditions. LAIV is contraindicated for persons with severe asthma or active wheezing - use TIV.
12. Two doses of varicella vaccine should be given 3 months apart.
13. Susceptible people with cystic fibrosis are a priority for varicella immunization.
14. There is an association between yellow fever vaccine-associated viscerotropic disease and a history of thymus disease; therefore, yellow fever vaccine is not generally recommended for persons with a history of thymoma, thymectomy or myasthenia gravis.

TIV = trivalent inactivated influenza vaccine

LAIV = live attenuated influenza vaccine



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## PART 3

# IMMUNIZATION OF IMMUNOCOMPROMISED PERSONS

- [General Recommendations and Principles](#)
- [Family or Medical History](#)
- [Congenital \(Primary\) Immunodeficiency](#)
- [Acquired \(Secondary\) Immunodeficiency](#)
- [Close Contacts](#)
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- [Selected References](#)

## GENERAL RECOMMENDATIONS AND PRINCIPLES

The safety and effectiveness of vaccines in immunocompromised persons are determined by the type of immunodeficiency and degree of immunosuppression. Each immunocompromised person is different and presents unique considerations regarding immunization. The relative degree of immunodeficiency is variable depending on the underlying condition. Immunodeficiency can also vary over time in many people and the decision to recommend for or against a particular vaccine will depend upon a case-by-case analysis of the risks and benefits. There is potential for serious illness and death if immunocompromised people are under-immunized and every effort should be made to ensure adequate protection through immunization; however, inappropriate use of live vaccines can cause serious adverse events in some immunocompromised people as a result of uncontrolled replication of the vaccine virus or bacterium.

The following recommendations reflect general best practices and are subject to individual considerations and new evidence as it arises.

### INACTIVATED VACCINES

Inactivated vaccines may be administered to immunocompromised people if indicated because the antigens in the vaccine cannot replicate and there is no increase in the risk of vaccine-associated adverse events; however, the magnitude and duration of vaccine-induced immunity are often reduced. When considering immunization of an immunocompromised person with an inactivated vaccine, consultation with the individual's attending physician may be of assistance in addition to the guidance provided in this chapter and in the Part 4 vaccine-specific chapters of the Canadian Immunization Guide. For complex cases, referral to a physician with expertise in immunization and/or immunodeficiency is advised.

### LIVE VACCINES

In general, **immunocompromised people should not receive live vaccines because of the risk of disease caused by the vaccine strains**. People who are severely immunocompromised or in whom immune status is uncertain should not receive live vaccines. In less severely immunocompromised people, the benefits of vaccination with routinely recommended live vaccines may outweigh risks. When considering immunization of an immunocompromised person with a live vaccine, **approval from the individual's attending physician should be obtained before vaccination**. In complex cases, referral to a physician with expertise in immunization and/or immunodeficiency is advised.

### SEROLOGIC TESTING AND RE-IMMUNIZATION

Immune response to vaccines may be inadequate in immunocompromised people and vaccines may remain susceptible despite appropriate vaccination. If serologic testing is available and there is a clear antibody correlate of protection, measurement of post-immunization antibody titres to determine immune

response and guide re-vaccination and post-exposure management should be considered. [Refer to vaccine-specific chapters in Part 4 for additional information.](#)

## GENERAL PRINCIPLES

Several general principles apply to the immunization of immunocompromised individuals:

- Maximize benefit while minimizing harm.
- Susceptibility or degree of protection vary according to degree of immune suppression.
  - In a severely immunosuppressed person, such as someone who has had a hematopoietic stem cell transplant, there may not be complete protection even when there is a history of childhood infection or previous immunization.
- Immunize at the time when maximum immune response can be anticipated.
  - Immunize early before immunodeficiency begins, if possible.
  - Delay immunization if the immunodeficiency is transient (if this can be done safely).
  - Stop or reduce immunosuppression to permit better vaccine response, if appropriate.
- Consider the immunization environment broadly.
  - Vaccinate close contacts when appropriate.
  - Strongly encourage up-to-date vaccinations, including annual influenza vaccination, for all healthcare workers providing care to immunocompromised people.
- Avoid live vaccines unless:
  - immunosuppression is mild and data are available to support their use.
  - the risk of natural infection is greater than the risk of immunization.
- Monitor vaccinees carefully and boost aggressively.
  - The magnitude and duration of vaccine-induced immunity are often reduced in immunocompromised individuals.

## FAMILY OR MEDICAL HISTORY

Immunodeficiency states may be undiagnosed in young children presenting for routine immunizations, which include live vaccines. This is particularly important to consider in infants receiving live vaccines **before 12 months of age**.

Clues pointing to the presence of significant immunodeficiency may be found in the medical or family history. Children with a history of failure to thrive and/or recurrent serious infections such as pneumonia or sepsis may have an immunodeficiency. A family history of congenital immunodeficiency may be known or may be suspected on the basis of a family history of early infant deaths. However, many congenital immunodeficiencies are autosomal recessive so the family history can be negative. Maternal HIV infection puts the infant at risk of immunodeficiency in the first year of life. Routine prenatal blood work in Canada includes HIV testing. A history of negative prenatal screening of the infant's mother for HIV should be obtained before administering a live vaccine to an infant less than 12 months of age. If a mother has not received routine prenatal care in Canada, the possibility of undiagnosed HIV infection should be considered.

## CONGENITAL (PRIMARY) IMMUNODEFICIENCY

Congenital immunodeficiency states are generally inherited and include defects in antibody production (e.g., agammaglobulinemia, isotype and IgG subclass deficiencies, common variable immunodeficiency), complement deficiencies, defects in one or more aspects of cell-mediated immunity, and mixed deficits. Individuals with defects in antibody and complement are highly susceptible to encapsulated bacteria such as *Streptococcus pneumoniae*, *Haemophilus influenza* type b (Hib) and *Neisseria meningitidis*. Individuals with mixed and T cell defects are particularly susceptible to virtually all viruses and some bacteria.

As a general rule, people with antibody defects can be protected from many of the vaccine preventable infections with the use of replacement immune globulin (Ig) or pathogen-specific Ig preparations; however, the level of antibody to specific pathogens may be variable and vaccination is recommended to

increase the level of protection. Receipt of replacement Ig is not a contraindication for vaccination; however, Ig can interfere with the immune response to some live attenuated viral vaccines such as measles and varicella vaccine. Refer to [Blood Products, Human Immune Globulin and Timing of Immunization](#) in Part 1 for the recommended intervals between Ig and subsequent immunization.

Refer to [Immunization of Persons with Chronic Diseases](#) in Part 3 for information regarding immunization of asplenic or hyposplenic people.

## INACTIVATED VACCINES

Inactivated vaccines should be administered to people with congenital immunodeficiency states according to routine immunization schedules. All individuals with congenital immunodeficiency disorders should receive pneumococcal, hepatitis B and Hib vaccines; annual immunization with trivalent inactivated influenza vaccine is recommended. In addition, persons with complement, properdin, factor D or primary antibody deficiencies should be vaccinated with quadrivalent conjugate meningococcal vaccine. Refer to [Table 1](#) and vaccine-specific chapters in Part 4 for additional information.

## LIVE VACCINES

All live vaccines are contraindicated for people with T cell, natural killer T cell, and mixed cellular and antibody defects (e.g. Severe Combined Immune Deficiency [SCID]). Inadvertent live vaccine administration and exposure to natural infections can be managed with rapid administration of Ig or pathogen-specific Ig with or without appropriate antiviral or antibacterial treatment.

In general, live vaccines are not recommended for individuals with other congenital immunodeficiency states, with the following exceptions:

- People with **X-linked agammaglobulinemia and Common Variable Immunodeficiency (and known intact T cell immunity)** generally should not receive live vaccines. However, they should be considered for measles-mumps-rubella (MMR), and univalent varicella vaccines as appropriate for age. Regular immune globulin replacement therapy may affect the efficacy of these live vaccines. All other live vaccines such as rotavirus, Bacille Calmette-Guérin (BCG) and oral typhoid are contraindicated.
- People with **isolated IgA deficiency who have no concomitant defects in T cell function** can receive most live vaccines. Live mucosal vaccines (rotavirus, live attenuated influenza vaccine [LAIV], oral typhoid) are likely safe and may be used although there may be lack of mucosal response; some experts may prefer to use inactivated vaccines (e.g., inactivated trivalent influenza vaccine, parenteral inactivated typhoid vaccine). However, given that there are limited data on the use of live mucosal vaccines, consultation with an immunologist is advised and immunization with these vaccines should be individually assessed.
  - People with **IgG subclass deficiencies** can receive live vaccines although response may be suboptimal. In addition, regular immune globulin replacement therapy may diminish response to a live vaccine.
- People with **phagocytic and neutrophil disorders** (e.g., congenital neutropenia, leukocyte adhesion and migration defects, chronic granulomatous disease) may be vaccinated with MMR, rotavirus, univalent varicella, herpes zoster, LAIV, or yellow fever vaccine, if indicated. Live bacterial vaccines (BCG and oral typhoid vaccine) are contraindicated.
- People with **complement deficiency** (e.g., properdin or factor D deficiency) may receive any live vaccine, if indicated.

Refer to [Table 1](#) and [Table 2](#) for recommendations for vaccination of persons with congenital immunodeficiency and [vaccine-specific chapters](#) in Part 4 for additional information.



**Table 1: Vaccination of persons with congenital immunodeficiency – inactivated vaccines**  
(Refer to text and [vaccine-specific chapters in Part 4](#) for additional information)

Inactivated vaccine	Congenital Immunodeficiency				Comments
	B cell deficiency	T cell, mixed defects	Phagocytic & neutrophil disorders	Complement deficiency	
<b>Cholera and travellers' diarrhea (inactivated)</b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	
<b>Diphtheria</b>	Routine use <sup>1</sup>	Routine use	Routine use	Routine use	
<b><i>Haemophilus influenzae</i> type b (Hib)</b>	Children less than 5 years of age: routine use	Children less than 5 years of age: routine use	Children less than 5 years of age: routine use	Children less than 5 years of age: routine use	<ul style="list-style-type: none"> <li>Refer to <a href="#">Haemophilus influenzae type B Vaccine</a> in Part 4 for additional information</li> </ul>
	Individuals 5 years of age and older: 1 dose recommended <sup>2</sup>	Individuals 5 years of age and older: 1 dose recommended <sup>2</sup>	Individuals 5 years of age and older: 1 dose recommended <sup>2</sup>	Individuals 5 years of age and older: 1 dose recommended <sup>2</sup>	
<b>Hepatitis A</b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	<ul style="list-style-type: none"> <li>Pre-exposure prophylaxis for travel: consider Ig with hepatitis A vaccine</li> <li>Post-exposure prophylaxis: Ig recommended along with vaccine</li> <li>Refer to <a href="#">Hepatitis A Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Hepatitis B</b>	Recommended	Recommended	Recommended	Recommended	<ul style="list-style-type: none"> <li>Higher dosage recommended</li> <li>Post-immunization serology testing of anti-HBs titres recommended with re-immunization if response less than 10 IU/L</li> <li>Periodic monitoring of anti-HBs titre recommended</li> <li>Refer to <a href="#">Hepatitis B Vaccine</a> in Part 4 for additional information</li> </ul>

Inactivated vaccine	Congenital Immunodeficiency				Comments
	B cell deficiency	T cell, mixed defects	Phagocytic & neutrophil disorders	Complement deficiency	
<b>HPV</b>	Routine use	Routine use	Routine use	Routine use	<ul style="list-style-type: none"> <li>○ 3-dose schedule recommended</li> </ul>
<b>Influenza (inactivated)</b>	Recommended	Recommended	Recommended	Recommended	<ul style="list-style-type: none"> <li>• Recommended annually</li> <li>• Refer to <a href="#">Influenza Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Japanese encephalitis</b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	
<b>Meningococcal conjugate</b>	Quadrivalent conjugate meningococcal vaccine recommended	Quadrivalent conjugate meningococcal vaccine recommended	Routine use	Quadrivalent conjugate meningococcal vaccine recommended	<ul style="list-style-type: none"> <li>• Refer to <a href="#">Meningococcal Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Pertussis</b>	Routine use	Routine use	Routine use	Routine use	
<b>Pneumococcal conjugate 13-valent (Pneu-C-13)</b>	Recommended	Recommended	Recommended	Recommended	<ul style="list-style-type: none"> <li>• Fair evidence to recommend</li> <li>• Refer to <a href="#">Pneumococcal Vaccine</a> in Part 4 for additional information</li> <li>• Should be followed – at least 2 months later or when reaches age 2 years – with a pneumococcal polysaccharide vaccine dose</li> </ul>
<b>Pneumococcal polysaccharide (Pneu-P-23)</b>	Recommended	Recommended	Recommended	Recommended	<ul style="list-style-type: none"> <li>• One life-time re-immunization recommended</li> <li>• Refer to <a href="#">Pneumococcal Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Polio (inactivated)</b>	Routine use	Routine use	Routine use	Routine use	

Inactivated vaccine	Congenital Immunodeficiency				Comments
	B cell deficiency	T cell, mixed defects	Phagocytic & neutrophil disorders	Complement deficiency	
<b>Rabies</b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	<ul style="list-style-type: none"> <li>Do not use intradermally</li> <li>Post-immunization serology recommended</li> <li>Refer to <a href="#">Rabies Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Tetanus</b>	Routine use	Routine use	Routine use	Routine use	
<b>Typhoid (inactivated)</b>	Use if indicated	Use if indicated	Use if indicated	Use if indicated	

<sup>1</sup> routine use: follow routine immunization schedules with age-appropriate booster doses

<sup>2</sup> regardless of prior history of Hib vaccination and at least 1 year after any previous dose

anti-HBs: antibody to hepatitis B surface antigen

Ig: immune globulin

**Table 2: Vaccination of persons with congenital immunodeficiencies – live attenuated vaccines**  
(Refer to text and [vaccine-specific chapters in Part 4](#) for additional information)

Live attenuated vaccine	Congenital Immunodeficiency					Comments
	B cell deficiency		T cell, mixed defects	Phagocytic & neutrophil disorders	Complement deficiency	
	X-linked agammaglobulinemia & Common Variable Immunodeficiency	IgA deficiency & IgG subclass deficiency				
BCG	Contraindicated	Use if indicated	Contraindicated	Contraindicated	Use if indicated	
Herpes zoster	Contraindicated	Routine use <sup>1</sup>	Contraindicated	Routine use	Routine use	
Influenza (live)	Contraindicated -- use inactivated	Consider use <sup>2, 3</sup>	Contraindicated -- use inactivated	May receive if indicated	May receive if indicated	<ul style="list-style-type: none"><li>Refer to <a href="#">Influenza Vaccine</a> in Part 4 for additional information</li></ul>
Measles-mumps-rubella	Consider use <sup>4</sup>	Routine use <sup>4</sup>	Contraindicated	Routine use	Routine use	<ul style="list-style-type: none"><li>Complement deficiency: consider post-immunization serology and re-immunization, if protective titres not achieved</li><li>Refer to <a href="#">Measles Vaccine</a> in Part 4 for additional information</li></ul>
Rotavirus	Contraindicated <sup>3</sup>	Consider use <sup>2</sup>	Contraindicated	Routine use	Routine use	
Smallpox	Contraindicated	Use if indicated	Contraindicated	Use if indicated	Use if indicated	
Typhoid (live)	Contraindicated; if indicated, use inactivated	Consider use <sup>2,3</sup>	Contraindicated; if indicated, use inactivated	Contraindicated; if indicated, use inactivated	Use if indicated	

Live attenuated vaccine	Congenital Immunodeficiency					Comments
	B cell deficiency		T cell, mixed defects	Phagocytic & neutrophil disorders	Complement deficiency	
	X-linked agammaglobulinemia & Common Variable Immunodeficiency	IgA deficiency & IgG subclass deficiency				
Varicella (univalent)	Consider use <sup>4</sup>	Routine use <sup>4</sup>	Contraindicated	May be given 2 doses at least 3 months apart	May be given 2 doses at least 3 months apart	<ul style="list-style-type: none"><li>Consider post-immunization serology</li><li>Refer to <a href="#">Varicella (Chickenpox) Vaccine</a> in Part 4 for additional information</li></ul>
Yellow fever	Contraindicated	Use if indicated	Contraindicated	Use if indicated	Use if indicated	

<sup>1</sup> routine use: follow routine immunization schedules with age-appropriate booster doses

<sup>2</sup> consult with immunologist in cases of IgA deficiency

<sup>3</sup> some experts may prefer inactivated vaccine for persons with IgA deficiency

<sup>4</sup> regular immune globulin replacement therapy may affect the efficacy of the vaccine. Refer to [Blood Products, Human Immune Globulin and Timing of Immunization](#) in Part 1 for the recommended intervals between Ig and subsequent immunization.

