

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
INACTIVATED VACCINES		
Cholera and travellers' diarrhea (inactivated)	Use if indicated	<ul style="list-style-type: none"> Beginning 6 months post-HSCT
Diphtheria	Recommended: 3 doses	<ul style="list-style-type: none"> Beginning 6 to 12 months post-HSCT Refer to <u>Diphtheria Toxoid</u> in Part 4 for additional information
Haemophilus influenzae type b (Hib)	Recommended: 3 doses	<ul style="list-style-type: none"> Beginning 6 to 12 months post-HSCT Refer to <u>Haemophilus influenzae type B Vaccine</u> in Part 4 for additional information
Hepatitis A	Use if indicated	<ul style="list-style-type: none"> Beginning 6 months post-HSCT Pre-exposure prophylaxis for travel: consider Ig with hepatitis A vaccine Post-exposure prophylaxis: Ig recommended along with hepatitis A vaccine Refer to <u>Hepatitis A Vaccine</u> in Part 4 for additional information
Hepatitis B	Recommended: 3 doses	<ul style="list-style-type: none"> Beginning 6 to 12 months post-HSCT Higher dosage recommended 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 Refer to <u>Hepatitis B Vaccine</u> in Part 4 for additional information
HPV	Recommended if indicated: 3 doses	<ul style="list-style-type: none"> Beginning 6 to 12 months post-HSCT
Influenza (inactivated)	Recommended annually	<ul style="list-style-type: none"> Beginning 4 to 6 months post-HSCT Refer to <u>Influenza Vaccine</u> in Part 4 for additional information
Japanese encephalitis	Use if indicated	<ul style="list-style-type: none"> Beginning 6 months post-HSCT

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Vaccine	Post-transplantation	Comments
Meningococcal conjugate	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"> Beginning 6 months post-HSCT Refer to <u>Meningococcal Vaccine</u> in Part 4 for additional information
Pertussis	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"> Beginning 6 to 12 months post-HSCT Refer to <u>Diphtheria Toxoid</u> in Part 4 for additional information
Pneumococcal conjugate 13-valent (Pneu-C-13)	Recommended: 3 doses	<ul style="list-style-type: none"> Beginning 3 to 9 months post-HSCT after discussion with transplant specialist 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 <u>Pneumococcal Vaccine</u> in Part 4 for additional information
Pneumococcal polysaccharide (Pneu-P-23)	Recommended: 1 dose	<ul style="list-style-type: none"> Consider re-immunization after 1 year Refer to <u>Pneumococcal Vaccine</u> in Part 4 for additional information
Polio (inactivated)	Recommended: 3 doses	<ul style="list-style-type: none"> Beginning 6 to 12 months post-HSCT Refer to <u>Diphtheria Toxoid</u> in Part 4 for additional information
Rabies	Use if indicated	<ul style="list-style-type: none"> Do not use intradermally As needed for post-exposure management Beginning 6 to 12 months post-HSCT for pre-exposure prophylaxis Post-immunization serology recommended Refer to <u>Rabies Vaccine</u> in Part 4 for additional information
Tetanus	Recommended: 3 doses	<ul style="list-style-type: none"> Beginning 6 to 12 months post-HSCT Refer to <u>Diphtheria Toxoid</u> in Part 4 for additional information
Typhoid (inactivated)	Use if indicated	<ul style="list-style-type: none"> Beginning 6 months post-HSCT

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

¹ 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


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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 influenzae* 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	Post-transplant (if not vaccinated pre-transplant)	Comments
INACTIVATED VACCINES²			
Cholera and travellers' diarrhoea (inactivated)	Use if indicated	Use if indicated	
Diphtheria	Routine use ³	Routine use	
Haemophilus influenzae type b (Hib)	Children less than 5 years of age: routine use Individuals 5 years of age and older: 1 dose recommended ⁴	Children less than 5 years of age: routine use Individuals 5 years of age and older: 1 dose recommended ⁴	<ul style="list-style-type: none"> Refer to <u>Haemophilus influenzae type B Vaccine</u> in Part 4 for additional information
Hepatitis A	Use if indicated	Use if indicated	<ul style="list-style-type: none"> Recommended for transplant candidates with chronic liver diseases Pre-exposure prophylaxis for travel: consider Ig with hepatitis A vaccine Post-exposure prophylaxis: Ig recommended along with hepatitis A vaccine Refer to <u>Hepatitis A Vaccine</u> in Part 4 for additional information
Hepatitis B	Routine use	Routine use	<ul style="list-style-type: none"> Higher dosage recommended for post-transplant vaccine recipients Post-immunization serology testing of anti-HBs recommended with re-immunization if response less than 10 IU/L Periodic monitoring of anti-HBs titre recommended Refer to <u>Hepatitis B Vaccine</u> in Part 4 for additional information
HEV	Routine use	Routine use	<ul style="list-style-type: none"> 3 dose schedule recommended May be considered for pre-transplant



