Welcome to the First of Two Modules in the Pre-Study!

In Module 1, you will learn about the current status of vaccine preventable illness in the world, and specifically in Alberta.

This Module also reviews the general principles about vaccination, pandemics, pandemic preparedness, and the role of the pharmacist in vaccination.
Module One: Diseases and Vaccines

LEARNING OBJECTIVES:
1. Discuss current status of vaccine-preventable illness in the world and specifically in Alberta.
2. Discuss general principles of vaccination, including immunity, classification and types of vaccines, number of doses, spacing and timing of vaccines,
3. Discuss indications for immunization, Canada’s immunization schedules, and immunizations recommended for travel outside of Canada.
4. Describe adverse reactions to vaccines and contraindications and precautions to their use and the signs, symptoms and treatment of anaphylaxis.
5. Discuss the role of the pharmacist in vaccination.
6. Discuss pandemics, pandemic preparedness and the role of the pharmacist.

Note: During the Pre-Study you will be directed to additional linked resources. If the link does not open immediately, please copy and paste the web url into a browser of your choice.
COMPETENCY:
1. Explain how vaccines work, using basic knowledge of the immune system.
2. Demonstrate an understanding of the rationale and benefit of immunization as relevant to the practice setting.
3. Apply the knowledge of the components and properties of immunizing agents as needed for safe and effective practice.
4. Recognize and respond to unique immunization needs of certain population groups.

Part I:
Discuss current status of vaccine-preventable illness in the world and specifically in Alberta.

REQUIRED READING:

KEY TERMS AND LEARNING:
Alberta’s immunization strategy, occurrence of vaccine-preventable illness in Alberta

Vaccines:
Vaccines, which protect against disease by inducing immunity, are widely and routinely administered around the world based on the principle that it is better to keep people from falling ill than to treat them once they are ill. Suffering, disability, and death can be avoided by their use. Immunization averted about two million deaths worldwide in 2002. In addition, contagion is reduced, strain on health care systems is eased, and money is frequently saved that can be used for other health services. Immunization is a proven tool for controlling and even eradicating disease. An immunization campaign carried out by the World Health Organization (WHO) from 1967 to 1977 eradicated the natural occurrence of smallpox. When the programme began, the disease still threatened 60% of the world’s population and killed every fourth victim. Eradication of poliomyelitis is within reach. Since the launch by WHO and its partners of the Global Polio
Eradication Initiative in 1988, infections have fallen by 99%, and some five million people have escaped paralysis. Between 1999 and 2003, measles deaths dropped worldwide by almost 40%, and some regions have set a target of eliminating the disease. Maternal and neonatal tetanus will soon be eliminated in 14 of 57 high-risk countries.  

New vaccines also have been introduced with significant results, including the first vaccine to help prevent liver cancer, hepatitis B vaccine, which is now routinely given to infants in 77% of WHO’s Member States. Rapid progress in the development of new vaccines means protection will be available in the near future against a wider range of serious infectious diseases.  

Although there are national recommendations for routine immunizations, schedules may vary between the different provinces or territories. Health care is provincially/territorially funded and each of the public health departments carries the roles and responsibilities associated with making decisions on their routine schedules. Such issues like local epidemiology or even funding may determine a provinces/territories routine schedule. Fortunately, Alberta has one of the most comprehensive, publicly-funded immunization programs in Canada; however, vaccine-preventable diseases such as whooping cough, meningococcal and pneumococcal disease still occur in Alberta. The province has a rapidly growing, mobile population that is diverse in age, with time and family constraints. It is essential that vaccine-preventable diseases are accurately diagnosed then reported, so that the proper authorities can monitor and address these cases immediately and prevent outbreaks. These factors point to the necessity of an accessible location for delivery of immunization; pharmacy-based immunization programs may address barriers such as accessibility to vaccine particularly in the event of an outbreak. 

**Did you know?** The ethics surrounding mandatory vs voluntary immunizations and targeted vs universal immunizations continue to be debated. Here is how they are defined and some examples. 

**Mandatory vs Voluntary Immunization** 
Immunization is not compulsory or “forced” in Canada, but we do have regulations that help ensure that as many people as possible are protected by vaccines from the diseases they prevent. Some provinces require certain vaccines to be given before a child can enter school, but these are not mandatory in the usual sense of the term. Rather, parents (or children, if they are old enough to give consent) are required to declare a choice of whether to have their child (or themselves) immunized or not. If they choose not to, the child may be told that he or she must stay home from school if there is an outbreak of disease. This rule is designed to keep unimmunized children from getting sick and to keep the outbreak from spreading. School entry regulations also give parents an opportunity to bring their child’s immunizations up to date. 

