### Program Name:

*Immunization Competencies Education Program*
*Module 11 - Populations Requiring Special Considerations*

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### CCCEP:

This continuing education lesson is designed primarily for community pharmacists and has been accredited by the Canadian Council on Continuing Education in Pharmacy (CCCEP) for 1 CEUs.

**CCCEP File Number:** 1066-2010-092-I-P

This online CME event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification program of the Royal College of Physicians and Surgeons of Canada. This program is recognized as 1 hour(s) of Continuing Professional Development.

**Family physicians may claim one (1) credit per hour of participation under Mainpro-M2.**

### Course Expiration Date:

June 15, 2013

### Sponsor:

This module is developed in collaboration with the Canadian Paediatric Society, the Public Health Agency of Canada and Health Canada.
Competency: Recognizes and responds to the unique immunization needs of certain population groups.

Learning Objectives
Upon successful completion of this section the health professional will be able to perform the following:

1. Describe the unique immunization needs of certain populations, as relevant to the practice setting, including:
   - individuals who are off course of a recommended immunization schedule;
   - individuals who have had a serious adverse event following a prior immunization;
   - individuals with certain medical conditions, including transplant recipients;
   - pregnant women;
   - women who are breastfeeding;
   - occupational risk groups;
   - travellers;
   - new Canadians;
   - international students;
   - individuals with behaviours that put them at risk for vaccine-preventable diseases;
   - “hard-to-reach” individuals; and
   - individuals who are in outbreak situations.

2. Appropriately refer to expert professionals/resources when required to address the immunization needs of certain populations.

Test your Current Knowledge:
Based on your current knowledge, determine if the following statements are true or false.

1. A verbal report of immunization from the patient is usually sufficient to complete the immunization schedule.
   a. True
   b. False

2. Once a patient falls off the immunization schedule it can be very difficult to determine which vaccines to administer as overimmunization is associated with significant adverse effects.
   a. True
   b. False

3. Immunocompromised patients should receive a yearly influenza vaccine
   a. True
   b. False

4. Live attenuated vaccines are normally contraindicated in immunosuppressed patients
   a. True
   b. False
a. True  
b. False

5. Breastfeeding is a contraindication to live vaccines.  
   a. True  
   b. False

6. International travellers are recommended to visit a travel clinic 6 months prior to departure.  
   a. True  
   b. False

7. Public health is the main coordinator of immunization strategies during outbreaks.  
   a. True  
   b. False

Ensuring we are Protecting Everyone

Immunizing our population is a shared responsibility and is important for the health of the individual as well as everyone living in the community. Ideally, most of the Canadian population will be immunized according to provincial/territorial immunization schedules. However, there are times when some patient groups do not fit the standardized schedules. In addition, when individuals move from one area to another, the fact that immunization schedules differ between jurisdictions needs to be taken into consideration. This module will focus on patient populations that may require some modification, deferral or delay of their immunization schedule.

Immunization of Children and Adults with Inadequate Immunization Records

Immunization providers will encounter many patients with inadequate or incomplete immunization schedules. The problem for the clinician is they will not be sure if these patients are under or over immunized. When considering a vaccine for a patient with incomplete schedules, it is important to consider the goal of protecting against vaccine preventable diseases against the increased risk of local reactions with overimmunization. The local reactions will increase with the number of vaccine doses against diphtheria, tetanus and pertussis given and can include large swelling at the injection site. The pain is generally limited, and such reactions are not a contraindication to continuing the recommended schedule. This is supported by data suggesting that booster doses of combination products administered at intervals less than 5 years are not associated with increased local reactions in adolescents.

If the immunization schedule is incomplete, an attempt should be made to obtain the person's immunization records from previous health care provider. While written documentation of immunization is preferred for both children and adults, information obtained by telephone from the previous immunization provider with the exact dates of immunization may be accepted in some circumstances.

For children, parental recall of prior immunization, in the absence of documentation provided by the administrator of the vaccine, correlates poorly with immunizations received and should not be accepted as evidence of immunization. Adults without immunization records should also be
considered unimmunized. The Canadian Immunization Guide states that routine serologic testing to determine immunity of children and adults without records is generally not practical. They recommend the following approaches:

- All children and adults lacking written documentation of immunization should be started on a primary immunization schedule as appropriate for their age.
- Measles, mumps, and rubella (MMR), polio, Haemophilus influenzae type b conjugate, pneumococcal conjugate, meningococcal conjugate, hepatitis B and A, varicella and influenza vaccines can be given, if indicated, on the basis of age and/or risk factors without concern about prior receipt of these vaccines. This is acceptable because adverse effects of repeated immunization with these vaccines have not been demonstrated.
- Persons who develop a serious adverse local reaction after administration of vaccines containing tetanus, diphtheria and pertussis should be individually assessed before they receive additional doses of these vaccines. The benefit of continuing the series needs to be weighed against the risk of further adverse reactions. Serologic testing for diphtheria and tetanus antitoxin levels may demonstrate immune status and guide the need for continued immunization. There are no established serologic correlates for protection against pertussis.
- Pneumococcal polysaccharide vaccine should be given, if indicated, when a record cannot be found since in most studies local reaction rates after revaccination have been similar to rates following initial vaccination.