Ig: immune globulin



## ACQUIRED (SECONDARY) IMMUNODEFICIENCY

Acquired immunodeficiency states result from diseases or infection that directly or indirectly cause immunosuppression (e.g., malignant hematologic disorders or solid tumours, hematopoietic stem cell transplantation, solid organ transplantation, HIV-infection) or long-term immunosuppressive therapy (e.g., long-term steroids, cancer chemotherapy, radiation therapy) used for organ transplantation and a range of chronic infectious and inflammatory conditions (e.g., inflammatory bowel disease, psoriasis, systemic lupus erythematosus). Refer to [Immunization of Persons with Chronic Diseases](#) in Part 3 for information regarding immunization of asplenic or hyposplenic people.

### ACQUIRED COMPLEMENT DEFICIENCY

People with conditions such as paroxysmal nocturnal hemoglobinuria who are receiving the terminal complement inhibitor eculizumab (Soliris™, Alexion Pharmaceuticals Inc.) should receive two doses of quadrivalent conjugate meningococcal vaccine. They must be vaccinated at least two weeks prior to receiving the first dose of eculizumab, if possible, and every 5 years thereafter if they continue to use the drug.

### MALIGNANT HEMATOLOGIC DISORDERS

(e.g., leukemia, lymphomas or other malignant neoplasms affecting the bone marrow or lymphatic systems)

#### Inactivated vaccines

Inactivated vaccines should be administered to people with malignant hematologic disorders according to routine immunization schedules. Individuals with malignant neoplasms, including lymphoma and leukemia, should receive pneumococcal and Hib vaccines because of increased susceptibility to disease. Annual immunization with trivalent inactivated influenza vaccine is also recommended.

#### Live vaccines

Live vaccines are contraindicated in individuals with severe immunodeficiency due to blood dyscrasias, lymphomas, leukemias of any type, or other malignant neoplasms affecting the bone marrow or lymphatic systems and in people undergoing immunosuppressive treatment for malignancy.

Children with Acute Lymphocytic Leukemia (ALL) may be vaccinated with MMR vaccine with or without varicella vaccine if the disease has been in remission for at least 12 months, the child's total lymphocyte count is at least  $1.2 \times 10^9/L$ , the child is not receiving radiation therapy, and maintenance chemotherapy can be withheld for at least 1 week before to 1 week after immunization. Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information. Persons with leukemia in remission and who have not received immunosuppressive chemotherapy or radiation for at least 3 months and who do not have defects in T cell function can receive herpes zoster vaccine if indicated. Refer to [Herpes Zoster \(Shingles\) Vaccine](#) in Part 4 for additional information.

### MALIGNANT SOLID TUMOURS

#### Inactivated vaccines

Inactivated vaccines should be administered to people with malignant solid tumours according to routine immunization schedules. In addition, pneumococcal vaccines should be given because of increased susceptibility to invasive pneumococcal disease. Annual immunization with trivalent inactivated influenza vaccine is also recommended.

#### Live vaccines

Live vaccines are contraindicated in people undergoing immunosuppressive treatment for any malignant solid tumours. In general, if a patient is 3 months post-chemotherapy and the cancer is in remission, the person is no longer considered immunocompromised.

## HEMATOPOIETIC STEM CELL TRANSPLANTATION (HSCT – autologous or allogeneic)

HSCT is the transplantation of blood-derived or bone marrow-derived hematopoietic stem cells following bone marrow ablation or non-ablative conditioning by chemotherapy or radiation. HSCT recipients receive either their own cells (autologous HSCT) or cells from a donor (allogeneic HSCT). Cells are sourced from bone marrow, peripheral blood, or umbilical cord blood.

Antibody titres to vaccine-preventable diseases decrease after allogeneic or autologous HSCT if the HSCT recipient is not revaccinated post-transplant. Virtually all HSCT recipients experience a prolonged period of immune suppression following transplantation. Allogeneic HSCT recipients experience profound immune suppression in the early post-transplant period but relatively normal immunity after 1 to 2 years if they are off immunosuppressive medication and free of graft-versus-host disease (GVHD). GVHD generally does not occur.

Immunity after transplant must be at least partially reconstituted for a vaccine to mount a clinically significant response. In general, T cells capable of responding to new antigens are generated at 6 to 12 months after transplant, earlier in young children and later in adults. The differences in responses of autologous and allogeneic HSCT recipients to vaccines are not well characterized and approaches to vaccination are the same. Efficacy data for vaccines in HSCT recipients are limited.

Vaccination in accordance with transplant centre-specific immunization guidelines is generally part of routine post-transplant care provided by many transplant centers.

### Pre-HSCT

If time permits, careful consideration must be given to the pre-ablation immunization status of the HSCT candidate. If the transplant is planned during the influenza season, trivalent inactivated influenza vaccine should be given at least 2 weeks prior to transplant. People awaiting HSCT should not receive live vaccines. Donor vaccination may improve responses of the HSCT recipient to some vaccines; however, in general, due to logistical and ethical issues, donor vaccination is not practiced.

### Post-HSCT

HSCT recipients should be viewed as “never immunized” and require re-immunization after transplant because the ablation of hematopoietic cells in the bone marrow pre-transplant eliminates the person’s immune memory. In addition, certain vaccine preventable diseases pose increased risk for HSCT recipients of all ages (e.g., pneumococcal, *Haemophilus influenzae* type b, measles, varicella, and influenza). Quadrivalent conjugate meningococcal vaccine should be given if indicated by age and risk factors for invasive meningococcal disease. HSCT recipients respond poorly to polysaccharide vaccines, such as pneumococcal polysaccharide 23-valent vaccine. If serologic testing is available and there is a clear antibody correlate of protection, measurement of post-immunization antibody titres to determine immune response and guide re-vaccination and post-exposure management should be considered.

#### Inactivated vaccines

Inactivated vaccines should be repeated for HSCT recipients generally beginning 6 to 12 months post-transplant (pneumococcal conjugate vaccine may be given beginning at 3 to 9 months post-transplant, trivalent inactivated influenza vaccine may be given beginning at 4 to 6 months post-transplant). Refer to [Table 3](#) and [vaccine-specific chapters in Part 4](#) for recommendations for HSCT recipients.

#### Live vaccines

MMR and univalent varicella vaccines may be considered 24 months or more post-transplant for HSCT recipients provided there is no evidence of chronic GVHD, immunosuppression has been discontinued for at least 3 months, and the person is considered immunocompetent by a transplant specialist. Refer to [Table 3](#) and [vaccine-specific chapters in Part 4](#) for recommendations for HSCT recipients.

**Table 3: Post-transplantation vaccination of hematopoietic stem cell transplantation (HSCT) recipients**  
(Refer to [text and vaccine-specific chapters in Part 4](#) for additional information)

Vaccine	Post-transplantation	Comments
<b>INACTIVATED VACCINES</b>		
<b>Cholera and travellers' diarrhea (inactivated)</b>	Use if indicated	<ul style="list-style-type: none"> <li>Beginning 6 months post-HSCT</li> </ul>
<b>Diphtheria</b>	Recommended: 3 doses	<ul style="list-style-type: none"> <li>Beginning 6 to 12 months post-HSCT</li> <li>Refer to <a href="#">Diphtheria Toxoid</a> in Part 4 for additional information</li> </ul>
<b><i>Haemophilus influenzae</i> type b (Hib)</b>	Recommended: 3 doses	<ul style="list-style-type: none"> <li>Beginning 6 to 12 months post-HSCT</li> <li>Refer to <a href="#">Haemophilus influenzae type B Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Hepatitis A</b>	Use if indicated	<ul style="list-style-type: none"> <li>Beginning 6 months post-HSCT</li> <li>Pre-exposure prophylaxis for travel: consider Ig with hepatitis A vaccine</li> <li>Post-exposure prophylaxis: Ig recommended along with hepatitis A vaccine</li> <li>Refer to <a href="#">Hepatitis A Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Hepatitis B</b>	Recommended: 3 doses	<ul style="list-style-type: none"> <li>Beginning 6 to 12 months post-HSCT</li> <li>Higher dosage recommended</li> <li>Post-immunization serology testing of anti-HBs titres recommended with re-immunization if response less than 10 IU/L Periodic monitoring of anti-HBs titre recommended</li> <li>Refer to <a href="#">Hepatitis B Vaccine</a> in Part 4 for additional information</li> </ul>
<b>HPV</b>	Recommended if indicated: 3 doses	<ul style="list-style-type: none"> <li>Beginning 6 to 12 months post-HSCT</li> </ul>
<b>Influenza (inactivated)</b>	Recommended annually	<ul style="list-style-type: none"> <li>Beginning 4 to 6 months post-HSCT</li> <li>Refer to <a href="#">Influenza Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Japanese encephalitis</b>	Use if indicated	<ul style="list-style-type: none"> <li>Beginning 6 months post-HSCT</li> </ul>

Vaccine	Post-transplantation	Comments
<b>Meningococcal conjugate</b>	Children and adolescents: routine use Adults: use quadrivalent conjugate meningococcal vaccine if indicated by risk factors for invasive meningococcal disease	<ul style="list-style-type: none"> <li>Beginning 6 months post-HSCT</li> <li>Refer to <a href="#">Meningococcal Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Pertussis</b>	Recommended: 3 doses for children and adolescents up to age 18  1 dose for adults 18 years of age and older	<ul style="list-style-type: none"> <li>Beginning 6 to 12 months post-HSCT</li> <li>Refer to <a href="#">Diphtheria Toxoid</a> in Part 4 for additional information</li> </ul>
<b>Pneumococcal conjugate 13-valent (Pneu-C-13)</b>	Recommended: 3 doses	<ul style="list-style-type: none"> <li>Beginning 3 to 9 months post-HSCT after discussion with transplant specialist</li> <li>3 doses of Pneu-C-13 vaccine at least 4 weeks apart followed by a dose of Pneu-P-23 vaccine 6 to 12 months after the last Pneu-C-13 dose</li> <li>Refer to <a href="#">Pneumococcal Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Pneumococcal polysaccharide (Pneu-P-23)</b>	Recommended: 1 dose	<ul style="list-style-type: none"> <li>Consider re-immunization after 1 year</li> <li>Refer to <a href="#">Pneumococcal Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Polio (inactivated)</b>	Recommended: 3 doses	<ul style="list-style-type: none"> <li>Beginning 6 to 12 months post-HSCT</li> <li>Refer to <a href="#">Diphtheria Toxoid</a> in Part 4 for additional information</li> </ul>
<b>Rabies</b>	Use if indicated	<ul style="list-style-type: none"> <li>Do not use intradermally</li> <li>As needed for post-exposure management</li> <li>Beginning 6 to 12 months post-HSCT for pre-exposure prophylaxis</li> <li>Post-immunization serology recommended</li> <li>Refer to <a href="#">Rabies Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Tetanus</b>	Recommended: 3 doses	<ul style="list-style-type: none"> <li>Beginning 6 to 12 months post-HSCT</li> <li>Refer to <a href="#">Diphtheria Toxoid</a> in Part 4 for additional information</li> </ul>
<b>Typhoid (inactivated)</b>	Use if indicated	<ul style="list-style-type: none"> <li>Beginning 6 months post-HSCT</li> </ul>

Vaccine	Post-transplantation	Comments
<b>LIVE VACCINES</b>		
<b>BCG</b>	Contraindicated	
<b>Herpes zoster</b>	Not recommended	
<b>Influenza (live)</b>	Not recommended -- use inactivated vaccine	
<b>Measles-mumps-rubella</b>	Consider use: 1 dose <sup>1</sup> , followed by 2 <sup>nd</sup> dose after 3 or more months if no seroconversion	<ul style="list-style-type: none"> <li>Beginning 24 months post-HSCT</li> <li>Serology recommended after 1<sup>st</sup> dose</li> <li>Refer to <a href="#">Measles Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Rotavirus</b>	Contraindicated	
<b>Smallpox</b>	Contraindicated	
<b>Typhoid (live)</b>	Contraindicated -- if indicated use inactivated	
<b>Varicella (univalent)</b>	Consider use: 1 dose <sup>1</sup>	<ul style="list-style-type: none"> <li>Beginning 24 months post-HSCT</li> <li>Pre- and post-immunizations serology recommended</li> <li>Refer to <a href="#">Varicella (Chickenpox) Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Yellow fever</b>	May be given if clearly indicated <sup>1</sup>	<ul style="list-style-type: none"> <li>Beginning 24 months post-HSCT</li> <li>Refer to <a href="#">Yellow Fever Vaccine</a> in Part 4 for additional information</li> </ul>

<sup>1</sup> if immunosuppression has been discontinued for at least 3 months, does not have chronic GVHD, and considered immunocompetent by a transplant specialist

anti-HBs: antibody to hepatitis B surface antigen

Ig: immune globulin



## SOLID ORGAN TRANSPLANTATION

### Pre-solid organ transplantation

Pre-transplant serology is routine at most transplant centres. Ideally, all non-immune solid organ transplantation candidates should be immunized prior to transplantation and as early in the course of disease as possible because vaccine response may be reduced in people with organ failure pre-transplant. In addition, vaccines are generally more immunogenic if given before transplantation because the immunosuppressive medications given after transplant to prevent and treat rejection of the transplanted organ may diminish the vaccine response.

Inactivated vaccines should be given at least 2 weeks before transplantation and live attenuated vaccines should be given at least 4 weeks prior to transplantation. Refer to [Table 4](#) and vaccine-specific chapters in Part 4 for recommendations for vaccination of solid organ transplant candidates.

### Post-solid organ transplantation

Solid organ recipients generally receive lifelong immunosuppression, which varies substantially depending on the organ transplanted. Usually the degree of immune suppression is greatest in the first 3 to 6 months post-transplant and less after a year, but a significant degree of immune suppression persists indefinitely. A minority of transplant recipients who experience chronic rejection, persistent organ dysfunction, or chronic infections, remain profoundly immune suppressed. In general, vaccination should not be re-initiated until 3 to 6 months post-transplant when baseline immunosuppression levels are attained. If serologic testing is available and there is a clear antibody correlate of protection, measurement of post-immunization antibody titres to determine immune response and guide re-vaccination and post-exposure management should be considered. Refer to [Table 4](#) and vaccine-specific chapters in Part 4 for recommendations for vaccination of solid organ transplant recipients.

Solid organ transplant recipients are at risk of severe illness or death due to influenza. Once infected, transplant recipients develop increased viral loads and prolonged shedding which increase the potential for disease dissemination. Solid organ transplant recipients are also at increased risk of invasive pneumococcal disease, *Haemophilus influenza* type b disease and complications of varicella infection.