**Targeted vs Universal Immunization** 
Specific groups may be targeted to receive certain immunizations that help prevent disease in themselves and /or prevent them from being carriers of disease.
For example: Health care workers may also be required to have certain vaccinations, such as hepatitis B vaccine and an annual ‘flu shot’. If they refuse, they may be required to stay away from work during an outbreak. This practice protects their patients, who could be in grave danger if they became ill with a communicable disease.23

Did you know? Administering a vaccine is a restricted activity.

The following health care professionals may administer vaccines:
• Physicians
• Pharmacists24
• Registered nurses, licensed practical nurses, registered psychiatric nurses are all authorized to administer a vaccine under their governing regulations.25

Part II:
Discuss general principles of vaccination, including: Immunity, classification and types of vaccines, number of doses, spacing and timing of vaccines.

INTRODUCTION TO THE KEY ORGANIZATIONS AND RESOURCES IN IMMUNIZATION IN CANADA:

Canadian Immunization Guide (CIG): Evergreen Edition
Information includes table of vaccines currently approved for use in Canada and updated NACI immunization schedules. A copy of the full guide is available here: http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php

National Advisory Committee on Immunization (NACI)
National committee of recognized experts in the fields of pediatrics, infectious diseases, immunology, medical microbiology, internal medicine and Public Health. Access the NACI website here: http://www.phac-aspc.gc.ca/naci-ccni/

National Immunization Strategy (NIS)
Launched in 2003 as a comprehensive strategy designed to meet new challenges in immunization
and the current and future immunization needs of all Canadians. The NIS has since enabled increased collaboration between Federal, Provincial and Territorial governments and key stakeholders that work in partnership to improve the effectiveness and efficiency of immunization programs across Canada. http://www.phac-aspc.gc.ca/im/nis-sni/index-eng.php

REQUIRED READING:

a) Canadian Immunization Guide: Evergreen Edition

i) General Considerations:

ii) Types and content of vaccines available in Canada:
   http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-tab01-eng.php

iii) Timing of Vaccine Administration:
   http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-09-eng.php


KEY TERMS AND LEARNING:
Immunity (passive & active), live-attenuated, inactivated and subunit vaccines, toxoids, timing of vaccines

The ability our body has to defend itself from bacterial or viral infection is called immunity. For immunity to be effective, the body must be able to recognize antigens (foreign substances). The immune system uses antigens to generate antibodies that direct the immune system to respond and destroy foreign substances.

Defining the different types of immunity:

Passive Immunity
Passive Immunity is provided when a person is given antibodies to a disease rather than producing them through his or her own immune system. Protection is immediate; however, passive immunity lasts only for a few weeks or months. Some examples of passive immunizing agents include botulism antitoxin (equine) (BAtx) and varicella immunoglobulin (VarIg).
Active Immunity
Active immunity results when exposure to a disease organism triggers the immune system to produce antibodies to that disease. Exposure to the disease organism can occur through infection with the actual disease or introduction of a killed or weakened form of the disease organism through vaccination. Active immunity is long-lasting, and sometimes life-long. Some examples of active immunizing agents include hepatitis A (HA) and hepatitis B (HB).

Primary Immune Response
Primary immune response is the immune response occurring on the first exposure to an antigen, with specific antibodies appearing in the blood after a multiple day latent period.

Memory Immune Response
Memory immune response, after an immune response, memory cells are produced. These lay dormant in the lymphatic system for many years, if they detect a pathogen with the specific antigen they can clone rapidly and secrete antibodies.

Secondary Immune Response
Secondary immune response occurs on second and subsequent exposures to an antigen, with a stronger response to a lesser amount of antigen, and a shorter lag time compared to the primary immune response.

Cell Mediated Immune Response
Cell mediated immune response is produced when sensitized T cells directly attack foreign antigens and secrete lymphokines that initiate the body’s humoral immune response.

Humoral Immune Response
Humoral immune response involves the transformation of B cells into plasma cells that produce and secrete antibodies to a specific antigen.

Herd Immunity (or Community Immunity)
Herd immunity (aka Community Immunity) is the resistance to invasion and spread of an infectious agent in a group or community, based on the resistance to infection of a high proportion of individual members of the group; resistance is a product of the number susceptible and the probability that susceptibles will come into contact with an infected person.