**Clinical Tip:**

It is important to understand that there is no need to restart a recommended vaccine series when an interruption has occurred.

Modifications of recommended vaccine schedules occur for a variety of reasons, such as missed appointments or intercurrent illness. Children, adolescents and adults with interruptions to their vaccines should be immunized to complete the schedule appropriate to their current age. The Canadian Immunization Guide lists immunization tables (see below) that can be used as a starting point in patients that have missed immunizations or have incomplete immunization records, although differences can exist between manufacturer's recommendations. Immunization providers should refer to the manufacturer's product monograph and refer to the National Advisory Committee on Immunization (NACI) or provincial/territorial guidelines for specific vaccines.
# Table 1. Routine Immunization Schedule for Children < 7 Years of Age Not Immunized in Early Infancy

<table>
<thead>
<tr>
<th>Timing</th>
<th>DTaP-IPV</th>
<th>Hib</th>
<th>MMR</th>
<th>Var</th>
<th>HB</th>
<th>Pneu-C-7</th>
<th>Men-C</th>
<th>Tdap</th>
</tr>
</thead>
<tbody>
<tr>
<td>First visit</td>
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<td>2 months later</td>
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<tr>
<td>6-12 months later</td>
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<tr>
<td>4-6 years of age</td>
<td>(†)</td>
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<tr>
<td>14-16 years of age</td>
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</tbody>
</table>

# Table 2. Routine Immunization Schedule for Children ≥ 7 Years of Age up to 17 Years of Age Not Immunized in Early Infancy

<table>
<thead>
<tr>
<th>Timing</th>
<th>Tdap</th>
<th>IPV</th>
<th>MMR</th>
<th>Var</th>
<th>HB</th>
<th>Men-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>First visit</td>
<td></td>
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<td></td>
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<tr>
<td>2 months later</td>
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<tr>
<td>6-12 months later</td>
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<tr>
<td>10 years later</td>
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</tr>
</tbody>
</table>

# Table 3. Routine Immunization Schedule for Adults (≥ 18 Years of Age) Not Immunized in Childhood

<table>
<thead>
<tr>
<th>Timing</th>
<th>Tdap</th>
<th>Td</th>
<th>MMR</th>
<th>Var</th>
<th>Men-C</th>
<th>Pneu-C-23</th>
<th>Inf</th>
</tr>
</thead>
<tbody>
<tr>
<td>First visit</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2 months later</td>
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<tr>
<td>6-12 months later</td>
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<tr>
<td>10 years later</td>
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</tbody>
</table>

**Notes**

(†) Symbols with brackets around them imply that these doses may not be required, depending upon the age of the child or adult at the time the schedule is begun.

**Diphtheria, tetanus, acellular pertussis and inactivated polio virus vaccine (DTaP-IPV):** DTaP-IPV(± Hib) vaccine is the preferred vaccine for all doses in the vaccination series, including completion of the series in children who have received one or more doses of DPT (whole cell) vaccine (e.g., recent immigrants). In Tables 2 and 3, the 4-6 year dose can be omitted if the fourth dose was given after the fourth birthday.

**Haemophilus influenzae type b conjugate vaccine (Hib):** the Hib schedule shown is for the Haemophilus b capsular polysaccharide - polyribosylribitol phosphate (PRP) conjugated to tetanus toxoid (PRP-T). For catch up, the number of doses depends on the age at which the schedule is begun. Not usually required past age 5 years.
**Measles, mumps and rubella vaccine (MMR):** a second dose of MMR is recommended for children at least 1 month after the first dose for the purpose of better measles protection. For convenience, options include giving it with the next scheduled vaccination at 18 months of age or at school entry (4-6 years) (depending on the provincial/territorial policy) or at any intervening age that is practical. In the catch-up schedule (Table 1), the first dose should not be given until the child is ≥ 12 months old. MMR should be given to all susceptible adolescents and adults.

**Varicella vaccine (Var):** children aged 12 months to 12 years should receive one dose of varicella vaccine. Susceptible individuals ≥ 13 years of age should receive two doses at least 28 days apart.

**Hepatitis B vaccine (HB):** hepatitis B vaccine can be routinely given to infants or pre-adolescents, depending on the provincial/territorial policy. For infants born to chronic carrier mothers, the first dose should be given at birth (with hepatitis B immunoglobulin), otherwise the first dose can be given at 2 months of age to fit more conveniently with other routine infant immunization visits. The second dose should be administered at least 1 month after the first dose, and the third at least 2 months after the second dose, but these may fit more conveniently into the 4 and 6 month immunization visits. A two-dose schedule for adolescents is an option.

**Pneumococcal conjugate vaccine - 7-valent (Pneu-C-7):** recommended for all children under 2 years of age. The recommended schedule depends on the age of the child when vaccination is begun.