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Vaccine	Pre-transplant	Post-transplant (prior vaccinated/pre-transplant)	Comments
Influenza (inactivated)	Recommended annually	Recommended annually	administration prior to routinely recommended age, if reasonably close to minimum recommended age for vaccination
Japanese encephalitis	Use if indicated	Use if indicated	Refer to Influenza Vaccine in Part 4 for additional information
Meningococcal conjugate	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"> Beginning 6 months post-transplant Refer to Meningococcal Vaccine in Part 4 for additional information
Partussis	Routine use	Routine use	
Pneumococcal conjugate 13-valent	Recommended	Recommended	<ul style="list-style-type: none"> Refer to Pneumococcal Vaccine in Part 4 for additional information Should be followed – at least 2 months later or when reaches age 2 years – with a pneumococcal polysaccharide vaccine dose⁵
Pneumococcal polysaccharide	Recommended	Recommended	<ul style="list-style-type: none"> One life-time re-immunization recommended Refer to Pneumococcal Vaccine in Part 4 for additional information
Polio (inactivated)	Routine use	Routine use	
Rabies	Use if indicated	Use if indicated	<ul style="list-style-type: none"> Do not use intradermally Post-immunization serology recommended Refer to Rabies Vaccine in Part 4 for additional information
Tetanus	Routine use	Routine use	

Vaccine	Pre-transplant	Post-transplant (if not vaccinated pre-transplant)	Comments
LIVE VACCINES⁵			
Typhoid (inactivated)	Use if indicated	Use if indicated	
Measles-mumps-rubella	Recommended ⁷	Not recommended	<ul style="list-style-type: none"> Refer to <u>Measles Vaccine in Part 4</u> for additional information
Varicella	Recommended ⁷	Not recommended	<ul style="list-style-type: none"> Consider post-immunization serology Complete 2-dose series 4 weeks or more pre-transplant Refer to <u>Varicella (Chickenpox) Vaccine in Part 4</u> for additional information
Rotavirus	Routine use	Not recommended	
Influenza (live)	Use if indicated	Not recommended; use inactivated vaccine	
Herpes zoster	Routine use	Not recommended	
Yellow fever	Use if indicated	Contraindicated	
Typhoid (live)	Use if indicated	Contraindicated; if indicated, use inactivated vaccine	
BCG	Use if indicated	Contraindicated	
Smallpox	Contraindicated	Contraindicated	

¹ whenever possible, vaccine series should be completed pre-transplantation. Vaccines given post-transplant may not be sufficiently immunogenic.
² 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
³ routine use: follow routine immunization schedules with age-appropriate booster doses
⁴ regardless of prior history of Hib vaccination and at least 1 year after any previous dose
⁵ 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.
⁶ live attenuated vaccines should be given at least 4 weeks prior to transplantation
⁷ 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

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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.

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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,

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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 $\geq 200 \times 10^6/L$ 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.

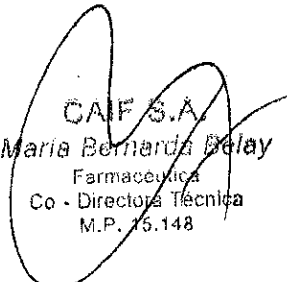

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Table 5: Vaccination of HIV-infected persons
(Refer to text and vaccine-specific chapters in Part 4 for additional information)

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

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

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

¹ routine use: follow routine immunization schedules with age-appropriate booster doses

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

³ 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>) and vaccine-specific chapters in Part 4.

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PART 3

IMMUNIZATION OF TRAVELLERS

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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>)

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](#) 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) Additional information is available from the [United States Centers for Disease Control and Prevention \(CDC\)](#) and the [World Health Organization \(WHO\)](#). (<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>)

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/>) for additional information. Refer to Hepatitis B Vaccine in Part 4 and to the CATMAT Statement on hepatitis vaccines for travellers 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.

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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/)

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/)

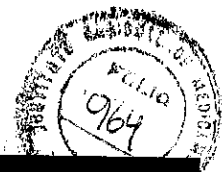
Rubella

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/)

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 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>)

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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 cooperation 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)

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_ITHRiskMap.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_ITHRiskMap.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-cmtmv/index-eng.php>) Refer to *WHO meningococcal disease outbreak information*. (http://www.who.int/csr/don/archive/disease/meningococcal_disease/en/)

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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)

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 which provides a map of endemic areas. (http://www.isw-tbe.info/tbe.aspx_param_target_is_150790_and_l_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>)

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 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://gamapservr.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 comorbidities. 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) Refer to Immunization of Persons with Inadequate Immunization Records in Part 3 for additional information.

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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.

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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 Care 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.

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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.