Herd immunity occurs when a significant proportion of the population (or the herd) have been vaccinated, and this provides protection for unprotected individuals. The larger the number of people who are vaccinated in a population, the lower the likelihood that a susceptible (unvaccinated) person will come into contact with the infection. It is more difficult for diseases to spread between individuals if large numbers are already immune, and the chain of infection is broken.
There are two basic types of vaccines: live attenuated and inactivated

Live Attenuated Vaccines
*Live attenuated vaccines* contain whole, weakened bacteria or viruses. Since the agent replicates within the vaccine recipient, the stimulus to the immune system more closely resembles that associated with natural infection, resulting in longer lasting and broader immunity than can be achieved with other vaccine types. Live vaccines require careful storage and handling to avoid inadvertent inactivation and are, in general, contraindicated for pregnant women and for people who are immunocompromised. Some examples of live-attenuated vaccines include measles, mumps, and rubella vaccine (MMR II), yellow fever (YF-VAX), and BCG vaccine.¹²

Inactivated Vaccines
*Inactivated vaccines* contain whole or part of (fractional) killed bacteria or viruses and cannot cause the disease it is designed to prevent, even in an immunocompromised person. (Some examples of inactivated vaccines include hepatitis A and polio vaccine (IPV)). Fractional inactivated vaccines can be protein or polysaccharide-based. Antigens of protein-based vaccines include toxoids (inactivated bacterial toxin), subunit and split-virus products. (Some examples of subunit vaccines are pneumococcal and hepatitis B vaccines.)

Because the immune response to inactivated vaccines may be less than that induced by live organisms, inactivated vaccines often require multiple doses: the first dose primes the immune system and a protective immune response develops after the second or third dose. These initial doses are called primary vaccination or the primary series. Because protection following primary vaccination may diminish over time, periodic supplemental doses (booster doses) may be required to increase or boost antibody levels.¹²

Inactivated vaccines may be administered to immunocompromised people if indicated because the antigens in the vaccine cannot replicate and there is no increase in the risk of vaccine-associated adverse events.⁶³

Toxoids
Toxoids are inactivated vaccines comprised of a natural biological toxin that has been inactivated by treating it with a chemical, such as formaldehyde. This modified toxin is non-toxic to the host but is still able to stimulate an immune response in the host to produce an antitoxin. Examples include tetanus and diphtheria vaccines. Unlike other vaccines, toxoids stimulate the immune system to protect against disease-causing toxin produced by the organism, not the organism itself.⁴

Related Terms:
Efficacy: capacity for producing a desired result or effect.³²
Reactogenicity: capable of causing a reaction and especially an immunological reaction.

Compatibility: capable of being administered jointly without interacting to produce deleterious effects or impairing their respective actions.

Can you describe or explain live attenuated, inactivated, subunit/split agents to people without science knowledge?

Spacing, Dosing and Timing of Vaccines

The number, timing, and spacing of doses of vaccines are generally determined by the vaccine manufacturer’s product monograph. However, there are some exceptions in which a province may do a study to determine if off-label dosing will still produce an acceptable immune response. They then incorporated in their routine immunization schedules set at the provincial level.

An example:
The HPV4 vaccine administered in British Columbia uses an off-label 2 dose series at 0, 6 months compared to the vaccine manufacturer’s 3 dose series at 0, 2, and 6 months.

Spacing and timing of vaccines can influence vaccine efficacy. In general, decreasing the dosing interval between doses of a vaccine series may interfere with antibody response and protection. However, there may be times this is required (such as international travel) and the product monograph should be consulted for information regarding decreasing the dosing interval.

An increased interval between doses of a vaccine series does not reduce effectiveness but may delay protection. It is not normally necessary to restart a series of a vaccine if there has been an extended interval between doses. Simultaneous administration of most vaccines does not result in decreased antibody responses or increased rates of adverse reactions. If more than one live vaccine is needed but cannot be administered simultaneously, then they should be separated by at least 4 weeks. When more than one vaccine is given simultaneously, each must be administered using separate syringes, needles and administration sites (see multiple injections Canadian Immunization Guide: Evergreen Edition, http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-07-eng.php). One of the most common breaches of the immunization schedule occurs when people miss an appointment, resulting in a longer than recommended interval between doses of a vaccine. Delays generally do not result in a reduction in final antibody concentrations for most multi-dose products. However, maximum protection may not be attained until the complete vaccine series has been administered.