**Pneumococcal polysaccharide - 23-valent (Pneu-P-23):** recommended for all adults ≥ 65 years of age.

**Meningococcal C conjugate vaccine (Men-C):** if meningococcal C conjugate vaccine is given to infants < 12 months of age, a booster dose should be given in the second year of life (from 12 to 23 months of age). A routine meningococcal conjugate vaccine dose is recommended in early adolescence, even in children immunized as an infant. For routine immunization of adolescents 11-24 years of age, NACI recommends the use of a meningococcal C conjugate vaccine

NACI recommends the use of conjugate meningococcal vaccine for serogroups A, C, Y and W135 (quadrivalent conjugate meningococcal vaccine – Menactra®) for immunization of persons 2-55 years of age in the following high-risk groups:
- Persons with anatomic or functional asplenia;
- Persons who have complement, properdin or factor D deficiencies;
- Travellers when meningococcal vaccine is indicated or required, including pilgrims to the Hajj in Mecca;
- Research, industrial and clinical laboratory personnel who are routinely exposed to *N. meningitidis*;
- Military recruits

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Diphtheria, tetanus, acellular pertussis vaccine - adult/adolescent formulation (Tdap): a combined adsorbed "adult type" preparation for use in people ≥ 7 years of age, contains less diphtheria toxoid and pertussis antigens than preparations given to younger children and is less likely to cause reactions in older people.

Diphtheria, tetanus vaccine (Td): a combined adsorbed "adult type" preparation for use in people ≥ 7 years of age, contains less diphtheria toxoid antigen than preparations given to younger children and is less likely to cause reactions in older people. It is given to adults not immunized in childhood as the second and third doses of their primary series and subsequent booster doses; Tdap is given only once under these circumstances as it is assumed that previously unimmunized adults will have encountered Bordetella pertussis and have some pre-existing immunity.

Influenza vaccine (Inf): recommended for all children 6-23 months of age and all persons ≥ 65 years of age. Previously unvaccinated children < 9 years of age require two doses of the current season's vaccine with an interval of at least 4 weeks. The second dose within the same season is not required if the child received one or more doses of Influenza vaccine during the previous Influenza season.
  • IPV Inactivated polio virus

Immunization of Individuals with a Serious Adverse Event Following a Prior Immunization

Vaccine providers will come in contact with patients who state they had a serious reaction to a particular vaccine. As an immunizer, it is important to determine the type of reaction from the previous injection. Patients may indicate they had a severe local reaction and this is usually due to high circulating antibodies and is not a contraindication to future doses of the vaccine. It is important to differentiate between minor local reactions and an Arthus reaction (most commonly associated with tetanus toxoid). While an Arthus reaction is not a contraindication for subsequent booster doses of tetanus toxoid, future boosters may need to be spaced at longer intervals or anti-toxin levels may be required to determine when boosting is needed.

Immunizers should try to acquire the exact details of the reaction. This would include the type of vaccine, manufacturer, lot and the exact type of reaction. If you feel the reaction has an allergic basis (e.g. anaphylaxis) a consultation with an allergist or the local Medical Office of Health is advisable before administration of future doses.

Patients developing rare neurological conditions such as Guillain-Barré syndrome or rare blood dyscrasias (e.g. thrombocytopenia) within a specific time frame post-immunization are normally contraindicated to receive future immunizations with the same vaccine.

The Canadian Immunization Guide provides an extensive listing of conditions that are true contraindications to immunization. These are covered extensively in Module 9 of this series.
Clinical Tip:

The time frame of some neurologic or hematologic adverse effects is important for determining whether they should be attributed to a vaccine. GBS is between 0-31 days (although 0-5 days is unlikely - takes longer antigen exposure). Within 31 days for thrombocytopenia and platelets must be less than 150,000.

Immunizing Patients with Medical Conditions

There are patients with medical conditions who may require changes in their immunization schedule. The following are some of the recommendations based on the Canadian Immunization Guide and the British Columbia Centre for Disease Control’s immunization in special population document. The Immunization of Special Populations document, which can be downloaded at:


Egg Allergy

- The yellow fever vaccine is contraindicated in patients with an anaphylactic reaction to eggs. Although the MMR vaccine viruses are grown in chick embryos, MMR is safe to administer to patients with egg allergy. Gastrointestinal intolerance to eggs is not a contraindication to administration of any vaccine. Administration of the pH1N1 vaccine was administered successfully in 62 children with egg allergies at high risk of developing disease. Within 1 hour of administration, 2 children developed hives, 1 child had a vasovagal response and 1 child had a hyporesponsive episode. There were no anaphylactic episodes. The authors concluded the pH1N1 vaccine can be safely administered in egg allergic children at high risk of H1N1 disease in a controlled hospital setting.