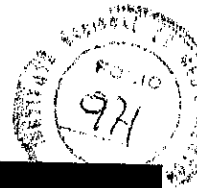


Table 1: Recommended immunization, health care workers
Refer to text and vaccine-specific chapters in Part 4 for additional information.

Vaccine	Recommendation(s)
ECCG	Consider use only in specified high-risk circumstances
Diphtheria Tetanus	All HCW should be immune Primary series if no previous immunization ¹ Booster doses of Td vaccine every 10 years
Hepatitis B	If no evidence of immunity ²
Influenza	Annually
Measles	If no evidence of immunity (refer to text), regardless of age - 2 doses
Meningococcal	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
Mumps	If no evidence of immunity (refer to text), regardless of age - 2 doses
Portacell	A single dose of Tdap vaccine if not previously received in adulthood.
Polio	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.
Rubella	If no evidence of immunity (refer to text) – 1 dose
Travel vaccines	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.
Varicella	If no evidence of immunity (refer to text) - 2 doses ³

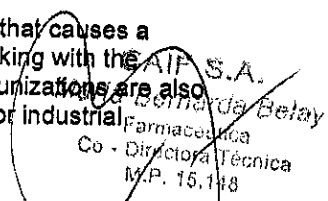
¹ Available as Td or Tdap or Tdap-IPV. Tdap is indicated if an adult pertussis dose is needed. Tdap-IPV is indicated if both pertussis and polio vaccinations are needed.

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

³ 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)
Hepatitis A	If involved in research on HA virus or production of HA vaccine
Hepatitis B	If involved in research on HB virus or production of HB vaccine
Influenza	Encouraged annually
Japanese encephalitis	If working with Japanese encephalitis virus Booster dose 12 months after completion of primary series if ongoing risk
Meningococcal	Quadrivalent conjugate meningococcal vaccine if handling <i>N. meningitidis</i> specimens – 1 dose with a booster every 5 years if at ongoing risk
Polio	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
Rabies	If handling rabies virus ^{1, 2}
Smallpox	May be considered if handling vaccinia or orthopox viruses including recombinant vaccinia products
Typhoid	If working with <i>S. typhi</i> Re-vaccination if ongoing risk. Re-vaccination interval is vaccine-specific.
Yellow fever	If working with Yellow fever virus Booster dose every 10 years if ongoing risk

¹ Serology recommended at 6 month or 2 year intervals depending on risk of exposure.
² 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

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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
Hepatitis A	Recommended for post-exposure prophylaxis of workers if hepatitis A occurs in a group child care centre or kindergarten	Refer to <i>Hepatitis A Vaccine</i> in Part 4 for additional information on post-exposure management
Hepatitis 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
Influenza	Recommended annually if regularly caring for children less than 60 months of age Encouraged annually for all	
Measles Mumps	Recommended for susceptible adults born in or after 1970 – 1 dose Adults born before 1970 – consider immune	
Meningococcal	Recommended for post-exposure prophylaxis of workers if vaccine preventable strain occurs in a child care or nursery school facility	Refer to <i>Meningococcal Vaccine</i> in Part 4 for additional information on post-exposure management
Rabies	A single dose of Tdap vaccine is recommended if not previously received in adulthood.	
Rubella	Recommended if susceptible – 1 dose	
Varicella	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

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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

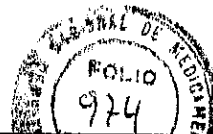
Humanitarian relief and overseas refugee workers in cholera-endemic countries or areas where hepatitis A, typhoid, Japanese encephalitis, tick-borne encephalitis, or yellow fever are present may be at significantly increased risk of exposure and may benefit from immunization. Re-vaccination may be recommended 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.

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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.