Most recently transplanted solid organ recipients receive vaccination in accordance with transplant centre-specific immunization guidelines as part of routine post-transplant care.

**Table 4: Vaccination of solid organ transplant candidates and recipients**  
(Refer to [text](#) and [vaccine-specific chapters in Part 4](#) for additional information)

Vaccine	Pre-transplant <sup>1</sup>	Post-transplant (if not vaccinated pre-transplant)	Comments
<b>INACTIVATED VACCINES<sup>2</sup></b>			
<b>Cholera and travellers' diarrhea (inactivated)</b>	Use if indicated	Use if indicated	
<b>Diphtheria</b>	Routine use <sup>3</sup>	Routine use	
<b><i>Haemophilus influenzae</i> type b (Hib)</b>	Children less than 5 years of age: routine use	<ul style="list-style-type: none"> <li>Children less than 5 years of age: routine use</li> </ul>	<ul style="list-style-type: none"> <li>Refer to <a href="#">Haemophilus influenzae type B Vaccine</a> in Part 4 for additional information</li> </ul>
	Individuals 5 years of age and older: 1 dose recommended <sup>4</sup>	<ul style="list-style-type: none"> <li>Individuals 5 years of age and older: 1 dose recommended<sup>4</sup></li> </ul>	
<b>Hepatitis A</b>	Use if indicated	Use if indicated	<ul style="list-style-type: none"> <li>Recommended for transplant candidates with chronic liver diseases</li> <li>Pre-exposure prophylaxis for travel: consider Ig with hepatitis A vaccine</li> <li>Post-exposure prophylaxis: Ig recommended along with hepatitis A vaccine</li> <li>Refer to <a href="#">Hepatitis A Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Hepatitis B</b>	Routine use	Routine use	<ul style="list-style-type: none"> <li>Higher dosage recommended for post-transplant vaccine recipients</li> <li>Post-immunization serology testing of anti-HBs recommended with re-immunization if response less than 10 IU/L</li> <li>Periodic monitoring of anti-HBs titre recommended</li> <li>Refer to <a href="#">Hepatitis B Vaccine</a> in Part 4 for additional information</li> </ul>
<b>HPV</b>	Routine use	Routine use	<ul style="list-style-type: none"> <li>3 dose schedule recommended</li> <li>May be considered for pre-transplant</li> </ul>

Vaccine	Pre-transplant <sup>1</sup>	Post-transplant (if not vaccinated pre-transplant)	Comments
			administration prior to routinely recommended age, if reasonably close to minimum recommended age for vaccination
<b>Influenza (inactivated)</b>	Recommended annually	Recommended annually	<ul style="list-style-type: none"> <li>Refer to <a href="#">Influenza Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Japanese encephalitis</b>	Use if indicated	Use if indicated	
<b>Meningococcal conjugate</b>	Children and adolescents: routine use Adults: use quadrivalent meningococcal conjugate vaccine if indicated by risk factors for invasive meningococcal disease	Children and adolescents: routine use Adults: use quadrivalent conjugate meningococcal vaccine if indicated by risk factors for invasive meningococcal disease	<ul style="list-style-type: none"> <li>Beginning 6 months post-transplant</li> <li>Refer to <a href="#">Meningococcal Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Pertussis</b>	Routine use	Routine use	
<b>Pneumococcal conjugate 13-valent</b>	Recommended	Recommended	<ul style="list-style-type: none"> <li>Refer to <a href="#">Pneumococcal Vaccine</a> in Part 4 for additional information               <ul style="list-style-type: none"> <li>Should be followed – at least 2 months later or when reaches age 2 years – with a pneumococcal polysaccharide vaccine dose<sup>5</sup></li> </ul> </li> </ul>
<b>Pneumococcal polysaccharide</b>	Recommended	Recommended	<ul style="list-style-type: none"> <li>One life-time re-immunization recommended</li> <li>Refer to <a href="#">Pneumococcal Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Polio (inactivated)</b>	Routine use	Routine use	
<b>Rabies</b>	Use if indicated	Use if indicated	<ul style="list-style-type: none"> <li>Do not use intradermally</li> <li>Post-immunization serology recommended</li> <li>Refer to <a href="#">Rabies Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Tetanus</b>	Routine use	Routine use	

Vaccine	Pre-transplant <sup>1</sup>	Post-transplant (if not vaccinated pre-transplant)	Comments
<b>Typhoid (inactivated)</b>	Use if indicated	Use if indicated	
<b>LIVE VACCINES<sup>6</sup></b>			
<b>Measles-mumps-rubella</b>	Recommended <sup>7</sup>	Not recommended	<ul style="list-style-type: none"> <li>Refer to <a href="#">Measles Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Varicella</b>	Recommended <sup>7</sup>	Not recommended	<ul style="list-style-type: none"> <li>Consider post-immunization serology</li> <li>Complete 2-dose series 4 weeks or more pre-transplant</li> <li>Refer to <a href="#">Varicella (Chickenpox) Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Rotavirus</b>	Routine use	Not recommended	
<b>Influenza (live)</b>	Use if indicated	Not recommended; use inactivated vaccine	
<b>Herpes zoster</b>	Routine use	Not recommended	
<b>Yellow fever</b>	Use if indicated	Contraindicated	
<b>Typhoid (live)</b>	Use if indicated	Contraindicated; if indicated, use inactivated vaccine	
<b>BCG</b>	Use if indicated	Contraindicated	
<b>Smallpox</b>	Contraindicated	Contraindicated	

<sup>1</sup> whenever possible, vaccine series should be completed pre-transplantation. Vaccines given post-transplant may not be sufficiently immunogenic.

<sup>2</sup> inactivated vaccines should be given at least 2 weeks before transplantation and, in general, should not be given until 3 to 6 months post-transplant when baseline immunosuppression levels are attained

<sup>3</sup> routine use: follow routine immunization schedules with age-appropriate booster doses

<sup>4</sup> regardless of prior history of Hib vaccination and at least 1 year after any previous dose

<sup>5</sup> Pneu-C-13 vaccine followed by Pneu-P-23 vaccine is recommended. Antibody titres decline after 3 years; however, experience with re-immunization after solid organ transplant is limited.

<sup>6</sup> live attenuated vaccines should be given at least 4 weeks prior to transplantation

<sup>7</sup> may be given to infants as early as 6 months of age if transplantation is anticipated before 12 to 15 months of age

anti-HBs: antibody to hepatitis B surface antigen

Ig: immune globulin

## IMMUNOSUPPRESSIVE THERAPY

Long-term immunosuppressive therapy (e.g., long-term steroids, cancer chemotherapy, radiation therapy) is used for organ transplantation and a range of chronic infectious and inflammatory conditions (e.g., inflammatory bowel disease, psoriasis, systemic lupus erythematosus). These therapies have their greatest impact on cell-mediated immunity, although T cell-dependent antibody production can also be adversely affected. Some chronic cancer therapies are hormonal (tamoxifen, gonadotropin release inhibitors) and have no significant immunologic effects. Some therapies for inflammatory conditions (such as hydroxychloroquine, sulfasalazine, or auranofin) are not considered immunosuppressive. The nature of the person's underlying disease should be considered. In general, if a patient is 3 months post-chemotherapy and the cancer is in remission, the person is no longer considered immunocompromised.

Refer to the list of immunosuppressive medications below. Product monographs for drugs authorized by Health Canada can be found at [Health Canada's Drug Product Database](http://webprod5.hc-sc.gc.ca/dpd-bdpp/index-eng.jsp). (<http://webprod5.hc-sc.gc.ca/dpd-bdpp/index-eng.jsp>)

**List of immunosuppressive medications and example brand name** (Adapted from: *Guidelines to Determining Immunosuppressing Conditions or Medications for which MMR is contraindicated*. Nova Scotia Department of Health and Wellness)

6-mercaptopurine - PURINETHOL® (Novopharm Ltd.)  
 Abatacept - ORENCIA™ (Bristol-Myers Squibb Canada)  
 Adalimumab - HUMIRA® (Abbott Laboratories Ltd.)  
 Alemtuzumab - MabCampath® (Genzyme Canada, Div. Of Sanofi-Aventis Canada Inc.)  
 Anti-thymocyte globulin - Thymoglobulin® (Genzyme Canada, Div. Of Sanofi-Aventis Canada Inc.)  
 Azathioprine - IMURAN (Triton Pharma Inc.)  
 Basiliximab - SIMULECT™ (Novartis Pharmaceuticals Canada Inc.)  
 Current or recent radiation  
 Cyclophosphamide - PROCYTOX (Baxter Corp.)  
 CYTOXAN  
 Cyclosporine - NEORAL™ (Novartis Pharmaceuticals Canada Inc.)  
 Etanercept - Enbrel® (Immunex Corp.)  
 High-dose systemic corticosteroids (2 mg/kg per day for a child or 20 mg/day or more of prednisone or its equivalent for an adult) for 14 days or more  
 Infliximab - REMICADE® (Janssen Inc.)  
 Leflunomide - ARAVA® (Sanofi-Aventis Canada Inc.)  
 Methotrexate  
 Mitoxantrone  
 Most cancer chemotherapies (except tamoxifen and hydroxyurea)  
 Mycophenolatemofetil - CellCept® (Hoffman-LaRoche Ltd.)  
 Rituximab - RITUXAN® (Hoffman-LaRoche Ltd.)  
 Sirolimus - Rapamune® (Pfizer Canada Inc.)  
 Tacrolimus - Prograf® (Astellas Pharma Canada Inc.)



## PRIOR TO IMMUNOSUPPRESSIVE THERAPY

Vaccination status should be reviewed for immunocompetent persons who might be anticipating initiation of immunosuppressive treatments or who have diseases that might lead to immunodeficiency. Ideally, all appropriate vaccines or boosters should be administered before the initiation of immunosuppressive therapy so that optimal immunogenicity is achieved. Although inactivated vaccines can be safely administered at any time before, during or after immunosuppression, inactivated vaccines should be administered at least 14 days before initiation of immunosuppressive therapy to optimize immunogenicity. Live vaccines should be administered at least 4 weeks before immunosuppressive therapy is started to reduce the risk of disease caused by the vaccine strain.

## DURING OR AFTER IMMUNOSUPPRESSIVE THERAPY

If vaccines cannot be given prior to initiation of immunosuppressive therapy, a period of at least 3 months should elapse after immunosuppressive drugs (except high-dose systemic corticosteroids) have been stopped before administration of inactivated vaccines (if possible to ensure immunogenicity) and live vaccines (to reduce the risk of disease caused by the vaccine strain). A period of at least 4 weeks should elapse between discontinuation of high-dose systemic steroids and the administration of vaccines. The interval between discontinuation of immunosuppressive drugs and vaccine administration may vary with the intensity of the immunosuppressive therapy, underlying disease and other factors (e.g., inactivated vaccines can be administered if required for post-exposure or outbreak management).

If immunosuppressive therapy cannot be stopped, live vaccines are generally contraindicated, although the risk to benefit ratio may favour immunization if only low doses of immunosuppressive drugs are required and there is significant risk of development of disease. The safety and efficacy of live, attenuated vaccines during low dose intermittent or maintenance therapy with immunosuppressive drugs (other than corticosteroids) are unknown. Immunosuppressive drugs have been reported to cause reactivation of latent tuberculosis infection and predisposition to other opportunistic infections. Therefore, until additional information becomes available, avoidance of live vaccines during intermittent or low dose chemotherapy or other immunosuppressive therapy is prudent. The use of live vaccines in persons on low dose immunosuppression is under review by the National Advisory Committee on Immunization (NACI). Inactivated vaccines should be given when the person is least immunosuppressed unless a vaccine is urgently needed (such as based on exposure risk to circulating diseases or for post-exposure management).

Corticosteroid therapy is not a contraindication to vaccine administration when steroid therapy is short-term (i.e., less than 14 days); or a low-to-moderate dose (less than 2 mg/kg/day for a child or less than 20 mg/day of prednisone or its equivalent per day for an adult); or long-term, alternate-day treatment with short-acting preparations; or maintenance physiologic replacement therapy; or administered topically, inhaled, or locally injected (e.g., joint injection).

## MONOCLONAL ANTIBODIES

Monoclonal antibodies are laboratory-produced substances that can bind to B cells (such as rituximab) or tumor necrosis factor and are called TNF inhibitors (such as infliximab and adalimumab) to induce a therapeutic immunosuppression. Monoclonal antibodies have many applications, including the treatment of cancer, prevention of transplant rejection, and treatment of autoimmune diseases (such as Crohn's disease or rheumatoid arthritis) and infectious diseases (such as RSV). Refer to [Immunization of Persons with Chronic Diseases](#) in Part 3 or [Passive Immunizing Agents](#) in Part 5 for additional information.

Monoclonal antibodies taken during pregnancy will be transferred to the fetus and their effects may persist after birth. For example, rituximab taken during pregnancy is associated with B cell depletion in both mother and fetus. Infants who have been exposed to rituximab, either during pregnancy or from breastfeeding, should have B-cell enumeration prior to immunization. Consultation with an immunologist is advised. Refer to [Immunization in Pregnancy and Breastfeeding](#) in Part 3 and to [Bacille Calmette-Guérin \(BCG\) Vaccine](#) in Part 4 for additional information.

The advice for vaccines is the same with monoclonal antibodies as other immunosuppressive agents. Vaccination status should be reviewed prior to commencing monoclonal antibodies. If vaccines cannot be given prior to initiation of therapy, a period of at least 3 months should elapse after monoclonal antibody exposure before administration of inactivated vaccines (if possible to ensure immunogenicity) and live vaccines (to reduce the risk of disease caused by the vaccine strain).

In general, live attenuated vaccines are contraindicated during monoclonal antibody treatment (or in infants exposed to monoclonal antibodies). There is evidence that use of therapeutic monoclonal antibodies, may lead to reactivation of latent tuberculosis infection and tuberculosis disease and predispose to other opportunistic infections. One exception to this is palivizumab which is specific for the prevention of respiratory syncytial virus (RSV) infection; it will not interfere with the response to a live vaccine.

### **Additional recommended vaccines**

People undergoing immunosuppressive therapy are at higher risk of invasive pneumococcal disease and influenza-related complications; therefore, they should receive pneumococcal vaccine as well as annual immunization with trivalent inactivated influenza vaccine. Hib vaccine may be recommended in some circumstances, such as following organ transplants. Refer to [vaccine-specific chapters in Part 4](#) for additional information.

## **HIV-INFECTION**

The degree of immune suppression varies widely among HIV-infected individuals, reflecting disease stage and response to antiretroviral therapy. Immune suppression is approximately predicted by a recent CD4 count and CD4 percentage. Elevated viral loads may diminish the effectiveness of some vaccines although this is not a reason to delay vaccination.

### **Inactivated vaccines**

When possible, vaccines should be given early in the course of HIV infection although there is no contraindication to the use of inactivated vaccines at any time. Inactivated vaccines should be administered to HIV-infected people according to routine immunization schedules and annual immunization with trivalent inactivated influenza vaccine is recommended. HIV-infected people should receive pneumococcal vaccines (conjugate followed by polysaccharide) and Hib vaccine; quadrivalent conjugate meningococcal vaccine should be considered.