Immunocompromised Patients

Immunocompromised individuals are many times unable to mount an adequate immune response. A large number of conditions and treatments classify the patient as immunocompromised and they include:

- Asplenia (functional or anatomic).
- Congenital immunodeficiencies involving any part of the immune system.
- Hematopoietic stem cell transplantation (HSCT).
- Human immunodeficiency virus infection (HIV).
- Immunosuppressive therapy including corticosteroids, chemotherapy, radiation therapy, post-organ-transplant therapy, and certain anti-rheumatic drugs such as the biologicals. Individuals with conditions that compromise the effectiveness of their immune system are at particular risk of infection with encapsulated bacteria such as Streptococcus pneumonia (pneumococcus), Neisseria meningitidis (meningococcus), and Haemophilus influenzae type b (Hib). Also this patient population does not respond as well to vaccines, and thus places them at higher risk of morbidity and mortality due to vaccine preventable diseases.
General Recommendations for immunocompromised Patients:

- Ensure that all household members of the immunocompromised patient are adequately immunized.
- There is potential for serious illness and death in the under-immunization of immunocompromised people and every effort should be made to ensure adequate protection through immunization.
- Vaccines may be less effective when administered during the period of altered immunocompetence.
  - Vaccinate at the time when maximum immune response can be anticipated.
  - Vaccinate early when immunologic decline is predictable.
  - Delay vaccination if the immunodeficiency is transient (if this can be done safely).
- There is NO contraindication to inactivated vaccines.
- Administer influenza vaccine yearly.
- Consider passive immunization agents if immunity is required quickly, such as in a varicella-sensitive leukemia patient who was exposed to the disease.
- Assess regularly the need for booster doses should be assessed regularly as duration of immunity is often diminished.
- Avoid live vaccines unless data supports their use or the risk of disease greatly exceeds the risk of immunization.

Asplenic Patients:

- High risk of infection from a variety of pathogens, particularly those caused by encapsulated polysaccharide bacteria (e.g. pneumococcal, meningococcal and Hib).
Meningococcal, pneumococcal and Hib vaccines should be given at least 14 days prior to elective splenectomy or if not possible 14 or more days post-splenectomy. NACI has new recommendations for these patients. They recommend the conjugated vaccine followed by the polysaccharide vaccines for meningococcus and pneumococcus:

Annual influenza vaccine is strongly encouraged

Chronic Renal Disease/Dialysis

- Bacterial and viral infections are a major cause of morbidity and mortality.
- Pay particular attention to ensuring there is adequate protection against varicella, hepatitis B, influenza, and pneumococcal diseases.
- It is best to immunize patients early in the course of their disease as immunosuppression increases as renal failure progresses.
- Hepatitis B immunization may require a higher dose in adults undergoing dialysis to ensure protective antibodies are achieved. Data for alternative dosing schedules are limited for children undergoing dialysis.

Chronic Liver Disease

- Individuals with chronic liver disease, including hepatitis C infection, may not be at increased risk of infection with hepatitis A or B viruses but are at increased risk for fulminant hepatitis A or more severe acute hepatitis B infection should infection occur.
- Immunization should be done early in the course of disease as the immune response may be suboptimal in advanced liver disease.
- Individuals with chronic liver disease (e.g., cirrhosis) and alcoholism are at increased risk of developing pneumococcal infection and severe pneumococcal disease and its complications.

Individuals with Bleeding Disorders

- Individuals who are receiving low doses of acetylsalicylic acid therapy or long term anticoagulation with either warfarin or heparin are not considered to be at higher risk of adverse events following immunization. Discontinuation or interruption of antiplatelet or anticoagulant therapy is not warranted.
- When the efficacy is known to be the same for a vaccine whether it is administered SC or IM, administer the vaccine using the SC route.
- If there is concern that the injection may stimulate bleeding.
  - Schedule it shortly after the administration of anti-hemophilia therapy.
  - Use a fine gauge needle of appropriate length.
  - Apply direct pressure to the injection site (without rubbing) for 5 minutes following immunization.

Individuals with Chronic Heart Disease, Lung Disease, Cystic Fibrosis, Diabetes Mellitus

Children and adults with these conditions are at higher risk of complications from pneumococcal disease and influenza. They should receive the appropriate pneumococcal vaccine and annual influenza immunization.

Hematopoietic Stem Cell Transplantation (HSCT)

- Hematopoietic stem cell transplantation (HSCT) is the transplantation of blood stem cells
derived from the bone marrow.

- This procedure is performed in some patients with hematological disorders or certain types of cancers.
- HSCT generally involves the ablation of the bone marrow followed by reimplantation of the person’s own stem cells (autologous HSCT) or stem cells from a donor (allogeneic HSCT).
- There may be some immunity to vaccine preventable diseases post-transplantation but these levels decline 1-4 years after HSCT if the patient is not re-immunized.
- Immunization with inactivated vaccines is generally started 12 months post HSCT, except influenza which can be administered 6 months post HSCT.
- Do not administer live vaccines until 24 months post HSCT and then only if there is no ongoing immune suppressive treatment or graft-versus-host disease (GVHD).
- Table 4 lists the Canadian Immunization Guide recommendations for HSCT patients.

**Table 4 – Recommendations of Vaccinations Post HSCT**

- **DTaP (< 7 years old) or one dose of Tdap followed by two doses of Td (persons ≥ 7 years old) should be given starting 12 months after transplantation. Three doses are required, at 12, 14 and 24 months after transplantation.**
- **Hib vaccine is recommended starting 12 months after transplantation. Three doses are required (12, 14 and 24 months after transplantation).**
- **Inactivated polio vaccine (IPV) should be given 12 months after transplantation. Three doses are required, 12, 14 and 24 months after transplantation.**
- **Pneumococcal vaccine** is recommended for all patients starting 12 months after transplantation. Adults and children > 5 years of age should receive the Pneu-P-23. Children < 5 years should be immunized with the pneumococcal conjugate vaccine according to the recommended schedule for their age, as if they
had not been previously immunized. Children 2 to 5 years of age should receive both conjugate and polysaccharide vaccine. Because antibody response to pneumococcal vaccination is known to be poor in these patients, some experts recommend that all transplant patients > 2 years of age receive a booster dose of polysaccharide vaccine 1 year after their initial Pneu-P-23 immunization.