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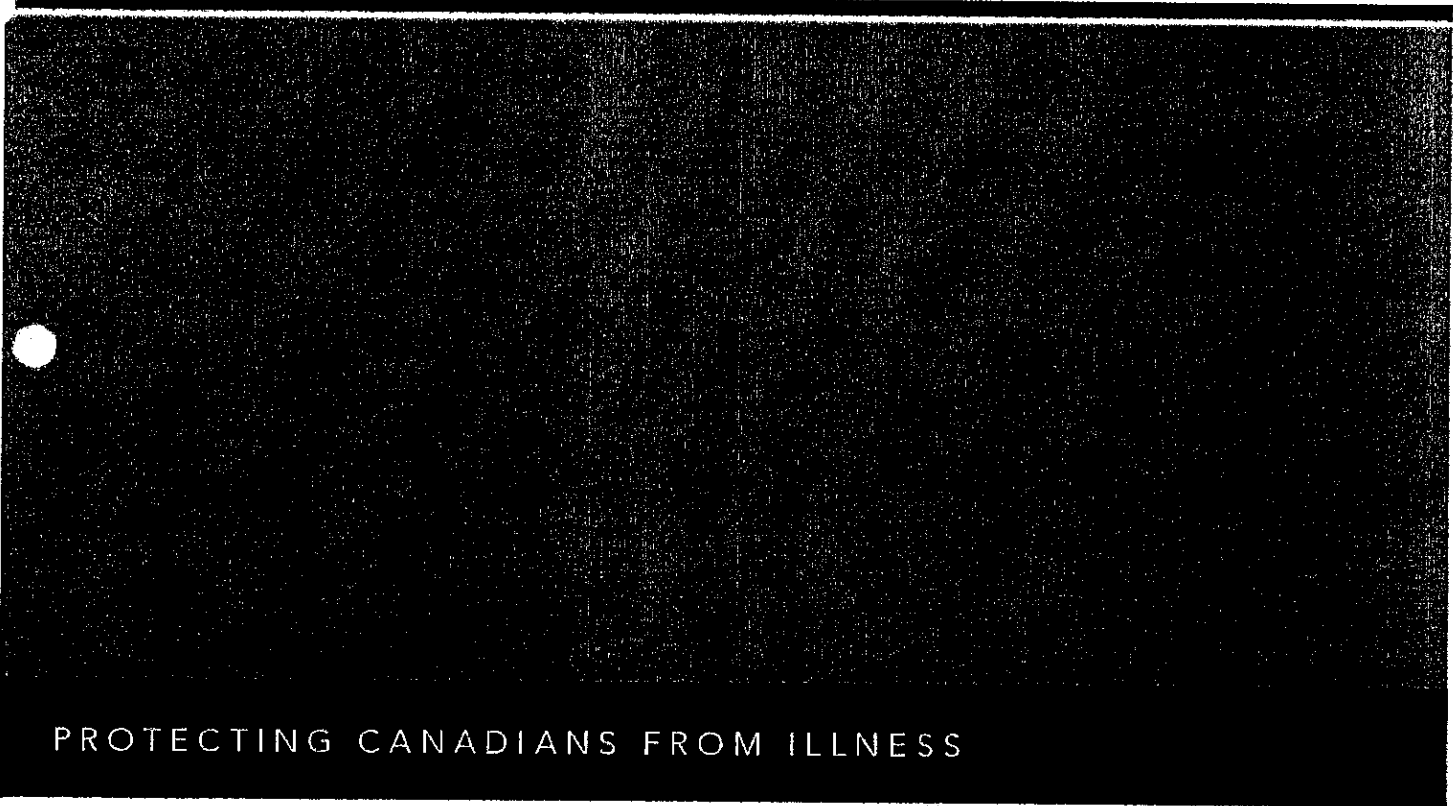
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CANADIAN IMMUNIZATION GUIDE

PART 4



PROTECTING CANADIANS FROM ILLNESS



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Canada

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

—Public Health Agency of Canada

Également disponible en français sous le titre :

Guide canadien d'immunisation Partie 4

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Publication date: April 2014

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Cat.: HP40-3/2014E-PDF
ISBN: 978-1-100-23215-7
Pub.: 130578



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KEY INFORMATION (refer to text for details)

What	<ul style="list-style-type: none"> • Tuberculosis (TB) is transmitted by the airborne route and usually requires prolonged exposure for infection to occur. • In Canada, TB occurs more commonly among Aboriginal people and foreign-born populations. • Risk factors for the acquisition of TB include proximity to a person with infectious TB, particularly in crowded living conditions. • Risk factors for progression to active TB include co-morbidities (such as HIV/AIDS, other immunodeficiencies, diabetes, silicosis), malnutrition, and smoking. • Bacille Calmette-Guérin (BCG) vaccine efficacy is estimated to be about 51% in preventing any TB disease and up to 78% in protecting newborns from miliary (disseminated) or meningeal TB. • Intradermal administration of BCG vaccine usually results in erythema and a papule or ulceration, followed by a scar at the immunization site.
Who	<ul style="list-style-type: none"> • BCG vaccine is not recommended for routine use in any Canadian population. • Following consideration of local TB epidemiology and if a program of early detection and treatment of latent TB infection cannot be implemented, BCG vaccination may be considered in exceptional circumstances such as infants in high risk communities, persons at high risk of repeated exposure, certain long term travellers to high prevalence countries, and in infants born to mothers with infectious TB disease. • In high risk communities, infants less than 2 months of age do not need to be tuberculin skin tested before administering BCG vaccine. For infants 2 to 6 months of age, an individual assessment of the risks and benefits of tuberculin skin testing prior to BCG vaccination is indicated. For infants over 6 months of age, administer BCG vaccine if the one-step tuberculin skin test (TST) is negative. • Immunocompromised persons and pregnant women should not receive BCG vaccine.
How	<ul style="list-style-type: none"> • BCG vaccine is administered as a single intradermal dose.