### **Live vaccines**

The risks and benefits of a live vaccine (and the alternative therapies available) need to be carefully considered in consultation with an infectious disease specialist/immunologist. In general, with the exception of BCG, smallpox, and oral, live typhoid vaccines, there are no contraindications to the use of any vaccine early in the course of HIV-infection. As the disease progresses, the risk of using live vaccines increases and consensus "cut-offs" based on clinical and immunologic categories have been determined for the use of MMR and univalent varicella vaccines as follow:

- **Measles-mumps-rubella vaccine (MMR):** HIV-infected children 12 months of age and older, and with Centers for Disease Control and Prevention (CDC) clinical category N, A or B and immunologic category 1 or 2 (i.e., CD4 counts  $\geq 15\%$ ) may receive two doses of MMR vaccine 3 to 6 months apart. Immunization with two doses of MMR vaccine administered 3 months apart may be considered for susceptible HIV-infected adolescents and adults with CD4 cell count  $\geq 200 \times 10^6/L$  and CD4 percentage  $\geq 15\%$ . MMR vaccine is contraindicated in persons with advanced HIV/AIDS.
- **Univalent varicella vaccine:** HIV-infected children 12 months of age and older, and with CDC clinical category N, A or B and immunologic category 1 or 2 (i.e., CD4 percentage  $\geq 15\%$ ) may receive two doses of univalent varicella vaccine 3 to 6 months apart. There are no published data on the use of varicella vaccine in susceptible HIV-infected adolescents and adults. HIV-infected adolescents and adults should be asked for a history of varicella disease or vaccination, and if negative for both, serology should be requested to confirm susceptibility. Based on expert opinion,

immunization with two doses of univalent varicella vaccine administered 3 months apart may be considered for susceptible HIV-infected adolescents and adults with CD4 cell count  $\geq 200 \times 10^6/\text{L}$  and CD4 percentage  $\geq 15\%$ . Varicella vaccine is contraindicated in persons with advanced HIV/AIDS.

No specific cut-off has been determined with regard to the safety of using Zoster vaccine. Refer to [Table 5](#) for recommendations for vaccination of HIV-infected persons and [vaccine-specific chapters in Part 4](#) for additional information.

**Table 5: Vaccination of HIV-infected persons**(Refer to text and [vaccine-specific chapters in Part 4](#) for additional information)

Vaccine	Recommendation	Comments
<b>INACTIVATED VACCINES</b>		
<b>Cholera and travellers' diarrhea (inactivated)</b>	Use if indicated	
<b>Diphtheria</b>	Routine use <sup>1</sup>	
<b><i>Haemophilus influenzae</i> type b (Hib)</b>	Children less than 5 years of age: routine use	<ul style="list-style-type: none"> <li>Refer to <a href="#">Haemophilus influenzae type b Vaccine</a> in Part 4 for additional information</li> </ul>
	Individuals 5 years of age and older: 1 dose recommended <sup>2</sup>	
<b>Hepatitis A</b>	Use if indicated	<ul style="list-style-type: none"> <li>Recommended for HIV-infected individuals with risk factors such as men who has sex with men or illicit drug use</li> <li>Pre-exposure prophylaxis for travel: consider Ig with hepatitis A vaccine</li> <li>Post-exposure prophylaxis: Ig recommended along with hepatitis A vaccine</li> <li>Refer to <a href="#">Hepatitis A Vaccine</a> in Part 4 for additional information</li> </ul>
<b>Hepatitis B</b>	Recommended	<ul style="list-style-type: none"> <li>Higher dosage recommended</li> <li>Post-immunization serology testing for anti-HBs recommended with re-immunization if response less than 10 IU/L.</li> <li>Periodic monitoring of anti-HBs titre recommended</li> <li>Refer to <a href="#">Hepatitis B Vaccine</a> in Part 4 for additional information</li> </ul>
<b>HPV</b>	Routine use	<ul style="list-style-type: none"> <li>3-dose schedule recommended</li> </ul>
<b>Influenza (inactivated)</b>	Recommended	<ul style="list-style-type: none"> <li>Recommended annually</li> <li>Refer to <a href="#">Influenza Vaccine</a> in Part 4 for additional information</li> </ul>

Vaccine	Recommendation	Comments
Japanese encephalitis	Use if indicated	
Meningococcal conjugate	Children: consider quadrivalent conjugate meningococcal vaccine	<ul style="list-style-type: none"> <li>Refer to <a href="#">Meningococcal Vaccine in Part 4</a> for additional information</li> </ul>
	Adults: consider quadrivalent conjugate meningococcal vaccine	
Pertussis	Routine use	
Pneumococcal conjugate 13-valent	Recommended	<ul style="list-style-type: none"> <li>Refer to <a href="#">Pneumococcal Vaccine in Part 4</a> for additional information</li> <li>Should be followed – at least 2 months later or when reaches age 2 years – with a pneumococcal polysaccharide vaccine dose</li> </ul>
Pneumococcal polysaccharide	Recommended	<ul style="list-style-type: none"> <li>One life-time re-immunization recommended</li> <li>Refer to <a href="#">Pneumococcal Vaccine in Part 4</a> for additional information</li> </ul>
Polio (inactivated)	Routine use	
Rabies	Use if indicated	<ul style="list-style-type: none"> <li>Do not use intradermally</li> <li>Post-immunization serology recommended</li> <li>Refer to <a href="#">Rabies Vaccine in Part 4</a> for additional information</li> </ul>
Tetanus	Routine use	
Typhoid (inactivated)	Use if indicated	
<b>LIVE VACCINES</b>		
BCG	Contraindicated	
Herpes zoster	Contraindicated in advanced HIV/AIDS	<ul style="list-style-type: none"> <li>Consult specialist in HIV infection/immunologist</li> </ul>
Influenza (live)	Not recommended, use inactivated vaccine	
Measles-mumps-rubella	Children 12 months of age and older: may receive 2 doses 3-6 months apart <sup>3</sup>	<ul style="list-style-type: none"> <li>Refer to criteria for administration of MMR</li> </ul>

Vaccine	Recommendation	Comments
	Adolescents and adults: consider use <sup>3</sup>	vaccine in text above
	Contraindicated in advanced HIV/AIDS	<ul style="list-style-type: none"> <li>Refer to <a href="#">Measles Vaccine in Part 4</a> for additional information</li> </ul>
<b>Rotavirus</b>	Routine use <sup>1, 3</sup>	<ul style="list-style-type: none"> <li>Approval from the infant's attending physician should be obtained and referral to a consultant with expertise in immunization and/or immunodeficiency is advised.</li> </ul>
<b>Smallpox</b>	Contraindicated	
<b>Typhoid (live)</b>	Contraindicated; if indicated, use inactivated vaccine	
<b>Varicella (univalent)</b>	Children 12 months of age and older: may receive 2 doses 3-6 months apart <sup>3</sup>	<ul style="list-style-type: none"> <li>Refer to criteria for administration of univalent varicella vaccine in text above</li> </ul>
	Adolescents and adults: consider use <sup>3</sup>	<ul style="list-style-type: none"> <li>Refer to <a href="#">Varicella (Chickenpox) Vaccine in Part 4</a> for additional information</li> </ul>
	Contraindicated in advanced HIV/AIDS	
<b>Yellow fever</b>	May be considered (if asymptomatic and not severely immune compromised)	<ul style="list-style-type: none"> <li>Consult specialist in HIV infection/immunologist</li> <li>Vaccinate well in advance of travel to monitor potential adverse events</li> <li>Consider post-immunization serology</li> <li>Refer to <a href="#">Yellow Fever Vaccine</a> in Part 4 for additional information</li> </ul>

<sup>1</sup> routine use: follow routine immunization schedules with age-appropriate booster doses

<sup>2</sup> regardless of prior history of Hib vaccination and at least 1 year after any previous dose

<sup>3</sup> if not significantly immunocompromised anti-HBs: antibody to hepatitis B surface antigen



## CLOSE CONTACTS

Up-to-date routine immunizations are recommended for household members and other close contacts of immunocompromised individuals, including health care workers. Non-immune close contacts of immunocompromised people should be immunized against measles, mumps, rubella, varicella, rotavirus and influenza as appropriate for age. Non-immune household or close contacts of immunocompromised people should be given hepatitis B vaccine. In addition, non-immune close contacts of HSCT recipients and close contacts of solid organ transplant candidates and recipients should receive hepatitis A vaccine if other risks are present.

Vaccine viruses in MMR vaccine are not transmitted to contacts. Susceptible close contacts of immunocompromised people should receive herpes zoster or varicella-containing vaccine as appropriate for age and risk factors. If the vaccine recipient develops a varicella-like rash, the rash should be covered and the vaccinee should avoid direct contact with the immunocompromised person for the duration of the rash. Secondary transmission from people with post-varicella vaccination varicella-like rashes is rare.

Infants living in households with persons who have or are suspected to have immunosuppressive conditions or who are receiving immunosuppressive medications can receive rotavirus vaccine. Following administration of rotavirus vaccine, viral antigen shedding in the stool may be detected in some vaccinees. Data on the potential for transmission of vaccine virus from vaccinees to household contacts has not been published; however, many experts believe that the benefit of protecting immunocompromised household contacts from naturally occurring rotavirus by immunizing infants outweighs the theoretical risk of transmitting vaccine virus. To minimize the risk of transmission of vaccine virus, careful hand washing should be used after contact with the vaccinated infant, especially after handling feces (e.g., after changing a diaper), and before food preparation or direct contact with the immunocompromised person.

Annual influenza immunization with trivalent inactivated influenza vaccine is recommended for close contacts of immunocompromised persons. Because of the theoretical risk for transmission, recipients of live attenuated influenza vaccine should avoid close association with persons with severe immunocompromising conditions (e.g., bone marrow transplant recipients requiring isolation) for at least two weeks following vaccination.

Oral polio vaccine should not be administered to household contacts of an immunocompromised person. Oral polio vaccine is not available in Canada.

Generally, smallpox vaccine should not be administered to household contacts of an immunocompromised person in a non-emergency situation. If vaccination is required in an outbreak situation, precautions should be taken for unvaccinated household and other close contacts.

## IMMUNOCOMPROMISED TRAVELLERS

A growing number of Canadians with reduced immune competence are travelling to tropical and low-income countries. Although the degree and range of infectious disease risks can increase significantly when an immunocompromised individual travels to other countries, the principles outlined above apply. For additional information about immunization of immunocompromised travellers, refer to the Committee to Advise on Tropical Medicine and Travel (CATMAT) statement on [The Immunocompromised Traveller](http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/07vol33/acs-04/index-eng.php) (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/07vol33/acs-04/index-eng.php>) and vaccine-specific chapters in Part 4.

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## PART 3

# IMMUNIZATION OF TRAVELLERS

- [Travel Health Information](#)
- [Immunization of Travellers](#)
- [Routine Immunizations](#)
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- [Recommended Immunizations](#)
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Immunization to protect travellers can be life-saving and is a cornerstone of travel health protection. Other protective measures, such as sanitation and hygiene, food precautions, insect/animal bite prevention, and accident avoidance, are also essential for health protection while travelling and are complementary to immunization. An understanding of the personal protective measures recommended for travellers is an integral part of travel preparation, refer to the [Committee to Advise on Tropical Medicine and Travel \(CATMAT\) website](http://www.phac-aspc.gc.ca/tmp-pmv/catmat-ccmtmv/index-eng.php). (<http://www.phac-aspc.gc.ca/tmp-pmv/catmat-ccmtmv/index-eng.php>)

## TRAVEL HEALTH INFORMATION

Travellers are exposed to different health risks than they are at home. Information about immunization requirements and recommendations related to travel is available from travel health clinics or public health agencies. Extensive information regarding travel-related diseases and immunization of travellers is available from the [Travel Health](http://www.phac-aspc.gc.ca/tmp-pmv/index-eng.php?utm_source=VanityURL&utm_medium=URL&utm_campaign=travelhealth.gc.ca) program of the Public Health Agency of Canada (PHAC) and from CATMAT. ([http://www.phac-aspc.gc.ca/tmp-pmv/index-eng.php?utm\\_source=VanityURL&utm\\_medium=URL&utm\\_campaign=travelhealth.gc.ca](http://www.phac-aspc.gc.ca/tmp-pmv/index-eng.php?utm_source=VanityURL&utm_medium=URL&utm_campaign=travelhealth.gc.ca)) Additional information is available from the [United States Centers for Disease Control and Prevention \(CDC\)](http://wwwnc.cdc.gov/travel/) and the [World Health Organization \(WHO\)](http://www.who.int/). (<http://wwwnc.cdc.gov/travel/>) Refer to the list of designated [Yellow Fever vaccination centers in Canada](http://www.phac-aspc.gc.ca/tmp-pmv/yf-fj/index-eng.php). (<http://www.phac-aspc.gc.ca/tmp-pmv/yf-fj/index-eng.php>)

## IMMUNIZATION OF TRAVELLERS

Travellers, in particular those undertaking travel to countries with health risks that are greater than in Canada, should solicit medical advice pre-departure. Pre-travel consultation affords an opportunity for health professionals to review the traveller's itinerary and develop appropriate health protection recommendations. It also allows for the review of preventive measures for travel-related illnesses and is an opportunity to assess the overall immunization status of clients. Unimmunized or incompletely immunized travellers should be offered vaccination as recommended in the routine immunization schedules (refer to [Recommended Immunization Schedules](#) in Part 1). A health care provider or travel health clinic should ideally be consulted as early as possible, ideally at least 4 to 6 weeks in advance of travel, to provide sufficient time for completion of optimal immunization schedules. In cases where there is insufficient time for the optimal immunization schedule, refer to the specific vaccine chapter for the suggested rapid or accelerated schedule. However, even if a traveller is departing at short notice, a pre-travel consultation is recommended.

The immunizations recommended for travellers vary according to the traveller's age; immunization history; existing medical conditions; destination(s); planned activities, duration and nature of travel (e.g., staying in urban hotels vs. visiting remote rural areas); legal requirements for entry into countries being visited; travellers' own preferences and values; and the amount of time available before departure. Immunizations related to travel can be categorized as those that are considered **routine** (part of the recommended primary series of immunizations or routine booster doses); those **required** by international law; and those **recommended** for maintenance of health while travelling.

## ROUTINE IMMUNIZATION

Unimmunized or incompletely immunized travellers should receive routine immunizations as appropriate for age and individual risk factors. Travellers may require additional doses or booster doses of routine immunizations, or a change in the routine immunization schedule. Refer to [Recommended Immunization Schedules](#) in Part 1 for a summary of the recommended immunization schedules for infants, children and adults. Recommendations for modification of the routine immunization schedule in relation to travel follow.

### ACCELERATED PRIMARY VACCINATION SCHEDULE - INFANTS

For infants embarking on travel, the primary vaccination series with diphtheria toxoid-tetanus toxoid-acellular pertussis-polio-Haemophilus influenzae type b-with or without hepatitis B vaccine (DTaP-IPV-Hib or DTaP-HB-IPV-Hib) and pneumococcal conjugate vaccine may be started at 6 weeks of age. Rotavirus vaccine may be given at 6 weeks of age concomitantly with these vaccines. The first dose of measles-mumps-rubella vaccine (MMR) should be given at an earlier age than usual for children travelling to countries outside of North America (refer to Measles below). Refer to vaccine-specific chapters in Part 4 for additional information including the minimum interval between vaccine doses in order to achieve maximum vaccination protection prior to travel.