A follow-up reminder sent to the patient by the pharmacist (e.g., telephone call, email, letter) may help minimize non-adherence to a recommended immunization schedule. This follow-up contact should be documented as well there should be follow-up action plan in the event that the patient is unable to get the scheduled vaccine (i.e. patient has a high fever so vaccination is postponed).

When possible and indicated, the simultaneous administration of vaccines may reduce the chance that a patient is lost to follow-up without receiving the required vaccinations.

It is important to note that similar vaccines are available from different manufacturers but they may NOT be identical (e.g. the influenza vaccine brands Vaxigrip and Fluviral). It is therefore essential that the pharmacist read the appropriate chapter in the Canadian Immunization Guide: Evergreen Edition, http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php see index AND the manufacturer’s package insert before administering the vaccine. The pharmacist may also check Principles of Vaccine Interchangeability, http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-06-eng.php for information regarding the interchangeability principles of vaccines.

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Part III:
Discuss indications for immunization, Canada’s immunization schedules, and immunizations recommended for travel outside of Canada.

REQUIRED READING:

a) The main information page for immunizations in Alberta is found at the Alberta Health website, http://www.health.alberta.ca/health-info/immunization.html

b) See the Canadian Immunization Guide: Evergreen Edition for General Contradictions and Precautions around vaccine safety: http://www.phac-aspc.gc.ca/publicat/cig-gci/p02-02-eng.php including Table 1.

c) See the Canadian Immunization Guide: Evergreen Edition for Immunization information for specific population groups (see list below): http://www.phac-aspc.gc.ca/publicat/cig-gci/p03-eng.php
KEY TERMS AND LEARNING: Indications for immunization and immunization schedules

Pharmacists must be familiar with the:

1. Action
2. Purpose
3. Use
4. Contraindications
5. Precautions, and
6. Nature


- Diphtheria-tetanus (Td)
- Tetanus (T)
- Poliomyelitis
- Haemophilus influenzae type b (Hib)
- Influenza
- Hepatitis A & B (HAV, HBV)
- Human Papillomavirus (HPV)
- Varicella
- Pertussis
- Meningococcal disease
- Pneumococcal disease
- Measles-mumps-rubella (MMR)
- Shingles vaccines
- Travel vaccines (various)

Pharmacists must also be familiar with recommendations for high-risk populations and specific population groups

Vaccines are one of the most important public health achievements; they keep people safe from disease that can be prevented by vaccines. All adults should have their immunization status
reviewed at least once during their adult life. High-risk groups in which specific immunizations are recommended include such groups as:

- People over age 65
- Healthcare workers
- Residents of long-term care facilities
- People under age 65 years considered high risk (i.e., immunocompromised, diabetes, cardiovascular disease, alcohol misuse, lung disease, chronic liver disease, asplenic)

Canada has numerous publicly funded immunization programs; however they vary from province to province. Read http://www.phac-aspc.gc.ca/publicat/cig-gci/assets/pdf/p03-eng.pdf of The Canadian Immunization Guide: Evergreen Edition for immunization information on the following specific population groups:

a. Children & adults with inadequate immunization records
b. Immunocompromised persons
c. Infants born prematurely
d. Patients in health care institutions
e. Persons new to Canada
f. Pregnant and breastfeeding women
g. Persons with neurologic or bleeding disorders
h. Adults
i. Travellers

See http://www.phac-aspc.gc.ca/publicat/cig-gci/p02-02-eng.php. Table 1 lists some host factors and whether or not live/inactive vaccines should be used in these populations.

Further information on immunizations in newly arrived Canadians and international students can be found at Citizenship and Immigration Canada.

It is suggested that travellers visit their health care provider or travel clinic six to eight weeks prior to leaving the country. Some destinations may also have specific vaccination requirements before they allow entry into the country. The Public Health Agency of Canada has established a website geared towards providing information for each individual traveller’s needs and destination found at: http://www.phac-aspc.gc.ca/tmp-pmv/index-eng.php

→ Did you know? Certain behaviours or lifestyle choices may put people at higher risk of certain vaccine preventable diseases. Some examples include:

1) Unprotected sex, tattoos/body piercings, hepatitis B
2) Smokers-influenza, pneumococcal
Pharmacists must NOT administer an injection to a child younger than five years old.8

It is also recommended that pharmacists NOT administer routine childhood immunizations in order to ensure that children receive all required immunizations from Public Health and that their immunization records are complete and accurate.