- **Inactivated influenza vaccine** should be given annually during early autumn, starting at least 6 months after transplantation.

- **Hepatitis B vaccine** should be given to all patients. Vaccination should be started 12 months after transplantation, and three doses are required, at 12, 14 and 24 months after transplantation.

- **MMR** should be given at least 2 years after the transplantation and only if the recipient is deemed to be immunocompetent by the transplant specialist. It should not be given to those with chronic graft-versus-host disease or those taking immunosuppressive therapy for chronic-graft-versus host disease. A second dose should be given 6-12 months later.

- **Varicella** vaccination of recipients at ≥ 2 years after transplantation may be considered, provided there is minimal immunosuppression and no graft-versus-host disease. Until further data are available, the same age-appropriate dosage schedule as for healthy children may be followed.

- Other live vaccines (BCG, yellow fever and oral typhoid vaccine) are usually contraindicated in hematopoietic stem cell recipients with active graft-versus-host diseases or immunosuppression. If such vaccines are required, consultation with a specialist is recommended.

- Non-immune household contacts should be immunized against measles, mumps, rubella, varicella and influenza. IPV and hepatitis A vaccine should be administered if indicated.

### Solid Organ Transplant

- **Best to immunize all recipients before transplantation whenever possible.** However, many children undergo solid organ transplantation before completion of their immunization schedule. Solid organ recipients usually receive lifelong immunosuppression.

- No formal recommendations have been developed about when to resume vaccination. In general, vaccination should not be re-initiated until at least 6-12 months after transplantation.

- Table 5 lists some general recommendations from the Canadian Immunization Guide for solid organ transplantation.

### Table 5 – Canadian Immunization Guide’s Recommendations for Solid Organ Transplant

- **IPV**: recommended in children and adults before or after transplantation to complete the routine immunization schedule.

- **DTaP** in children < 7 years old and Td (first dose as Tdap) in patients ≥ 7 years old: recommended in children and adults before or after transplantation to complete the routine immunization schedule.

- **Hib vaccine**: recommended in children before or after transplantation to complete the routine immunization schedule. Hib vaccine should be administered to all lung transplant recipients.

- **Pneumococcal vaccine**: recommended before or after transplantation because of the increased risk of invasive pneumococcal disease in these patients. See the schedule described in the section on asplenic
patients. A booster with Pneu-P-23 should be given once after 3-5 years.

- **Meningococcal vaccine**: recommended before or after transplantation if routinely indicated.
- **MMR vaccine**: recommended before transplantation for children, contraindicated after transplantation. Some experts consider using MMR in seronegative females before pregnancy ≥ 2 years after transplantation, when the patient is deemed to be taking minimal immunosuppressive therapy.
- **Inactivated influenza vaccine** is recommended yearly.
- **Hepatitis B vaccine**: recommended in children and adults before or after transplantation to complete the immunization schedule.
- **Hepatitis A vaccine**: recommended for all transplant candidates with chronic liver diseases and for other transplant candidates if indicated. It can be considered for all solid organ transplant candidates before or after transplantation.
- **Varicella vaccine**: recommended before transplantation for non-immune (as determined by serology) children and adults but not recommended after transplantation. However, it may be considered ≥ 2 years after transplantation, when the patient is deemed to be taking minimal immunosuppressive therapy. Until further data are available, the same age-appropriate dosage schedule as for healthy children may be followed. Children awaiting renal and liver transplants may be immunized with one to two doses of varicella vaccine (depending on their age), the last dose being given at least 4-6 weeks prior to transplantation. They should not be receiving immunosuppressive treatment at the time of vaccination. As there is currently insufficient information regarding varicella immunization of cardiac and lung transplant candidates, no firm recommendation can be made at this time for these patients.
- **Other live vaccines** are usually contraindicated after transplantation. However, if some live vaccines are needed, consultation with a specialist is recommended. Household contacts who do not have immunity should be immunized against Hib, measles, mumps, rubella, varicella and influenza. IPV, hepatitis A and hepatitis B and any other vaccines should be administered if indicated.

**Immunization in Pregnancy and Breastfeeding**

There are a number of indications for immunization of pregnant women for the benefit of their own health and the health of their fetus. Recommendations include hepatitis B vaccine in a person with ongoing exposure risks, hepatitis A vaccine in a traveler or close contact of a person with hepatitis A, tetanus toxoid, meningococcal vaccine in an outbreak setting, and pneumococcal and influenza vaccines for all adult indications. Although pregnancy is an immunologically altered state, there are no data to support an inadequate response to vaccines.

**Safety of Immunization in Pregnancy**

There is no evidence of increased risk of adverse reactions to vaccines administered in pregnancy. Reactions to vaccines in pregnancy are usually limited to local reactions, and no increase in anaphylactic reactions or events that might induce pre-term labour has been observed.