### HEPATITIS B

Travel is a good opportunity to offer hepatitis B (HB) immunization to children and adults who have not been previously vaccinated. Hepatitis B vaccine should be particularly recommended to travellers who will be residing in areas with high levels of HB endemicity or working in health care facilities, and those likely to have contact with blood or to have sexual contact with residents of such areas. The age at which infants, children and adolescents are routinely offered HB vaccine varies from jurisdiction to jurisdiction in Canada. Since HB carrier rates are much higher in developing countries, complete HB immunization is recommended for children who will live in an area where HB is endemic. Hepatitis B is endemic in the Far East, the Middle East, Africa, South America, Eastern Europe and Central Asia. Refer to a map of [countries and areas of risk for HB](http://apps.who.int/ithmap/) (<http://apps.who.int/ithmap/>) for additional information. Refer to [Hepatitis B Vaccine](#) in Part 4 and to the [CATMAT Statement on hepatitis vaccines for travellers](http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/08vol34/acs-2/index-eng.php) for additional information. (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/08vol34/acs-2/index-eng.php>)

Concomitant immunization with HA and HB vaccines is recommended as HA vaccination is also indicated for travellers to developing countries. For those who are susceptible to both HA and HB virus, a combined HAHB vaccine can be used. For travellers presenting less than 21 days before departure, monovalent HA and HB vaccines should be administered separately, with the completion of both vaccine series after travel. Refer to Hepatitis A in the recommended vaccine section below.

### MEASLES, MUMPS, RUBELLA AND VARICELLA

#### Measles

Protection against measles is especially important for people planning travel to destinations outside of North America. Travellers born in 1970 or later who do not have documented evidence of receiving two doses of measles-containing vaccine on or after their first birthday, or laboratory evidence of immunity, or a history of laboratory confirmed measles disease should receive two doses of measles-containing vaccine.



Measles vaccine should be given at an earlier age than usual for children travelling to countries outside of North America. MMR vaccine may be given as early as 6 months of age; however, two additional doses of measles-containing vaccine must be administered after the child is 12 months old to ensure long lasting immunity to measles.

Travellers born before 1970 who do not have documented evidence of receiving measles-containing vaccine on or after their first birthday, or laboratory evidence of immunity, or a history of laboratory confirmed measles disease should receive one dose of MMR vaccine. Although immigrants originating from countries with high rates of circulating measles may already be immune to measles, they may still require MMR vaccine because they are susceptible to mumps or rubella as described below. Refer to [Measles Vaccine](#) in Part 4 for additional information.

Measles is endemic in many developing countries. Refer to [measles incidence rates in WHO member countries](#) for additional information. ([http://www.who.int/immunization\\_monitoring/diseases/en/](http://www.who.int/immunization_monitoring/diseases/en/))

### **Mumps**

Protection against mumps is especially important for people planning travel to destinations outside of North America. Travellers born in 1970 or later who do not have documented evidence of receiving two doses of mumps-containing vaccine on or after their first birthday, or laboratory evidence of immunity, or a history of laboratory confirmed mumps disease should receive two doses of mumps-containing vaccine. Many immigrants originate from countries where mumps vaccine is not routinely given and may therefore have increased susceptibility to mumps. Travellers born before 1970 who do not have documented evidence of receiving mumps-containing vaccine on or after their first birthday, or laboratory evidence of immunity, or a history of laboratory confirmed mumps disease should receive one dose of MMR vaccine. Refer to [Mumps Vaccine](#) in Part 4 for additional information.

Mumps is endemic in many countries. Refer to [mumps incidence rates in WHO member countries](#) for additional information. ([http://www.who.int/immunization\\_monitoring/diseases/en/](http://www.who.int/immunization_monitoring/diseases/en/))

### **Rubella**

Protection against rubella is important for people planning travel to rubella-endemic areas. Travellers who do not have documented evidence of receiving rubella-containing vaccine on or after their first birthday, or laboratory evidence of immunity, or a history of laboratory confirmed rubella infection should receive one dose of rubella-containing vaccine. In addition, many immigrants originate from countries where rubella vaccine is not routinely given resulting in increased susceptibility to rubella in this population. Refer to [Rubella Vaccine](#) in Part 4 for additional information.

Refer to [rubella incidence rates in WHO member countries](#) for additional information. ([http://www.who.int/immunization\\_monitoring/diseases/en/](http://www.who.int/immunization_monitoring/diseases/en/))

### **Varicella**

People travelling or living abroad should be immune to varicella. In tropical climates varicella tends to occur at older ages (compared with temperate climates) and at any time of the year. Adolescent and adult immigrants born in tropical countries therefore are more likely to be susceptible to varicella as compared to the Canadian population. Two doses of univalent varicella or measles-mumps-rubella-varicella vaccine (MMRV) are recommended for immunization of healthy children aged 12 months to 12 years of age. Two doses of univalent varicella vaccine are recommended for susceptible adolescents (13 to 17 years of age) and susceptible adults (18 to 49 years of age). For adults 50 to 59 years of age, herpes zoster vaccine may be considered. Herpes zoster vaccine is recommended for adults without contraindications 60 years of age and older. Refer to [Varicella \(Chickenpox\) Vaccine](#) and [Herpes Zoster \(Shingles\) Vaccine](#) in Part 4 for additional general information.



## PERTUSSIS - ADULTS

For pertussis prevention, acellular pertussis-containing vaccine (tetanus toxoid-reduced diphtheria toxoid-reduced acellular pertussis [Tdap]) is recommended for adults who have not previously received a dose in adulthood – regardless of the interval from the last tetanus-containing vaccine. The pre-travel consultation is an opportunity to give the adult booster to those who may not otherwise seek immunization from a vaccine provider. Refer to [Pertussis Vaccine](#) in Part 4 for additional information.

## POLIOMYELITIS - ADULTS

Polio vaccine for unimmunized adults is recommended to prevent the introduction and circulation of polio. If an adult has not been immunized against polio, catch-up vaccination can be done opportunistically. For example, IPV-containing vaccine is recommended for previously unimmunized adults when tetanus toxoid-containing vaccine is being given. A full primary series should be given to the unimmunized adult who is at increased risk of exposure to polio (e.g., travellers to areas where there are polio epidemics, military personnel or workers in refugee camps in endemic areas). For adults previously immunized against polio, a single lifetime booster of polio-containing vaccine is recommended for certain travellers at increased risk of exposure to polio (e.g., travellers to areas where there are polio epidemics, military personnel or workers in refugee camps in endemic areas). Refer to [Poliomyelitis Vaccine](#) in Part 4 for additional information.

Polio remains endemic in Afghanistan, Nigeria and Pakistan. Additional countries are known or suspected of having re-established transmission of poliovirus. Refer to the WHO polio eradication site for the most up-to-date information about the current status of polio around the world.

## TETANUS AND DIPHTHERIA - ADULTS

Travel is a good opportunity to opportunistically provide tetanus and diphtheria immunization to adults who have not been previously vaccinated. A full primary series should be given to the unimmunized adult. All doses should contain polio vaccine as well and the first dose should contain acellular pertussis vaccine.

Previously immunized adult travellers should receive a booster dose of tetanus and diphtheria toxoid-containing vaccine every 10 years. For adults who have not previously received a dose of acellular pertussis vaccine in adulthood, it is recommended that the Tdap vaccine be given, regardless of the interval from the last tetanus-diphtheria booster. Refer to [Tetanus Toxoid](#) and [Diphtheria Toxoid](#) in Part 4 for additional information.

Tetanus occurs worldwide. A [list of countries where diphtheria is endemic](http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-3-infectious-diseases-related-to-travel/diphtheria.htm) is available from the CDC. (<http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-3-infectious-diseases-related-to-travel/diphtheria.htm>)

## REQUIRED IMMUNIZATION

The following immunizations may be a requirement of international law or proof of immunization may be considered a visa requirement:

### MENINGOCOCCAL

As a condition of entry, Saudi Arabia requires proof of meningococcal immunization for pilgrims to the Hajj or Umrah in Mecca. Quadrivalent conjugate meningococcal vaccine is recommended; monovalent serogroup C conjugate meningococcal vaccine is not appropriate for protection of travellers as it does not protect against serogroup A, which is endemic in selected regions of the world, or serogroup W-135 disease. Vaccination is needed between 10 days and 3 years prior to the date of entry into Saudi Arabia. Refer to the [Saudi Ministry of Health requirements](#) for additional information. (<http://www.hajinformation.com/main/p3001.htm>)

## YELLOW FEVER

Yellow fever (YF) vaccine is unique amongst travel vaccines in that its use is governed not only by patient requirements but also by international laws and agreements. YF immunization (documented by an International Certificate of Vaccination or Prophylaxis) is required to enter certain countries. Recent co-operation between WHO and CDC have defined areas of the globe by YF exposure risk and classify areas as either endemic, transitional, low risk or no risk. YF vaccine is recommended for healthy travellers (greater than 9 months of age) travelling through, visiting or living in areas where YF is considered endemic or transitional. There may also be nation specific immunization entry requirements in these regions.

YF vaccination is generally not recommended in areas where there is low potential for YF virus exposure; however, vaccination might be considered for a small subset of travellers to these areas, who are at increased risk of exposure to mosquitoes because of prolonged travel, heavy exposure to mosquitoes, or inability to avoid mosquito bites. Vaccination is not recommended for travellers whose itineraries are restricted to areas with no risk. Certain countries in Asia have both the primate hosts and insect vectors for YF but have had no documented cases. Some of these countries require proof of vaccination (or documentation of medical contraindication to vaccination) if a person is travelling from a YF risk area.

The decision to immunize a traveller against YF should take into account the traveller's itinerary and the associated risk for exposure to YF virus, the requirements of the country to be visited (including stopovers and airport transit) and individual risk factors for serious adverse events following vaccination. Although these serious adverse effects are very rare, certain groups such as older travellers (greater than 60 years of age) and persons with certain immune disorders are at higher risk and thus the decision to immunize must be carefully weighed with the risks. YF vaccine is contraindicated in infants less than 6 months of age, and is generally not recommended in infants less than 9 months of age. Refer to [Yellow Fever Vaccine](#) in Part 4 for additional information.

A recent update from WHO recommends that a transit time of less than 12 hours through an international airport would not put a traveller at risk for contraction of YF. Thus, this type of transit time through a region of transmission of YF should not be considered an actual exposure by subsequent destination countries. These recommendations have been published by WHO, but it is the right of each country to define its entry requirements. This should be confirmed prior to departure.

Some countries do not require YF vaccination of infants younger than a certain age (e.g., less than 1 year). Refer to a [list of country-specific YF vaccination requirements and WHO recommendations](#) and a [WHO map of the areas in the Americas where YF vaccination is recommended](#). ([http://gamapserver.who.int/mapLibrary/Files/Maps/ITH\\_YF\\_vaccination\\_americas.png](http://gamapserver.who.int/mapLibrary/Files/Maps/ITH_YF_vaccination_americas.png))

The International Certificate of Vaccination or Prophylaxis is valid for 10 years, beginning 10 days after primary immunization and immediately after re-immunization, if re-immunized within the 10-year period. Travellers requiring the certificate but in whom the YF vaccine is medically contraindicated can be provided with an International Certificate of Medical Contraindication to Vaccination by a Yellow Fever Vaccination Centre following an individual risk assessment. Travellers without a valid International Certificate of Vaccination or Prophylaxis or a Certificate of Medical Contraindication to Vaccination may be denied entry into a country requiring such documentation, quarantined, or offered immunization at the point of entry (e.g., at the airport), potentially putting the health of the traveller at risk. If a booster is given beyond 10 years, there is a wait period of 10 days before the Certificate of Vaccination becomes valid. Although usually accepted, the International Health Regulations do not compel any country to accept an International Certificate of Medical Contraindication to Vaccination.

In Canada, Yellow Fever Vaccination Centre clinics are designated by PHAC (or in the case of the Canadian Forces, by the Directorate of Force Health Protection) to provide the International Certificate of Vaccination or Prophylaxis or International Certificate of Medical Contraindication to Vaccination. A [list of YF vaccination centres](#) available to the public can be obtained from PHAC. (<http://www.phac-aspc.gc.ca/tmp-pmv/yf-fj/index-eng.php>)

## RECOMMENDED IMMUNIZATION

Based on a risk assessment of the travel itinerary, the nature of travel, and the traveller's underlying health, the following vaccines should be considered (also refer to [Yellow Fever](#)):

### HEPATITIS A

Protection against hepatitis A (HA) is recommended for all travellers to developing countries, especially if travelling to rural areas or places with inadequate sanitary facilities. HA is one of the most common vaccine-preventable diseases in travellers. For travellers who are susceptible to both HA and HB virus, a combined HAHB vaccine can be used. Refer to [Hepatitis A Vaccine](#) and [Hepatitis B Vaccine](#) in Part 4 for additional information. Refer to the [CATMAT Statement on hepatitis vaccines for travellers](#) for additional information on rapid dosing schedules. (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/08vol34/acs-2/index-eng.php>)

Refer to a [WHO map of countries and areas of risk for hepatitis A](#). ([http://gamapserver.who.int/mapLibrary/Files/Maps/Global\\_HepA\\_IHTRiskMap.png](http://gamapserver.who.int/mapLibrary/Files/Maps/Global_HepA_IHTRiskMap.png))

### INFLUENZA

All travellers are encouraged to receive influenza vaccine, especially those who are pregnant, children up to 5 years of age, those over 65 years of age, children and adults with a chronic health condition or other factors that would make them recommended recipients of influenza vaccine. Vaccines prepared specifically for use in the Southern Hemisphere are not available in Canada, and the extent to which recommended vaccine components for the Southern Hemisphere may overlap with those in available Canadian formulations will vary. It is not recommended to revaccinate a traveller vaccinated for the most recent influenza season if travelling in the Southern hemisphere between April and October. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### JAPANESE ENCEPHALITIS

Japanese encephalitis (JE) vaccine is recommended for adult travellers with a high exposure risk going to JE endemic/epidemic areas during the transmission season. The risk for acquiring JE is low for most travellers, particularly for short-term visitors to major urban areas. This is because the mosquito vector for JE and its animal reservoir(s) are primarily found in rural agricultural areas. JE occurs in many areas of Asia, especially in the south east and in parts of the western Pacific, and is the leading cause of viral encephalitis in Asia. Refer to [Japanese Encephalitis Vaccine](#) in Part 4 for additional information.

Refer to a [CDC map of the areas at risk for JE transmission](#) (<http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-3-infectious-diseases-related-to-travel/japanese-encephalitis>) or the [WHO map of the areas at risk for JE](#). ([http://gamapserver.who.int/mapLibrary/Files/Maps/Global\\_JE\\_IHTRiskMap.png](http://gamapserver.who.int/mapLibrary/Files/Maps/Global_JE_IHTRiskMap.png))

### MENINGOCOCCAL INFECTION

Travellers to destinations where risk of meningococcal transmission is high should be vaccinated with a quadrivalent conjugate meningococcal vaccine. Refer to [Meningococcal](#) above for information about the requirement for meningococcal vaccination as a condition to entry for certain travellers to Saudi Arabia. Refer to [Meningococcal Vaccine](#) in Part 4 for additional information.

Invasive meningococcal disease occurs sporadically worldwide and in focal epidemics. The traditional endemic areas of the world include the savannah areas of sub-Saharan Africa extending from Gambia and Senegal in the west to Ethiopia and Western Eritrea in the east. Meningococcal disease is also associated with the Hajj, an Islamic pilgrimage to Mecca, Saudi Arabia. Refer to the [CATMAT information on assessing a traveller's need for pre-travel vaccination](#) for additional information. (<http://www.phac-aspc.gc.ca/tmp-pmv/catmat-ccmtmv/index-eng.php>) Refer to [WHO meningococcal disease outbreak information](#). ([http://www.who.int/csr/don/archive/disease/meningococcal\\_disease/en/](http://www.who.int/csr/don/archive/disease/meningococcal_disease/en/))

## RABIES

Travellers to rabies endemic areas where there is poor or unknown access to adequate and safe post-exposure management, as well as frequent and long-term travellers to high-risk areas should be considered for pre-exposure rabies immunization. Children (especially those who are too young to understand either the need to avoid animals or to report a traumatic animal contact) should receive pre-exposure immunization when travelling to endemic areas.