National Guidelines for Immunization Practices are found at:  
http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-03-eng.php

The Alberta Immunization Schedule is found at:  

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Part IV:  
Describe adverse reactions to vaccines and contraindications and precautions to their use and the signs, symptoms and treatment of anaphylaxis.

REQUIRED READING:  
a) Canadian Immunization Guide: Evergreen Edition found online at:  

KEY TERMS AND LEARNING:  
Contraindications and precautions associated with vaccines, local and systemic reactions, anaphylaxis recognition and management

There are only three contraindications to vaccines currently available in Canada:  
• Allergy to a component of any vaccine,  
• Significant immunosuppression (live vaccines only), and  
• Pregnancy (live vaccines only).

There are precautions related to vaccine administration (see Table 1):  
in the *Canadian Immunization Guide: Evergreen Edition* for both precautions and conditions that are NOT considered contraindications to immunization. Pharmacists should check individual product monographs for contraindications and precautions.

**ADVERSE REACTION TO VACCINES**

*Adverse reactions to vaccines fall into three general categories: local, systemic, and allergic.*

**Local Reactions**

*Local reactions* include symptoms of pain, swelling, and redness at the site of injection. These symptoms generally occur within a few hours of injection and are usually mild and self-limited. They occur most commonly to inactivated vaccines with an incidence of as high as 50 percent. Oral analgesics and antipyretics (such as acetaminophen or ibuprofen) can be used for treatment of minor adverse reactions such as fever or injection site discomfort that might occur following vaccination or ice can be applied to the injection site for comfort. These are NOT allergic reactions.

**Systemic Reactions**

*Systemic reactions,* such as fever and myalgia, mimic a mild form of the natural disease and are more common following administration of a live vaccine. They usually occur a week or two after the vaccine was given.

**Allergic Reactions**

The vaccines used in Canada are highly effective and extremely safe. Vaccines are among the safest medical products available. Serious side effects, such as severe allergic reactions, are very rare. Any component in a vaccine may be a potential allergen. People may report an allergy to a number of vaccine components, such as gelatin, latex, neomycin or thimerosal. Pre-vaccination screening should include questions about possible allergy to any component(s) of the vaccine being administered in order to identify possible contraindications. Has the vaccine recipient ever had a serious reaction (e.g. anaphylactic reaction) after receiving a vaccine or is the recipient aware of any allergies to medications, a component of the vaccine, or latex?

Vaccine providers are familiar with the signs and symptoms of serious immediate allergic reactions to vaccines and are prepared to initiate management of the allergic reaction and administer appropriate medications.

*Anaphylaxis* generally develops within 15–30 minutes of vaccine administration and usually involves at least two body systems (respiration, circulation, and/or skin). The cardinal features of anaphylaxis are: itchy, urticarial rash; angioedema about the face and mouth, which may be
preceded by itchiness, tearing, nasal congestion or facial flushing; hypotension that may progress to shock and collapse (usually occurs later); and respiratory symptoms (sneezing, coughing, wheezing, laboured breathing and upper airway swelling). It is critical that pharmacists participating in pharmacy-based immunization programs be able to recognize and appropriately manage an anaphylactic reaction.


Assessment
When the pharmacist is assessing for contraindications or precautions related to vaccines, assessment should include questioning the patient about the following:

- History of allergy or anaphylaxis related to thimerosal, eggs, latex, gelatin, neomycin (content varies with each vaccine)
- Acute febrile illness
- Acute nerve disorder (such as Guillain-Barré Syndrome)
- Patient under 5 years of age*
- Pregnancy status
- Severely immunocompromised
- Severe bleeding disorder
- Recent administration of a live virus vaccine
- Recent administration of a blood product containing antibodies

Note: *Remember, pharmacists must not administer an injection to a child younger than 5 years of age!

Authorization to Administer Drugs by Injection
Pharmacists on the Clinical Register with the Alberta College of Pharmacists may apply to the Registrar for authorization to administer drugs by injection after meeting these criteria:

1. Successfully complete an injection and immunization education program approved by the College or a CCCEP Stage 2 accredited program.
2. Provide proof of valid CPR (minimally Level C) and First Aid Certification.
3. Apply to the College for authorization to administer drugs by injection. Complete the application form and send it to the College.
Note: Alberta Pharmacists must submit an application within 12 months of completing an accredited program.
- Pharmacist transferring under the Mobility Agreement for Canadian Pharmacists must apply before authorization expires in their province.
- Graduates from a Canadian University must apply within 6 months of graduation.
- Jurisprudence around the administration of injections may vary amongst the provinces/territories. It is the responsibility of the pharmacist to be aware of regulations and standards in the jurisdiction in which they are licensed.