A major issue to consider regarding immunization in pregnancy is the risk or benefit of the vaccine for the fetus or neonate. There are no published data showing that any of the currently approved vaccines are teratogenic or embryotoxic, or have resulted in specific adverse
pregnancy outcomes. Rather, there is substantial evidence supporting the benefit of antenatal vaccination on reducing vaccine-preventable disease in the neonate. Risks associated with vaccines in pregnancy are primarily theoretical risks associated with the administration of live virus vaccines. There are circumstances in which immunization with a live-attenuated product may be considered (e.g., yellow fever vaccine). If a live vaccine is inadvertently given to a pregnant woman, termination of the pregnancy is not recommended.

Key Recommendations:
1. In general, live-attenuated virus vaccines (such as measles, mumps and rubella (MMR) or varicella) are contraindicated in pregnancy as there is a theoretical risk to the fetus. However, it is important to mention that to date, there is no evidence to demonstrate a teratogenic risk from such vaccines.
2. There is no evidence to suggest a risk to the fetus or to the pregnancy from maternal immunization with inactivated viral and bacterial vaccines or toxoids.
3. Breastfeeding does not represent a contraindication to any maternal immunization and breast-feeding women who have not received all recommended adult immunizations may be safely immunized. Infants who are breast-fed should receive all recommended vaccines at the usual times.

Table 6 lists the Canadian Immunization Guides recommendations for use of vaccines in pregnancy.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Indication for use in pregnancy</th>
<th>Comment</th>
</tr>
</thead>
</table>
| Measles, mumps, and rubella (MMR) | • Contraindicated  
• Immunize susceptible women post-partum. | • No known fetal effects but live vaccine - theoretical risk.  
• Not reason for termination of pregnancy. |
| Varicella                | • Contraindicated  
• Immunize susceptible women post-partum. | • No known fetal effects but live vaccine - theoretical risk.  
• Not reason for termination of pregnancy. |
<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Contraindication Remarks</th>
<th>Pregnancy Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poliomyelitis Salk (IPV)</td>
<td>• Not contraindicated</td>
<td>• To be considered if pregnant woman needs immediate protection (high-risk situation/travel). No known fetal effects.</td>
</tr>
<tr>
<td>Influenza</td>
<td>• Safe</td>
<td>• No adverse effects.</td>
</tr>
<tr>
<td>Rabies</td>
<td>• Not contraindicated for post-exposure prophylaxis.</td>
<td>• Prudent to delay pre-exposure immunization unless substantial risk of exposure.</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>• No apparent risk</td>
<td>• To be considered in high-risk situations in which benefits outweigh risks.</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>• No apparent risk</td>
<td>• Vaccine recommended for pregnant women at risk.</td>
</tr>
<tr>
<td>Pneumococcal polysaccharide</td>
<td>• No apparent risk</td>
<td>• Vaccine recommended for pregnant women in high-risk categories.</td>
</tr>
<tr>
<td>Meningococcal</td>
<td>• Polysaccharide vaccine safe and effective in pregnancy.</td>
<td>• Polysaccharide vaccine to be administered as per general guidelines for non-pregnant women.</td>
</tr>
<tr>
<td></td>
<td>• No data available for conjugate vaccine</td>
<td>• Consider conjugate vaccine when necessary.</td>
</tr>
<tr>
<td>Disease</td>
<td>Benefits</td>
<td>Drawbacks</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Typhoid</td>
<td>No data on safety.</td>
<td>To be considered only in high-risk cases (e.g., travel to endemic areas).</td>
</tr>
<tr>
<td>Diphtheria/tetanus</td>
<td>No evidence of teratogenicity.</td>
<td>Susceptible women to be vaccinated as per general guidelines for non-pregnant women.</td>
</tr>
<tr>
<td>Pertussis</td>
<td>Lack of data confirming the safety and immunogenicity of acellular pertussis vaccine in pregnant women.</td>
<td>Warranted when the risk of disease outweighs the risk of vaccine both for the mother and the fetus.</td>
</tr>
</tbody>
</table>

### Health Care and Child Care Workers

Health care workers include persons who provide health care to patients or work in institutions that provide patient care. These workers are at risk of exposure to communicable diseases because of their contact with patients or material from patients with infections, both diagnosed and undiagnosed.

Maintenance of immunity against vaccine-preventable diseases is an integral part of a health care facility’s occupational health program. Optimal usage of immunizing agents in hospital staff will not only safeguard the health of staff members but may, in some instances, also protect patients from becoming infected by hospital employees.