Pre-exposure rabies vaccination obviates the requirement for rabies immune globulin if rabies exposure occurs, which may be unsafe or unavailable in many countries with high rabies risk. Refer to [Rabies Vaccine](#) in Part 4 for additional information.

Public health officials should be consulted regarding travellers who have had an exposure to a potentially rabid animal, even if the traveller received a complete course of post-exposure prophylaxis in that country. The prevalence of rabies in developing countries is often much higher than in Canada and there may be concerns about the efficacy of available vaccines in these countries.

To identify high risk areas, see the [WHO map of areas at risk for rabies transmission](http://www.who.int/rabies/rabies_maps/en/index.html). ([http://www.who.int/rabies/rabies\\_maps/en/index.html](http://www.who.int/rabies/rabies_maps/en/index.html))

## TICK-BORNE ENCEPHALITIS

Tick-borne encephalitis (TBE) vaccine is available in Canada and may be indicated prior to travel in some countries. To identify travellers who are at risk of contracting the TBE virus, the season of travel, the travel itinerary, and planned activities should be considered. Ticks may bite on warm days throughout the year, but the majority of tick activity is from March to November. Risk activities include fieldwork, biking, hiking or camping outdoors. A map of endemic areas can be found on the site for the [International Scientific Working Group on TBE](http://www.isw-tbe.info/tbe.aspx_param_target_is_150790_and_I_is_2.v.aspx) which provides a map of endemic areas. ([http://www.isw-tbe.info/tbe.aspx\\_param\\_target\\_is\\_150790\\_and\\_I\\_is\\_2.v.aspx](http://www.isw-tbe.info/tbe.aspx_param_target_is_150790_and_I_is_2.v.aspx)) Refer to the [CATMAT Statement on Tick-borne Encephalitis](http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06vol32/acs-03/index-eng.php). (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/06vol32/acs-03/index-eng.php>)

## TYPHOID

Travellers to regions where typhoid fever is endemic or epidemic are at risk, with certain subpopulations at increased risk such as children and individuals visiting friends and relatives. Typhoid immunization is recommended for travellers to countries with a high incidence of typhoid disease who will have prolonged exposure to potentially contaminated food and water. Immunization is not routinely recommended for short-term holidays in resort hotels. Refer to [Typhoid Vaccine](#) in Part 4 for additional information.

Travellers to South Asia (i.e., the Indian subcontinent) are at highest risk of typhoid. But it is also found in Africa and the rest of Asia, and to some degree in all regions where sanitation and hygiene are suboptimal.

## BACILLE CALMETTE-GUÉRIN (BCG)

Immunization with BCG vaccine may be considered for travellers planning extended stays in areas or countries of high tuberculosis prevalence in exceptional circumstances. Consultation with an infectious disease or travel medicine specialist is recommended. Refer to [Bacille Calmette-Guérin Vaccine](#) in Part 4 and the [CATMAT statement Risk assessment and prevention of tuberculosis among travellers](http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/09vol35/acs-dcc-5/index-eng.php) for additional information. (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/09vol35/acs-dcc-5/index-eng.php>)

## CHOLERA AND TRAVELLERS' DIARRHEA

Travellers to cholera-endemic countries who may be at significantly increased risk of exposure (e.g., humanitarian workers or health professionals working in endemic countries) may benefit from cholera vaccination. Most travellers following the usual tourist itineraries in countries affected by cholera are at extremely low risk of acquiring cholera infection. Travellers' diarrhea is usually a mild and self-limited illness. For protection against travellers' diarrhea, vaccination with cholera and travellers' diarrhea vaccine is of limited benefit and is not routinely recommended except for high-risk travellers (who are 2 years of



age and older). Refer to [Cholera and Travellers' Diarrhea Vaccine](#) in Part 4 and the [CATMAT Statement on new oral cholera and travellers' diarrhea vaccination](#) for additional information. (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/05vol31/asc-dcc-7/index-eng.php>) Refer to the [WHO map of the areas reporting cholera outbreaks](#). ([http://gamapserver.who.int/mapLibrary/Files/Maps/Global\\_CholeraCases0709\\_20091008.png](http://gamapserver.who.int/mapLibrary/Files/Maps/Global_CholeraCases0709_20091008.png))

## IMMUNOCOMPROMISED TRAVELLERS

An increasing number of Canadians are living with conditions that reduce immune competence, including organ transplantation, HIV infection and treatment with corticosteroids or immunosuppressive agents for a variety of indications. A growing number of these individuals are travelling to tropical and low-income countries. For information about immunization of travellers who are immunocompromised refer to [Immunization of Immunocompromised Persons](#) in Part 3, vaccine-specific chapters in Part 4, and the [CATMAT statement The Immunocompromised Traveller](#). (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/07vol33/acs-04/index-eng.php>)

## PREGNANT AND BREASTFEEDING TRAVELLERS

The decision of whether to vaccinate pregnant or breastfeeding women travellers depends on many factors including the stage of pregnancy, the destination, the duration of travel, the risk of contracting the disease, the severity of the effect of the disease on the pregnant or breastfeeding woman and/or the fetus, the adverse effects of the vaccine on the pregnant woman and/or the fetus, and the values and preferences of the pregnant or breastfeeding woman and the vaccine provider. Live vaccines (such as MMR) should generally not be given to pregnant women. Probable transmission of vaccine strain of YF virus from a mother to her infant through breastfeeding has been reported; therefore, in general, breastfeeding mothers should not be vaccinated with YF vaccine. For information regarding immunization of pregnant or breastfeeding travellers refer to [Immunization in Pregnancy and Breastfeeding](#) in Part 3, vaccine-specific chapters in Part 4, and the [CATMAT Statement on Pregnancy and Travel](#). (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/10vol36/acs-2/index-eng.php#c4>)

## OLDER TRAVELLERS

Older people travel to the full range of destinations, including high-risk destinations, and comprise a substantial proportion of travellers. Both vaccine efficacy and risk of adverse reactions may be affected by age. Declining cell-mediated and humoral immunity influence the response to immunization, potentially resulting in diminished, delayed, and less durable immune responses in the elderly with or without co-morbidities. The elderly may be more susceptible to adverse effects of some vaccines, especially yellow fever; however, they may also be more vulnerable to disease and complications for some vaccine-preventable illnesses, such as hepatitis A, typhoid fever, and yellow fever. For additional information regarding immunization of older travellers refer to the [CATMAT Statement on older travellers](#). (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/11vol37/acs-2/index-eng.php>)

## PEDIATRIC TRAVELLERS

Travel immunization recommendations for children will vary with the individual risk of exposure and the severity of potential infection. Some travel-related infections, such as hepatitis A, typhoid, and rabies are more likely to occur in pediatric travellers than in adult travellers. Children are at higher risk for meningococcal infections. For additional information regarding immunization of pediatric travelers, refer to the [CATMAT Statement on pediatric travellers](#). (<http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/10vol36/acs-3/june-juin-2010-eng.php>)

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## PART 3

# IMMUNIZATION OF PERSONS NEW TO CANADA

- [Evaluation of Immunization Status](#)
- [Internationally Adopted Children](#)
- [Health Assessment of Persons New to Canada](#)
- [Recommended Immunization](#)
- [Visiting Friends and Relatives in Country of Origin](#)
- [Selected References](#)

People newly arrived in Canada may be susceptible to vaccine preventable diseases. For example, a Canadian study showed that more than one-third of new immigrants and refugees, particularly women, were susceptible to measles, mumps, or rubella.

Immunization of persons new to Canada is often challenging because:

- immunization records may not exist
- records may be difficult to interpret because of language barriers
- immunization schedules and vaccines may differ from those used in Canada
- there may be doubt about the authenticity of the records or vaccines used. Judgment should be used when assessing the reliability and/or authenticity of immunization records of people new to Canada.

People new to Canada often return to their country of origin to visit friends and relatives. During such visits, people new to Canada, and particularly their Canadian born family members, may be exposed to risks for vaccine preventable diseases which need to be considered when evaluating immunization status and recommending vaccines.

## EVALUATION OF IMMUNIZATION STATUS

New immigrants, refugees and internationally adopted children may lack immunizations and/or immunization records. Vaccination should only be considered valid if there is written documentation of administration of vaccine at ages and intervals comparable with the Canadian schedule. Although the potency of vaccines administered in other countries can generally be assumed to be adequate, immunization schedules vary. The age at immunization (e.g., 9 months of age for immunization against measles in some countries), the number of doses, and the intervals between doses should be carefully reviewed and compared with Canadian and provincial/territorial recommendations to determine the need for additional doses of vaccines.

In many countries outside of Canada, mumps and rubella vaccines are in limited use, and measles vaccine alone is given. *Haemophilus influenzae* type b (Hib), hepatitis B (HB), hepatitis A (HA), varicella, pneumococcal conjugate, and meningococcal conjugate vaccines are also in limited use. An adult booster of pertussis vaccine is a relatively new recommendation in developed countries. Refer to World Health Organization (WHO) information on [vaccination schedules in other countries](http://apps.who.int/immunization_monitoring/globalsummary/schedules). ([http://apps.who.int/immunization\\_monitoring/globalsummary/schedules](http://apps.who.int/immunization_monitoring/globalsummary/schedules)) Refer to [Immunization of Persons with Inadequate Immunization Records](#) in Part 3 for additional information.

## INTERNATIONALLY ADOPTED CHILDREN

Studies of internationally adopted children have shown that, despite written documentation of adequate immunizations, serologic evidence of protection against diphtheria and tetanus may be lacking. Recommendations regarding an approach to vaccinating these children vary and include:

- ignoring the written record and repeating the vaccinations, especially when there is doubt about the authenticity of the records or vaccines used;
- accepting the written record if it appears valid in terms of age of administration and timing of doses; or
- if possible, using serologic tests to ensure that adequate protection is present

Judgment is required to determine the best option in any particular situation.

Family members travelling outside of Canada to adopt a child should receive all appropriate routine and travel immunizations before departure from Canada to pick up adopted children (refer to [Immunization of Travellers](#) in Part 3 for additional information). Other close contacts, including extended family members, should have up-to-date routine immunizations with some additional considerations. For example, many countries continue to use oral polio vaccine (OPV). Following receipt of OPV, poliovirus can be present in the throat for 1 to 2 weeks and can remain in feces for several weeks. Although rare, close contacts of children who have received OPV may become infected with vaccine-derived polio virus if they are not adequately immunized. Therefore, ensuring up-to-date polio vaccination of close contacts is important. In addition, HA vaccine is recommended for pre-exposure prevention in household or close contacts of children adopted from HA endemic countries and HB vaccine is recommended for pre-exposure prevention in close contacts of children adopted from HB endemic countries if the adopted child is HB surface antigen (HBsAg) positive.

## HEALTH ASSESSMENT OF PERSONS NEW TO CANADA

### ASSESSMENT BEFORE ARRIVAL TO CANADA

Citizenship and Immigration Canada typically conduct Immigration medical examinations (IME) before foreign nationals (non-Canadian citizens) arrive in Canada. They are required for:

- most people seeking permanent residence in Canada;
- [foreign nationals](#) that are seeking to work in Canada in an occupation in which the protection of public health is essential (<http://www.cic.gc.ca/english/helpcentre/glossary.asp>) ;
- foreign nationals seeking temporary residence in Canada for 6 months or more **and** have been residing in a [designated country](#) for 6 months or more (<http://www.cic.gc.ca/english/information/medical/dcl.asp>);
- [convention refugees](#) that have been selected for resettlement in Canada (<http://www.cic.gc.ca/english/helpcentre/glossary.asp>); and
- [refugee claimants](#) in Canada (<http://www.cic.gc.ca/english/helpcentre/glossary.asp>)

If the IME is not conducted prior to arrival (such as refugee claimants in Canada) it is done as soon as possible after arrival.

### ASSESSMENT AFTER ARRIVAL IN CANADA

Health care providers in Canada who see persons newly arrived in the country should prioritize assessing and updating immunizations for persons new to Canada because the IME does not include a review of immunization status. In addition, health care providers should perform a complete health assessment, including comprehensive testing for a variety of chronic and non-vaccine preventable diseases.

As part of the health assessment, the following tests should be completed (if not already available from a completed IME) to determine the need for vaccines or contraindications to vaccination:

- **HB serologic testing:** HBsAg, HB surface antibody, HB core antibody. As well, if any member of a household is found to be positive for HBsAg, the entire household should be vaccinated with hepatitis B vaccines as appropriate based on a review of their HB test results. The combined HA/HB vaccine can be used if protection against both infections is indicated.
- **Hepatitis C (HC) antibody:** persons chronically infected with HC should be vaccinated against HA and HB if susceptible.
- **Human immunodeficiency virus (HIV) serologic testing** for persons from countries with high rates of HIV (if HIV status is unknown). HIV testing is performed as part of the IME only for those 15 years of age and older and some children identified as at increased risk (those who have received blood and blood products, those whose mother is known to be HIV positive and all potential adoptees). If HIV status is unknown and the person is coming from a country with high rates of HIV, HIV screening should be performed and HIV status ascertained in order to provide appropriate immunization recommendations. The HIV status should be evaluated before administering a live vaccine. Refer to [Immunization of Immunocompromised Persons](#) in Part 3 for recommendations for vaccination of HIV infected people.
- **Tuberculin skin testing:** people from countries with a high incidence of tuberculosis (smear-positive pulmonary tuberculosis greater than 15 per 100 000 population), who do not have a known history of active TB or a documented positive TB skin test, should be screened as soon as possible after their arrival in Canada with a tuberculin skin test and referred for assessment if results are positive. MMR and varicella-containing vaccines should not be given if active untreated TB is suspected.
- **Complete blood counts, sickle cell preparation test and hemoglobin electrophoresis** for persons from areas of the world where sickle cell disease and genetic hemoglobinopathies (such as beta-thalassemia) are present. Sickle cell anemia is most often found in people of African descent. Alpha- and beta-thalassemias are most common in Africa, the Mediterranean, India and Southeast Asia. Refer to [Hyposplenism or asplenia](#) in [Immunization of Persons with Chronic Diseases](#) in Part 3 for recommendations for vaccination of people with sickle cell disease or thalassemia.

## RECOMMENDED IMMUNIZATION

Persons newly arrived in Canada lacking adequate documentation of immunization should be considered unimmunized and started on an immunization schedule appropriate for their age and risk factors unless known to be immune by serologic testing. In addition to the routine immunization schedule, certain vaccines may be recommended for people newly arrived in Canada as follows:

### HEPATITIS A VACCINE

Vaccination against HA should be considered for people from countries that are endemic for HA. Individuals born in developing countries are more likely to be immune to HA; therefore, testing for immunity before administering HA vaccine to persons from HA endemic countries should be considered. Household or close contacts of children adopted from HA endemic countries should be immunized with HA-containing vaccine. Persons new to Canada should be tested for HB and HC infection and persons chronically infected with HB (HB carriers) or HC should be vaccinated against HA, based on susceptibility testing if indicated. Refer to [Hepatitis A Vaccine](#) in Part 4 for additional information.

## HEPATITIS B VACCINE

All persons from a country that is endemic for HB should be assessed and vaccinated against HB if not immune and not infected. Individuals born in developing countries are more likely to be carriers of HB, necessitating vaccination of their sexual and household contacts based on review of their serologic test results. HB vaccine is recommended for all household contacts whose families have immigrated to Canada from areas where there is a high prevalence of HB and who may be exposed to HB carriers through their extended families or when visiting their country of origin. Children adopted from countries in which there is a high prevalence of HB infection should be screened for HBsAg and, if positive, household or close contacts in the adopting family should be immunized before adoption or as soon as possible thereafter. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

Persons new to Canada from high hepatitis C endemic countries should be tested for HC antibody and persons chronically infected with HC should be vaccinated against HB if susceptible. Countries with high rates of chronic infection are Egypt (15%), Pakistan (4.8%) and China (3.2%).