Your application will be reviewed and if successful, you will receive authorization from the Registrar to administer drugs by injection. You must receive authorization prior to providing injection services. Applications are reviewed at regularly scheduled intervals and authorization, including an updated practice permit, will be sent in writing.

Effective at the time of annual permit renewal in 2015, pharmacists who have been authorized to administer drugs by injection will be required to:

a) Complete a professional declaration annually as part of their registration renewal indicating that they:
   i. have taken action to maintain both their clinical and technical competencies required for administering injections, and
   ii. have and will maintain valid CPR and First Aid Certification

Pharmacists who are unable to sign the professional declaration because they have not maintained the competence and proficiency or have not administered injections within the past three years must re-qualify for the authorization to administer drugs by injection by completing an accredited training program. Please see the Alberta College of Pharmacists website for more information, https://pharmacists.ab.ca/authorization-inject

For the expanded scope of practice for all of the provinces and territories see Appendix F or go to http://www.pharmacists.ca/cpha-ca/assets/File/ExpandedScopeChart_SEPT2015_EN.pdf

First Aid and CPR skills will help you manage an adverse reaction to immunization or injection administration!
COMPETENCY:
Communicates effectively about immunization, as relevant to practice settings.

Part V:
Discuss the role of the pharmacist in vaccination.

REQUIRED READING:
a) Addressing Parents’ Concerns: Do Vaccines Contain Harmful Preservatives, Adjuvants, Additives, or Residuals? Found at http://pediatrics.aappublications.org/content/112/6/1394.full.pdf+html. Read the entire article as it will help you to better understand parents’ concerns.


Do you want your patients to learn too? Direct them to this patient reference: Vaccination Information on the Internet: Can You Trust What You Read? It is found online at, http://resources.cpha.ca/immunize.ca/data/0288e.pdf
The role of IMPACT in the of surveillance in designing and monitoring immunization programs

IMPACT, Canada’s Immunization Monitoring Program ACTive, is a paediatric hospital-based national active surveillance network for adverse events following immunization, vaccine failures and selected infectious diseases that are, or will be, vaccine preventable.

IMPACT monitors vaccine safety and the pattern of diseases that are currently or potentially vaccine-preventable in children. IMPACT complements existing national surveillance systems, supports public health action, informs policy dialogue with Federal, Provincial, Territorial and other national stakeholders, and assists in meeting Canada’s international commitments for vaccine safety monitoring and disease reporting.

IMPACT surveillance is designed to detect any unexpected or unusual occurrences that result in hospitalization after vaccines are given and provide information on how well Canadian immunization programs work. It is ideally positioned to monitor any changes in event rates, new, signals of concern and emerging diseases.

Gathering information on cases of selected infections, such as pertussis (whooping cough), the influenza virus, rotavirus, varicella and zoster virus (chickenpox and shingles), and invasive infections caused by *Haemophilus influenzae*, *Neisseria meningitidis*, and *Streptococcus pneumoniae*, helps determine the severity of these infections and measures the benefits of new vaccines, http://www.cps.ca/en/impact

**KEY TERMS AND LEARNING:**

**Pharmacist’s role in immunization; communication strategies**

Pharmacists play a major role in the public health effort to reduce childhood and adult vaccine-preventable infections by increasing immunization rates. Pharmacists can educate, encourage, and facilitate patients receiving appropriate vaccines and can also administer them.

Here are some tools to help:

1. The American Society of Hospital Pharmacists has guidelines surrounding the role of pharmacists in immunization and while not every part of this document is relevant in Canada, there is a pertinent section discussing immunization promotion. Find it at: http://www.ashp.org/DocLibrary/BestPractices/SpecificGdlImmun.aspx

2. Although a ‘mass media’ approach for public communication does not lend itself to pharmacy, there are excellent patient tools such as educational posters and brochures that can be displayed at the pharmacy. Such products are available from Immunize Canada: http://www.immunize.cpha.ca/en/default.aspx
3. Online at http://www.phac-aspc.gc.ca/publicat/cig-gci/p01-04-eng.php of The Canadian Immunization Guide: Evergreen Edition discusses techniques for communicating effectively to patients about immunization. Patients often have various concerns about vaccine safety and the pharmacist should be able to respond effectively to those concerns.