Childcare workers have unique and intense exposures to young children on a daily basis. Persons in the childcare field who will be providing direct childcare should have written proof of vaccinations previously received. Maintenance of an up-to-date immunization status is vital to protect the health of both childcare workers and the children in their care. A great summary of this information can be found in the reference: Well-Beings: A guide to Health in Child Care at:


The priority for all health and childcare workers should be to ensure that all routine
immunizations, including booster doses, are completed and booster doses are provided as needed on an ongoing basis.²

Here are some specific recommendations:

- **Hepatitis B:** Recommended for all healthcare workers who may be exposed to blood or body fluids, or who may be at increased risk of sharps injury, bites, or penetrating injuries. The same risk exists in daycare.
- **Hepatitis A:** Prevention of hepatitis A transmission within a hospital should be based on the use of good hygiene practices and patient/childcare techniques, especially proper hand washing and management of potentially infected materials.²
- **Influenza:** Yearly immunization is recommended for both healthcare workers and childcare workers.²

### Immunization of International Travellers

International travellers can be exposed to vaccine preventable diseases that are very rare in Canada. For this reason they may require some specific immunization recommendations. There is no single schedule for the administration of immunizations to travellers.¹ Each schedule must be personalized. The immunization recommendations for travellers will vary according to:¹

- The traveller’s age. An excellent poster you can place in your clinic on travelling abroad with your child can be downloaded at: [http://www.cps.ca/English/surveillance/cpsp/publications/Travel_poster.pdf](http://www.cps.ca/English/surveillance/cpsp/publications/Travel_poster.pdf)
- Immunization history.
- Existing medical conditions.
- Countries to be visited.
- The duration and nature of travel (whether the traveller is staying in urban hotels or visiting remote rural areas).
- The legal requirements for entry into countries being visited.
- The amount of time available before departure.

### Study Note:

The Canadian Paediatric Surveillance Program is presently conducting a study on travellers visiting friends and relatives abroad. Information on the study is available at:


The key recommendation for clinicians is to advise the patient to visit a travel medicine clinic 6 months in advance of travel in order to allow for sufficient time
for immunization schedules to be completed.\textsuperscript{1} Even if a traveller is leaving at short notice, a pre-travel consultation will be beneficial.\textsuperscript{1} A listing of travel clinics across Canada can be found in the Travel Medicine Program section of the PHAC Web site, http://www.travelhealth.gc.ca.

The recommended immunizations for travellers are continuously changing depending on outbreaks in different regions of the world and the introduction of new vaccines. Clinicians are advised to visit the following websites for specific travel recommendations:

- Travel Medicine Program on the Public Health Agency of Canada (PHAC) website at: http://www.travelhealth.gc.ca
- Health Information for International Travel (U.S. Centers for Disease Control and Prevention): www.cdc.gov/travel
- International Travel and Health: Vaccination Requirements and Health Advice (World Health Organization): www.who.int/ith
- PHAC also has a listing of travel-related diseases that may be helpful when counselling patients: http://www.phac-aspc.gc.ca/tmp-pmv/info/index-eng.php

The Canadian Immunization Guides has some general recommendations for traveller immunizations. They can be accessed at http://www.phac-aspc.gc.ca/publicat/cig-gci/p03-10-eng.php

**Immunizing People New to Canada**

Immunization of new residents to Canada can be challenging as:\textsuperscript{1}

- Immunization records may not exist
- Records that do exist may be difficult to interpret because of language barriers
- Immunization schedules and products may differ from those used in Canada. Some vaccines presently included in routine immunizations in Canada are not given in some countries.

To help manage this population there are two very useful tools:
1. The World Health Organization has developed a comparison of the immunization schedules for countries around the world. This can be accessed at: http://www.who.int/immunization_monitoring/en/globalsummary/ScheduleSelect.cfm

2. The Center for Disease Control in the United States has developed a tool to help clinicians translate the foreign vaccine terminology and product contents. This document can be downloaded at: http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/B/foreign-products-tables.pdf

New immigrants, refugees and internationally adopted children may be lacking immunizations and/or immunization records because of their living conditions before arriving in Canada or because the vaccines are not available in their country of origin. The Canadian Immunization Guide advises clinicians that only written documentation of vaccination given at ages and intervals comparable with the Canadian schedule should be considered valid.

Although the potency of vaccines administered in other countries can be generally 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 in determining 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 generally given. *Haemophilus influenzae* type b conjugate, hepatitis B, varicella, pneumococcal conjugate and meningococcal C conjugate vaccines are also in limited use.

The Canadian Immunization Guide advises clinicians that patients with incomplete immunization records should follow the immunization schedules listed in Tables 1, 2 and 3.

**Immunizing “Hard-to-Reach” Individuals**

The current national guidelines on immunization state that:

1. Immunization services should be readily available
2. No barriers or unnecessary prerequisites to the receipt of vaccines should exist
3. All clinical opportunities to screen for needed vaccines and, when indicated, to vaccinate should be used by providers.

Fortunately for most Canadians there are not any significant barriers to immunization and they can receive their scheduled vaccines at the appropriate times. In some populations there is limited access due to their socioeconomic status, lack of access to a primary care clinicians and rural geographical locations. This can limit the opportunity for immunization and many of these patients are at higher risk of vaccine preventable diseases.

Some of the key recommendations for this

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**Immunization Fact:**

A national vaccine registry is needed in Canada to
- identify missed vaccines
- immunize appropriately
- document effectively
population include:

- Take any opportunity of contact with the healthcare system to access and appropriately immunize
- Administer multiple vaccines at the same time, when appropriate
- Consider offering outreach programs for patients that cannot easily access primary care services
- Consider following the immunization schedules listed in tables 1, 2 and 3, for patients with incomplete immunization records.