## RUBELLA-CONTAINING VACCINE

Unless known to be immune to rubella because of prior serology or documentation of a dose of rubella-containing vaccine, rubella-containing vaccine should be given to persons new to Canada; pre-immunization serology is not needed. Unless there is a contraindication to use, rubella susceptible people should be immunized with one dose of a measles-mumps-rubella-containing (MMR) vaccine as soon as possible after entry to Canada. Foreign-born women of childbearing age from countries where rubella-containing vaccine is not in use should be a priority. Susceptible women who are pregnant should receive MMR vaccine after delivery. Refer to [Rubella Vaccine](#) in Part 4 for additional information.

## VARICELLA-CONTAINING VACCINE

In tropical countries, varicella occurs at an older age and most tropical countries do not have varicella immunization programs. People from tropical regions are more likely to be susceptible to varicella and should be a priority for varicella testing and immunization if non-immune. Susceptible women who are pregnant should be vaccinated after delivery. Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information.

## INACTIVATED POLIO-CONTAINING VACCINE (IPV)

Children who have received one or more doses of polio vaccine before arriving in Canada should have their vaccine series completed with IPV-containing vaccine as appropriate for age. Similar to vaccination of children, vaccination of adults is recommended to prevent the introduction and circulation of polio. A complete series of IPV-containing vaccine is recommended for previously unimmunized adults who are also receiving a primary series of tetanus toxoid-containing vaccine. For other adults who are unvaccinated against polio, vaccination efforts should be focused on those who are at increased risk of exposure to polioviruses including: family or close contacts of internationally adopted infants who may have been or will be vaccinated with OPV vaccine, and travellers to, or persons receiving travellers from, areas where poliovirus is known or suspected to be circulating. Refer to the [WHO Polio Global Eradication Initiative](#) for the current status of polio around the world. (<http://www.polioeradication.org/Infectedcountries.aspx>) Adults previously immunized with polio vaccine and at increased risk of exposure to polio should receive a single lifetime booster dose of IPV-containing vaccine.

## VISITING FRIENDS AND RELATIVES IN COUNTRY OF ORIGIN

When persons new to Canada return to visit their country of origin, vaccines may be indicated. For example, HA and HB vaccine are often indicated if not previously received. Additional vaccines, such as typhoid, may also be indicated before a person new to Canada visits his/her country of origin. Refer to the Committee to Advise on Tropical Medicine and Travel (CATMAT) [Statement on Visiting Friends and Relatives](#) in development. (<http://www.phac-aspc.gc.ca/tmp-pmv/catmat-ccmtmv/index-eng.php>)

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## PART 3

# IMMUNIZATION OF WORKERS

- [Health Care Workers](#)
- [Laboratory Workers](#)
- [Child Case Workers and Workers in Educational Settings](#)
- [Workers with Occupational Exposure to Animals or Materials from Animals](#)
- [Humanitarian Relief and Overseas Refugee Workers](#)
- [Refugee Workers in Canada](#)
- [Emergency Services Workers](#)
- [Workers in Institutions for the Developmentally Challenged or Correctional Facilities](#)
- [Workers who Provide Services within Closed Settings](#)
- [Workers who Provide Essential Community Services](#)
- [Workers in Shelters for the Homeless](#)
- [Military Personnel](#)
- [Selected References](#)

Workers in a variety of settings may be exposed to vaccine-preventable diseases. Vaccination against specific vaccine-preventable diseases will protect the worker and/or reduce transmission of infection to others.

Vaccines recommended for workers (and people who are about to enter the workforce) include vaccines that are part of the routine immunization schedule and vaccines recommended for adults considered at-risk (refer to [Recommended Immunization Schedules](#) in Part 1), as well as vaccines recommended because of specific occupational risks. In addition, all employers and employees should consider annual influenza immunization for working adults, as this has been shown to decrease work absenteeism due to respiratory and other illnesses. When considering immunization of adult workers, their medical history will inform whether other immunizations are needed in addition to routinely recommended vaccines. Refer to [Immunization of Persons with Chronic Diseases](#) and [Immunization of Immunocompromised Persons](#) in Part 3 for further information about how underlying medical conditions may modify immunization recommendations.

A detailed discussion of personal protective measures recommended for workers is beyond the scope of the *Canadian Immunization Guide*.

## HEALTH CARE WORKERS

Health care workers (HCW), including hospital employees, other staff who work or study in hospitals (e.g., students in health care disciplines, contract workers, volunteers) and other health care personnel (e.g., those working in clinical laboratories, nursing homes, home care agencies and community settings) are at risk of exposure to communicable diseases because of their contact with patients/clients (diagnosed or undiagnosed) or their environment. There is also a risk that HCW could transmit an undiagnosed vaccine-preventable disease to others. Some health care institutions and jurisdictions are moving towards making vaccination a condition of employment for HCW.

HCW require assessment of immunization status, completion of routinely recommended vaccine series, and booster doses as necessary. In addition, HCW may require additional doses or booster doses of routine immunizations, or a change in the routine immunization schedule. Unimmunized or incompletely immunized HCW should receive routine immunizations as appropriate for age as well as vaccines



recommended because of specific occupational risks. Refer to [Table 1](#) for a summary of recommended immunizations for HCW.

### **BACILLE CALMETTE-GUÉRIN (BCG)**

In general, HCW do not need BCG vaccine. Appropriate personal protection, environmental controls, treatment of the source, and tuberculosis (TB) screening and chemoprophylaxis of the exposed person as indicated are the typical approaches to TB control in HCW. If early identification and treatment of latent TB infection are not available, BCG vaccine may be considered for HCW who may be repeatedly exposed to persons with untreated, inadequately treated or drug-resistant active TB or tubercle bacilli in conditions where protective measures against infection are not feasible. Consultation with a TB and/or infectious disease expert is recommended. Refer to [Bacille Calmette-Guérin \(BCG\) Vaccine](#) in Part 4 for additional information.

### **DIPHTHERIA, TETANUS**

All HCW should have received a primary series of tetanus toxoid-diphtheria toxoid-containing vaccine. Tetanus toxoid-reduced diphtheria toxoid vaccine (Td) booster doses are indicated every 10 years. Tdap vaccine should be administered if a pertussis-containing vaccine was not received in adulthood. Tdap vaccine can be given even if Td vaccine was recently administered.

### **HEPATITIS B**

Immunization with hepatitis B (HB) vaccine and post-immunization serologic testing to assess vaccine response within 1 to 6 months of completion of the vaccine series are recommended for all HCW due to potential occupational exposure to blood, blood products and bodily fluids that may contain HB virus. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information on management of non-responders.

### **INFLUENZA**

Influenza vaccination provides benefits to HCW and to the patients/clients they care for. Transmission of influenza between infected HCW and their vulnerable patients/clients results in significant morbidity and mortality. Randomized controlled trials conducted in geriatric long-term care settings have demonstrated that vaccination of HCW is associated with substantial decreases in morbidity and mortality in the residents. Influenza vaccination of HCW who have direct patient contact (i.e., activities that allow opportunities for influenza transmission between a HCW and a patient) is an essential component of the standard of care for the protection of patients. HCW who have direct patient contact should consider it their responsibility to provide the highest standard of care, which includes annual influenza vaccination. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### **MEASLES**

It is recommended that all HCW be immune to measles. HCW, regardless of their year of birth, should receive two doses of measles-mumps-rubella (MMR) vaccine if they do not have one or more of the following: documented evidence of receiving two doses of measles-containing vaccine on or after their first birthday or laboratory evidence of immunity; or a history of laboratory confirmed measles disease. Refer to [Measles Vaccine](#) in Part 4 for additional information.

### **MENINGOCOCCAL**

Clinical laboratory personnel who handle *Neisseria meningitidis* specimens should be offered immunization with one dose of quadrivalent conjugate meningococcal vaccine. Re-vaccination is generally recommended every 5 years. Good laboratory practices should be employed at all times to minimize the risk of exposure in laboratory workers and post-exposure prophylaxis should be offered after recognized exposures. There is no evidence to recommend routine meningococcal immunization of other HCW. Nosocomial transmission of invasive meningococcal disease is very uncommon. Post-exposure chemoprophylaxis may be indicated for HCW who are close contacts of cases of invasive meningococcal disease. HCW are considered as close contacts only if they have had intensive, unprotected contact (without wearing a mask) with infected patients (e.g., intubating, resuscitating or closely examining the oropharynx). It is recommended that HCW use barrier precautions to avoid direct contact with respiratory secretions of patients with meningococcal disease until the patient has completed 24 hours of effective antibiotic therapy. Refer to [Meningococcal Vaccine](#) in Part 4 for additional information.

## MUMPS

It is recommended that all HCW be immune to mumps. HCW, regardless of their year of birth, should receive two doses of MMR vaccine if they do not have one or more of the following: documented evidence of receiving two doses of mumps-containing vaccine on or after their first birthday; or laboratory evidence of immunity; or a history of laboratory confirmed mumps disease. Refer to [Mumps Vaccine](#) in Part 4 for additional information.

## PERTUSSIS

All adult HCW, regardless of age, should receive a single dose of tetanus toxoid-reduced diphtheria toxoid-reduced acellular pertussis-containing vaccine (Tdap) for pertussis protection if not previously received in adulthood. The adult dose is in addition to the routine adolescent booster dose. Adolescent volunteers in health care settings should receive their routine booster dose of Tdap vaccine. Refer to [Pertussis Vaccine](#) in Part 4 for additional information.

## POLIO

All HCW who have not received a primary series of poliomyelitis vaccine should receive a primary series of inactivated poliomyelitis vaccine.

Health care workers at highest risk for polio exposure, including those who have close contact with patients who might be excreting wild type virus (e.g., from travel abroad) or vaccine type poliovirus (e.g., infants who received oral polio vaccine abroad) and laboratory workers handling specimens that may contain poliovirus, should be particularly targeted for polio vaccination. HCW at highest risk for polio exposure should receive a single lifetime booster dose of inactivated poliomyelitis vaccine. If these HCW have not received a primary series, they should receive a full primary series and then receive a single lifetime booster dose after 10 years. Refer to [Poliomyelitis Vaccine](#) in Part 4 for additional information.

## RUBELLA

It is recommended that all HCW be immune to rubella. HCW, regardless of age, should receive one dose of MMR vaccine if they do not have one or more of the following: documented evidence of receiving one dose of rubella-containing vaccine on or after their first birthday; or laboratory evidence of immunity; or a history of laboratory confirmed rubella disease. Refer to [Rubella Vaccine](#) in Part 4 for additional information.

## TRAVEL VACCINES FOR HEALTH CARE PROVIDERS WORKING ABROAD

Health care providers working in cholera-endemic countries or areas where hepatitis A, typhoid, Japanese encephalitis, tick-borne encephalitis, or yellow fever are present may be at significantly increased risk of exposure and should be appropriately vaccinated. Re-vaccination may be recommended if risk of exposure is ongoing. Consultation with a travel medicine expert is advised. Refer to [Immunization of Travellers](#) in Part 3 and vaccine-specific chapters in Part 4 for additional information.

## VARICELLA

It is recommended that all HCW be immune to varicella. HCW should receive two doses of varicella vaccine if they do not have one or more of the following: a health care provider diagnosis of varicella or herpes zoster; or documented evidence of immunization with two doses of a varicella-containing vaccine; or laboratory evidence of immunity; or a history of laboratory confirmed varicella infection. A second dose of varicella vaccine should be offered to workers who would have received only one dose of vaccine.

A self-reported history of varicella is not considered as proof of immunity for HCW. A diagnosis of varicella or herpes zoster by a health care provider, based on clinical presentation, is required for immunity to be considered reliable without laboratory confirmation. Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information.

**Table 1: Recommended immunization, health care workers**

Refer to text and vaccine-specific chapters in Part 4 for additional information.

Vaccine	Recommendation(s)
<b>BCG</b>	Consider use only in specified high-risk circumstances
<b>Diphtheria Tetanus</b>	All HCW should be immune Primary series if no previous immunization <sup>1</sup> Booster doses of Td vaccine every 10 years
<b>Hepatitis B</b>	If no evidence of immunity <sup>2</sup>
<b>Influenza</b>	Annually
<b>Measles</b>	If no evidence of immunity (refer to text), regardless of age - 2 doses
<b>Meningococcal</b>	Not routinely for HCW Quadrivalent conjugate meningococcal vaccine for clinical laboratory workers who handle <i>N. meningitidis</i> specimens – 1 dose with a booster every 5 years if at ongoing risk
<b>Mumps</b>	If no evidence of immunity (refer to text), regardless of age - 2 doses
<b>Pertussis</b>	A single dose of Tdap vaccine if not previously received in adulthood.
<b>Polio</b>	Primary series if no previous immunization – 3 doses. Unvaccinated HCW at highest risk of exposure should be particularly targeted for primary immunization. A single lifetime booster dose for HCW at highest risk of exposure.
<b>Rubella</b>	If no evidence of immunity (refer to text) – 1 dose
<b>Travel vaccines</b>	For HCW planning to work abroad, consider hepatitis A, cholera, Japanese encephalitis, tick-borne encephalitis, typhoid, and yellow fever vaccines prior to departure Re-vaccination for some vaccines if ongoing risk.
<b>Varicella</b>	If no evidence of immunity (refer to text) - 2 doses <sup>3</sup>

<sup>1</sup> Available as Td or Tdap or Tdap-IPV. Tdap is indicated if an adult pertussis dose is needed. Tdap-IPV is indicated if both pertussis and polio vaccinations are needed.

<sup>2</sup> Post-immunization serologic testing within 1 to 6 months of completion of primary series.

<sup>3</sup> Self-reported history of varicella or herpes zoster is not reliable for a HCW to be considered immune.

## LABORATORY WORKERS

Medical, research or industrial laboratory workers routinely handling a bacteria or virus that causes a vaccine preventable disease should be immunized against it. For example, anyone working with the influenza virus should receive influenza vaccine on an annual basis. Routine adult immunizations are also indicated. Refer to [Table 2](#) for a summary of recommended immunization for research or industrial laboratory workers.

### HEPATITIS A, HEPATITIS B

Workers involved in research on hepatitis A (HA) or hepatitis B (HB) virus or production of HA and/or HB vaccine and who may be exposed to HA or HB viruses should receive HA and HB vaccine. Post-immunization serologic testing for HB should be done within 1 to 6 months of completion of the vaccine series to assess vaccine response. Refer to [Hepatitis A Vaccine](#) and [Hepatitis B Vaccine](#) chapters in Part 4 for dosing and additional information.

### MENINGOCOCCAL

Research and industrial laboratory personnel who handle *N. meningitidis* specimens should be offered immunization with one dose of quadrivalent conjugate meningococcal vaccine. Re-vaccination is generally recommended every 5 years. Good laboratory practices should be employed at all times to minimize the risk of exposure in laboratory workers and post-exposure prophylaxis should be offered after recognized exposures. Refer to [Meningococcal Vaccine](#) in Part 4 for additional information.

### POLIO

Laboratory workers handling specimens that may contain poliovirus should be particularly targeted for polio vaccination. Laboratory workers at highest risk for polio exposure who have received a primary series of poliomyelitis vaccine should receive a single lifetime booster dose of inactivated poliomyelitis vaccine. If the worker has not received a primary series, they should receive a full primary series and then receive a single lifetime booster dose after 10 years. Refer to [Poliomyelitis Vaccine](#) in Part 4 for additional information.