4. The Canadian Pharmacists Association has developed an Influenza Immunization Guide for Pharmacists available at: http://www.pharmacists.ca/cpha-ca/assets/File/education-practice-resources/FluInfluenzaGuideEN.pdf
   This guide outlines many of the processes necessary to hold an immunization clinic in a pharmacy. Pharmacists may wish to use some of these resources for guidelines in developing personalized resources for their pharmacies.


One of the concerns patients often have regarding immunization surrounds the safety of vaccination, especially in children. The American Academy of Pediatrics published an article discussing the issues of preservatives, additives and adjuvants in vaccines. It is found at: http://pediatrics.aappublications.org/content/112/6/1394.full.pdf+html and attempts to address some of parents’ concerns about vaccination. It concludes that the quantities of mercury, aluminum and formaldehyde contained in vaccines are likely harmless. It acknowledges that some anaphylactic reactions do occur with vaccines that contain egg protein and gelatin, generally in patients who have a pre-existing allergy.


**What is the adjuvanted vaccine? What is the difference between adjuvanted and non-adjuvanted?**

An adjuvant is an ingredient of a vaccine that helps create a stronger immune response in the patient’s body. In other words, adjuvants help vaccines work better. Some vaccines made from weakened or dead germs contain naturally occurring adjuvants and help the body produce a strong protective immune response. However, most vaccines developed today include just small components of germs, such as their proteins, rather than the entire virus or bacteria. These vaccines often must be made with adjuvants to ensure the body produces an immune response strong enough to protect the patient from the germ he or she is being vaccinated against. In some vaccines, the weakened or inactivated virus stimulates a strong immune response so no additional adjuvant is needed for it to be effective to protect against infections.

On February 2, 2010, The Lancet printed a retraction of a 12 year old study that implied a link
between autism and the MMR vaccine. Find information about the retraction in the Canadian Medical Association Journal at http://www.cmaj.ca/content/182/4/E199.full?etoc

The original article stood alone as the only 'study' that suggested the MMR vaccine-autism link. However, it was greatly publicized in the media and due to this type of exposure; many parents opted not to vaccinate their children with MMR vaccine. As a result, there were considerable increases in the associated diseases. This situation highlights two important considerations:

1. Mass media (plus social media) can have a considerable impact on how the population is 'educated' and how this may modify their 'risk perception' of immunizations.
2. Pharmacist must stay current in their knowledge of immunization and follow an evidence-based decision making process to ensure their patients are properly informed.

... Part VI Discuss pandemics, pandemic preparedness and the role of the pharmacist.

REQUIRED READING:
a) The Canadian Pharmacists Association has information on Pandemics and the Role of the Pharmacist available at:
   http://www.pharmacists.ca/cpha-ca/assets/File/education-practice-resources/PandemicGuideEN.pdf

b) Comprehensive information about Seasonal Influenza can be found at:

KEY TERMS AND LEARNING: Epidemic, pandemic, preparedness, challenges associated with lack of preparedness, pharmacist’s role in pandemic preparedness, personal protection equipment (PPE), antigenic shift, vaccination, vaccine

An epidemic means that the number of people with a disease in a specific geographical area is higher than usual (Valanis, 1992). Even one case of smallpox or polio in Canada would be an epidemic since it is believed that both diseases have been eradicated in this country. The danger of smallpox has been eliminated worldwide and vaccination against the disease is no longer required. Canada was declared free of polio in 1977. This status has been achieved by an extensive program of immunization, and this level must be maintained to prevent polio from recurring.

A recent example of an epidemic was the outbreak of severe acute respiratory syndrome (SARS) that began in November 2002 in China, and by March 2003, had rapidly spread to Hong Kong, Singapore, Vietnam, Taiwan, Toronto, and other areas. Initially, there was a lack of information about cases of a novel form of atypical pneumonia in China in November/December 2002. The second problem was difficulty in determining the causative organism, which later was identified as a zoonosis caused by a different coronavirus. This organism is highly infectious by close contacts through airborne and droplet spread. It then took time to develop a laboratory test to confirm a diagnosis, and even when the test was available, it was not possible to get a rapid confirmation of disease in individuals in a pre-symptom or early stage of the disease.