Managing Disease Outbreak in the Population

Even with an optimal immunization program, disease outbreaks can occur and will require interventions to reduce transmission to a larger proportion of the population. As was apparent in 2009-2010 with the pH1N1 infection, outbreaks and pandemics require a special focus to advert a disease crisis.

In times of outbreaks or pandemics, public health will provide direction of appropriate strategies for clinicians to follow. These strategies are designed to target resources in such a way that they can maximize benefit and reduce the risk to the population. The benefit of having a central agency providing direction is the continuity in the disease prevention message delivered as well as ensuring a single strategy is followed throughout the country.

Key Learning Points

1. Many of the patients immunizers will encounter will have inadequate or incomplete immunization schedules.
2. All children and adults lacking written documentation of immunization should be started on a primary immunization schedule as appropriate for their age.
3. Patients who experienced a serious adverse reaction post immunization should be asked about the nature of the reaction and the type of vaccine, manufacturer and lot should be investigated further.
4. For immunocompromised patients:
   - Ensure that all household members of the immunocompromised patient are adequately immunized.
   - There are no contraindications to inactivated vaccines.
   - Avoid live vaccines.
   - Annual influenza immunization is recommended.
5. Patients undergoing an hematopoietic stem cell transplant (HSCT) will require a special immunization schedule as their immunity to vaccine preventable diseases will be destroyed or will deteriorate rapidly.
6. Live vaccines are normally contraindicated during pregnancy.
7. No vaccine has been shown to be a problem during breastfeeding.
8. Ideally, individuals should consult a travel clinic 6 months prior to travel to receive a customized travel immunization schedule. New immigrants to Canada should have their vaccine status schedule adequately assessed.

Discussion Forum
1. Are there any special tips or techniques that you utilize in your clinical practice to identify patients with incomplete immunization schedules?
2. Did this module correct any of the myths regarding the use of immunization in special populations?
3. Health care workers have a very low immunization rate, do you have any thoughts that can be used to improve immunization in this population?
4. What did you learn from the H1N1 pandemic in 2009-2010 that will help you if we were ever to have another disease outbreak in Canada?

Quiz
You have been asked to consult on a patient that has appeared at the immunization clinic. The patient mentions that he has been living on the street for the last couple of months. He admits to being HIV positive and has a problem with both alcohol and drug abuse. You question about his HIV medications and he states he has been adherent but when you ask him about his immunization status he has not had a vaccine for at least 15 years.
1. Which of the following immunizations would be contraindicated for this patient
   a. Varicella
   b. Pneumococcus
   c. Influenza
   d. All of the above
2. Which of the following vaccines should be recommended for this patient?
   a. Hepatitis A
   b. Tetanus/diphtheria/acellular pertussis
   c. Influenza
   d. All of the above
3. You counsel the patient on the vaccines that you plan to administer and he mentions that the last time he had a vaccine injection he had a very sore arm and the injection site became very sore. He cannot remember which vaccine he reacted to. Which of the following is the MOST appropriate course of action?
   a. Avoid all immunizations as he is likely allergic to a component
   b. Consider using only live vaccines as they are subcutaneous injections and much less likely to cause injection site reactions
c. Immunize as you originally planned but consider keeping him in your clinic for 30 minutes afterwards
d. Consider serological testing before giving the vaccines

You were asked for a consult on an adult patient Matthew B. who underwent a hematopoietic stem cell transplant (HSCT) approximately 6 months ago.

4. Which of the following statements regarding HSCT transplantation is true?
   a. The majority of patients will maintain their immunity to live vaccines post-HSCT
   b. Some HSCT patients will require immunosuppressive agents
   c. If reimmunization is required, live vaccines should be initiated at 18 months post procedure.
   d. All of the above are true

5. Which vaccine could be administered to Matthew today?
   a. Varicella
   b. Hepatitis B
   c. Hib
   d. Influenza

6. Which of the following vaccines should be delayed until at least two years post HSCT?
   a. Varicella
   b. Tetanus/diphtheria/acellular pertussis
   c. Meningococcal
   d. Hib

You have been approached by Margaret S. regarding her current immunization status. She is 4 months pregnant and her immunization schedule is not complete. Based on your assessment she is missing and is due for the following immunizations:

- Varicella
- Tetanus/diphtheria/acellular pertussis
- Hepatitis B
- HPV

7. Which vaccine should be postponed until after delivery?
   a. Varicella
   b. Hepatitis B
   c. Tetanus/diphtheria/acellular pertussis
   d. All of the above

8. Which of the following statements regarding immunizations in pregnancy is FALSE?
   a. There does not appear to be any evidence of increased risk of adverse maternal reactions to vaccines administered in pregnancy
   b. There is an altered immune response to vaccines in pregnancy and they may require a different immunization schedule
   c. There are no published data showing that any of the currently approved vaccines are teratogenic or embryotoxic
d. If a live vaccine is inadvertently given to a pregnant woman, termination of the pregnancy is not recommended
9. Margaret refused immunization during pregnancy. She is current breastfeeding her newborn. Which of the following vaccines are contraindicated in breastfeeding?
   a. Varicella
   b. Hepatitis B
   c. HPV
   d. None of the above

References