### RABIES

Pre-exposure rabies immunization should be offered to laboratory workers who handle or may be exposed to the rabies virus. Workers with ongoing high risk of exposure to the rabies virus require periodic serology testing following completion of a primary series to ensure the persistence of circulating antibodies. For workers at continuous risk of exposure (e.g., those who work with the rabies virus in a research laboratory or production of rabies vaccine) – obtain serology every 6 months. For those at frequent risk of exposure (e.g., rabies diagnostic laboratory workers) - obtain serology every 2 years. A booster dose of rabies vaccine is recommended if antibody levels fall below an acceptable concentration. Refer to [Rabies Vaccine](#) in Part 4 for additional information.

### JAPANESE ENCEPHALITIS

Laboratory personnel who work with Japanese encephalitis (JE) virus should receive JE vaccine. Laboratory workers at continuous risk for acquiring JE should receive a booster dose 12 months after primary immunization. Data on the need for further booster doses are not available. Refer to [Japanese Encephalitis Vaccine](#) in Part 4 for additional information.

### YELLOW FEVER

Laboratory personnel who work with yellow fever virus should receive yellow fever vaccine. Re-immunization is recommended every 10 years if risk of exposure is ongoing. Refer to [Yellow Fever Vaccine](#) in Part 4 for additional information.

### TYPHOID

Typhoid vaccine is recommended for laboratory personnel regularly working with *S. typhi*. Re-vaccination at vaccine specific intervals is recommended if risk of exposure is ongoing. Technicians working in routine microbiology laboratories do not need to be vaccinated. Refer to [Typhoid Vaccine](#) in Part 4 for additional information.

### SMALLPOX

Smallpox vaccine may be indicated for certain workers at high risk of exposure, such as laboratory workers who handle vaccinia or other orthopox viruses including recombinant vaccinia products in specialized reference or research facilities. Refer to [Smallpox Vaccine](#) in Part 4 for additional information.

**Table 2: Recommended immunization, research and industrial laboratory workers\***

Refer to text and vaccine-specific chapters in Part 4 for additional information.

Vaccine	Recommendation(s)
<b>Hepatitis A</b>	If involved in research on HA virus or production of HA vaccine
<b>Hepatitis B</b>	If involved in research on HB virus or production of HB vaccine
<b>Influenza</b>	Encouraged annually
<b>Japanese encephalitis</b>	If working with Japanese encephalitis virus Booster dose 12 months after completion of primary series if ongoing risk
<b>Meningococcal</b>	Quadrivalent conjugate meningococcal vaccine if handling <i>N. meningitidis</i> specimens – 1 dose with a booster every 5 years if at ongoing risk
<b>Polio</b>	Primary series if not previously vaccinated – 3 doses Unvaccinated laboratory workers at highest risk of exposure should be particularly targeted for primary immunization. A single lifetime booster dose for laboratory workers at highest risk of exposure
<b>Rabies</b>	If handling rabies virus <sup>1, 2</sup>
<b>Smallpox</b>	May be considered if handling vaccinia or orthopox viruses including recombinant vaccinia products
<b>Typhoid</b>	If working with <i>S. typhi</i> Re-vaccination if ongoing risk. Re-vaccination interval is vaccine-specific.
<b>Yellow fever</b>	If working with Yellow fever virus Booster dose every 10 years if ongoing risk

<sup>1</sup> Serology recommended at 6 month or 2 year intervals depending on risk of exposure.<sup>2</sup> Booster dose recommended if antibody levels fall below acceptable level.

## CHILD CARE WORKERS AND WORKERS IN EDUCATIONAL SETTINGS

Child care workers and workers in educational settings are at risk of exposure to communicable diseases such as varicella, measles, mumps, rubella, influenza and pertussis because of their contact with young people. Child care workers are also capable of transmitting communicable diseases (such as influenza or pertussis) to young children. Child care workers should also receive all vaccines routinely recommended for adults.

### HEPATITIS A

Hepatitis A vaccine is recommended for post-exposure prophylaxis of workers if hepatitis A occurs in a group child care centre or kindergarten. Refer to [Hepatitis A Vaccine](#) in Part 4 for additional information.

### HEPATITIS B

Workers in child care settings in which there is a child or worker who has acute HB or is a HB carrier should receive HB vaccine and post-immunization serologic testing within 1 to 6 months of completion of the vaccine series. As children with HB are usually asymptomatic and the HB status of children in child



care settings is generally unknown, consider vaccination of all child care workers. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

### INFLUENZA

Annual influenza immunization is recommended for people providing regular child care to children less than 60 months of age (whether in or out of the home) because these child care workers are capable of transmitting influenza to young children who are at high risk of influenza-related complications. Influenza vaccine is encouraged for all other adults. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### MEASLES, MUMPS, RUBELLA

One dose of MMR vaccine is recommended for measles and/or mumps susceptible adults born in or after 1970; adults born before 1970 can be considered immune. One dose of MMR vaccine is recommended for rubella susceptible adults. Non-immune people who work with children (e.g., child care workers, teachers) and non-immune, non-pregnant female workers of childbearing age in educational settings are priorities for rubella immunization. Refer to [Measles Vaccine](#), [Mumps Vaccine](#), [Rubella Vaccine](#) in Part 4 for additional information.

### MENINGOCOCCAL

Staff members (regardless of immunization status) in contact with a case of invasive meningococcal disease in a child care or nursery school facility should receive chemoprophylaxis and, if the meningococcal serogroup identified in the case is vaccine preventable, should also be considered for immunoprophylaxis with an appropriate meningococcal conjugate vaccine. Refer to [Meningococcal Vaccine](#) in Part 4 for additional information.

### PERTUSSIS

All child care workers and teachers, regardless of age, should receive a single dose of Tdap vaccine for pertussis protection if not previously received in adulthood. Adolescents providing child care should receive their routine booster dose of Tdap vaccine. Refer to [Pertussis Vaccine](#) in Part 4 for additional information.

### VARICELLA

Varicella outbreaks can occur in child care and educational settings where there are unimmunized children. Varicella susceptible child care workers and teachers of young children should receive two doses of univalent varicella vaccine. Refer to [Varicella \(Chickenpox\) Vaccine](#) in Part 4 for additional information.



**Table 3: Recommended immunization, child care workers and workers in educational settings**

Refer to text and vaccine-specific chapters in Part 4 for additional information.

Vaccine	Recommendation	Comments
<b>Hepatitis A</b>	Recommended for post-exposure prophylaxis of workers if hepatitis A occurs in a group child care centre or kindergarten	Refer to <a href="#">Hepatitis A Vaccine</a> in Part 4 for additional information on post-exposure management
<b>Hepatitis B</b>	Recommended for workers in settings in which there is a child or worker who has acute HB or is a HB carrier	Post-immunization serology within 1 to 6 months of completion of primary series recommended
<b>Influenza</b>	Recommended annually if regularly caring for children less than 60 months of age Encouraged annually for all	
<b>Measles Mumps</b>	Recommended for susceptible adults born in or after 1970 – 1 dose Adults born before 1970 – consider immune	
<b>Meningococcal</b>	Recommended for post-exposure prophylaxis of workers if vaccine preventable strain occurs in a child care or nursery school facility	Refer to <a href="#">Meningococcal Vaccine</a> in Part 4 for additional information on post-exposure management
<b>Pertussis</b>	A single dose of Tdap vaccine is recommended if not previously received in adulthood.	
<b>Rubella</b>	Recommended if susceptible – 1 dose	
<b>Varicella</b>	Recommended for susceptible child care workers and teachers of young children -2 doses	

## WORKERS WITH OCCUPATIONAL EXPOSURE TO ANIMALS OR MATERIAL FROM ANIMALS

Workers with occupational exposure to animals or materials from animals with infections (e.g., veterinarians and veterinary staff, animal control workers, wildlife workers, zoo-keepers, researchers, laboratory workers) may be at higher risk of exposure to diseases that can be transmitted from animals to humans, such as hepatitis A or rabies. These workers should also receive all vaccines routinely recommended for adults.

### HEPATITIS A

Zoo-keepers, veterinarians and researchers who handle non-human primates should receive two doses of hepatitis A vaccine. Refer to [Hepatitis A Vaccine](#) in Part 4 for additional information.

### INFLUENZA

Annual seasonal influenza immunization is recommended for people in direct contact during culling operations with poultry infected with avian influenza. This is to reduce the potential for mixing of human and avian strains of influenza that may arise if workers become co-infected with seasonal and with avian

influenza. Influenza immunization of swine and poultry workers is currently under National Advisory Committee on Immunization (NACI) review. Influenza vaccine is encouraged for all adults. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

### **RABIES**

Pre-exposure rabies immunization should be offered to workers such as veterinarians, veterinary staff, animal control and wildlife workers at high risk of occupational exposure to potentially rabid animals or the rabies virus. Certain workers with ongoing high risk of exposure to the rabies virus require periodic serology testing following completion of the primary series to ensure the persistence of circulating antibodies. For workers at frequent risk of exposure (veterinarians, veterinary staff, animal control and wildlife workers in areas where rabies is enzootic) – obtain serology every 2 years. A booster dose of rabies vaccine should be given if antibody levels fall below an acceptable concentration. For workers at less frequent risk of exposure to potentially rabid animals and/or whose risk is likely to be from a recognized source (such as veterinarians, veterinary staff and students, and animal control officers who work with terrestrial animals in areas where rabies is uncommon) periodic serologic testing is not required. Refer to [Rabies Vaccine](#) in Part 4 for additional information.

### **TETANUS**

Persons handling animals may be at risk for tetanus from bite and other puncture wounds and should have up-to-date routine tetanus immunization.

## **HUMANITARIAN RELIEF AND OVERSEAS REFUGEE WORKERS**

Humanitarian relief workers are at risk of exposure to vaccine-preventable diseases such as cholera, diphtheria, hepatitis A, polio, TB, yellow fever, tick-borne encephalitis, Japanese encephalitis and typhoid when posted to endemic areas and may benefit from immunization. These workers should also have up-to-date routine adult immunizations prior to departure. Refer to [Immunization of Travellers](#) in Part 3 and vaccine-specific chapters in Part 4 for additional information.

### **POLIO**

Humanitarian relief workers in refugee camps in areas where poliovirus is known or suspected to be circulating or who come in close contact with those who may be excreting poliovirus should be particularly targeted for polio vaccination. Relief workers at highest risk for polio exposure who have received a primary series of poliomyelitis vaccine should receive a single lifetime booster dose of inactivated poliomyelitis vaccine. If the worker has not received a primary series, he/she should receive a full primary series and then receive a single lifetime booster dose after 10 years. Refer to [Poliomyelitis Vaccine](#) in Part 4 for additional information.

### **TRAVEL VACCINES FOR HUMANITARIAN RELIEF AND OVERSEAS REFUGEE WORKERS**

Humanitarian relief and overseas refugee workers in cholera-endemic countries or areas where hepatitis A, typhoid, Japanese encephalitis, tick-borne encephalitis, or yellow fever are present may be at significantly increased risk of exposure and may benefit from immunization. Re-vaccination may be recommended if the risk of exposure is ongoing. Consultation with a travel medicine expert is advised.

## **REFUGEE WORKERS IN CANADA**

People who plan to work with refugees in Canada should have up-to-date routine adult immunizations. In addition, prior to initiating work with refugees, the worker's risk of exposure to polio should be assessed.

### **POLIO**

People who work with refugees in Canada should be particularly targeted for polio vaccination because they may come in close contact with refugees who are excreting poliovirus. Refugee workers at highest risk for polio exposure who have received a primary series of poliomyelitis vaccine should receive a single

lifetime booster dose of inactivated poliomyelitis vaccine. If the worker has not received a primary series, they should receive a full primary series and then receive a single lifetime booster dose after 10 years. Refer to [Poliomyelitis Vaccine](#) in Part 4 for additional information.

## EMERGENCY SERVICES WORKERS

Emergency service workers include police and fire fighters and any other front line workers who may need to respond to emergencies. For paramedical and ambulance workers refer to [Health Care Workers](#). For other emergency service workers, routine adult immunizations should be up to date and hepatitis B and influenza vaccines are recommended.

### HEPATITIS B

Pre-exposure hepatitis B immunization and post-immunization serologic testing within 1 to 6 months of completion of the vaccine series are recommended for emergency services workers. These workers may be at higher risk of blood exposure and potential HB virus exposure, although there are no data to quantify their risk. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

### INFLUENZA

Annual influenza immunization of emergency service workers is recommended because these workers provide essential community services. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

## WORKERS IN INSTITUTIONS FOR THE DEVELOPMENTALLY CHALLENGED OR CORRECTIONAL FACILITIES

Workers in institutions for the developmentally challenged or correctional facilities should receive all vaccines routinely recommended for adults including influenza vaccine. In addition, hepatitis B vaccine is recommended.

### HEPATITIS B

Pre-exposure hepatitis B immunization and post-immunization serologic testing within 1 to 6 months of completion of the vaccine series are recommended for workers in institutions for the developmentally challenged or correctional facilities because these workers are at higher risk of exposure to hepatitis B through bites or penetrating injuries, or exposure to blood or blood products. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

## WORKERS WHO PROVIDE SERVICES WITHIN CLOSED SETTINGS

Workers who provide services within closed settings (e.g., crews on ships) should receive all vaccines routinely recommended for adults, including annual influenza vaccine.

### INFLUENZA

Annual influenza immunization is recommended for workers who provide services within closed or relatively closed settings to persons at high risk of influenza-related complications because these workers are capable of transmitting influenza to these high-risk individuals. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

## WORKERS WHO PROVIDE ESSENTIAL COMMUNITY SERVICES

Workers who provide essential community services should receive all vaccines routinely recommended for adults, including annual influenza vaccine.

## INFLUENZA

Annual influenza immunization of workers who provide essential community services is recommended to minimize the disruption of routine activities during seasonal influenza epidemics. Refer to [Influenza Vaccine](#) in Part 4 for additional information.

## WORKERS IN SHELTERS FOR THE HOMELESS

Workers in shelters for the homeless should receive all vaccines routinely recommended for adults. In addition, hepatitis B vaccine is recommended if the worker is at risk of exposure to blood or body fluids.

## HEPATITIS B

Pre-exposure hepatitis B immunization and post-immunization serologic testing within 1 to 6 months of completion of the vaccine series are recommended for workers at risk of exposure to blood or body fluids. Refer to [Hepatitis B Vaccine](#) in Part 4 for additional information.

## MILITARY PERSONNEL

On enrolment into the Canadian Forces, the medical history and immunization records of recruits are reviewed and then vaccination, as required is offered during recruit training to boost or induce immunity against tetanus, diphtheria, measles, mumps, polio, pertussis, varicella, influenza, meningococcal disease, hepatitis A, and hepatitis B. The immunization status of personnel is reviewed throughout their service career and any required booster doses, as well as additional vaccines to address individual risks resulting from military occupations, lifestyle choices, travel plans, and deployments are offered.

The Canadian Forces immunization standards adopt the *Canadian Immunization Guide*, advisory statements of the National Advisory Committee on Immunization, and relevant statements of the Committee to Advise on Tropical Medicine and Travel, as guiding documents for use of immunizing agents. The Directorate of Force Health Protection at National Defence Headquarters in Ottawa adapts these national guidelines and produces advisories on the use of specific vaccines in the Canadian Forces, and provides the recommendations on vaccinations requirements for health protection at specific deployment locations.

## SELECTED REFERENCES

Centers for Disease Control and Prevention. *Immunization of Health-Care Personnel: Recommendations of the Advisory Committee on Immunization Practices (ACIP)*. MMWR Recomm Rep 2011;60(RR-7):1-45.

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