Naylor, Chantler, and Griffiths (2004) identified what was learned from SARS outbreaks in Hong Kong and Toronto. The key findings included problems in such areas as preparedness, coordination, and communication.

**Preparedness**
- Slow alert system in Canada
- No plan for an infectious disease outbreak
- Serious lack of knowledge of basic principles of infection control
- Deficiency in providing personal protection equipment (PPE)
- Failure of surveillance which allowed SARS cases to go undetected, leading to a secondary outbreak of SARS
- Lack of frontline preparedness
- Difficulties in mounting a large quarantine operation
- No international consensus on travel screening and border controls

**Coordination**
- Poor linkages between public health and health care system
- Lack of agreement to share public health and clinical personnel which led to shortage of specialized personnel in acute care institutions
- Lack of linkages between hospital and public health diagnostic laboratories
- Initial shutdown of all elective procedures in all 28 Toronto hospitals (which led to a massive backlog) followed by containing SARS cases to four hospitals

**Communication**
- Confused lines of authority among leaders for health care, public health, and general emergency response which led to tensions and no single spokesperson
• Risk information to health care personnel and the public was uneven
• Nurses alerted officials of problems in containing the spread of SARS, but were ignored
• Poor communication between Toronto, Hong Kong, and other centres prevented personnel from
  learning from each other

Despite the problems, public health and health care personnel accepted the challenge and contained
the SARS outbreak.

**Influenza**

Influenza is an example of a disease that can occur as an epidemic or as a **pandemic**. Influenza
is an acute viral disease of the respiratory tract. Major signs and symptoms include fever, sore
muscles, rhinitis, cough, sore throat, headaches, and fatigue. After 2 to 3 days the individual’s
symptoms improve, although the cough and fatigue may persist for several weeks (Nicholson,
1998). The primary complications of influenza are bacterial pneumonia (which can be fatal) and
viral pneumonia.

There are three types of influenza virus: Type A, Type B, and Type C. Type A occurs each year
in humans, avians, and animals such as pigs and horses and can cause epidemics and pandemics.
Type B also occurs each year, primarily in humans, but usually causes a milder illness. Type C has
a more local distribution and may even be asymptomatic (Wilschut & McElhaney, 2005). The
influenza virus also contains the antigens haemogglutinin (with subtypes H1, H2, and H3) and
neuraminidase (with subtypes N1 and N2). These antigens sit on the surface of the virus and are
responsible for the virus’s ability to change (**antigenic shift**). Antibodies produced against one
subtype of antigen are ineffective against another subtype. This is the reason influenza occurs each
year and that WHO recommends the influenza **vaccine** for each year is based on the previous year’s
virus and antigens as well as several current and new strains. The National Advisory Committee on
Immunization Practices makes the final decision on the vaccine composition by taking into account
Canadian data (Public Health Agency of Canada, 2008).

Influenza tends to occur as seasonal epidemics globally each year. It occurs between November
and March in the northern hemisphere and May to September in the southern hemisphere
(WHO, 2009). Those most affected by influenza are the very young, the elderly, and those with co-
morbidities.

**Nurses (Pharmacists) and Influenza Vaccination**

In a study in British Columbia, 25% of health care workers were infected with influenza virus
during the winter months, meaning they could pass the virus to others (Skowronski, Parker &
Strang, 2000). Nurses (and pharmacists) are in a unique position: they can transmit the influenza
virus to vulnerable patients through close personal contact and can influence patients and other
health care personnel to be vaccinated or not. Nurses make up the largest group of health care
providers and have been identified as being the most reluctant to be vaccinated against influenza
(O’Rorke, Bourke, & Bedford, 2003). The National Advisory Committee on Immunization
Practices makes the final decision on the vaccine composition by taking into account
Canadian data (Public Health Agency of Canada, 2008).
(NACI) in Canada reported in 2002 that influenza vaccination rates for health care personnel working in hospitals was 26%, whereas for those working in long-term care facilities the rate was 61%. Because most immunization programs for influenza aim for at least a 70% vaccination rate, the previous results are cause for concern (NACI, 2002).

Nursing students are encouraged to receive the influenza vaccination but are often required to do so if they will be working in long-term care or with other vulnerable patient populations. Their only alternative is to take antiviral medication for the duration of the clinical experience. It is hoped that the nursing (and pharmacy) students of today who are immunized as students will continue to receive influenza vaccination as graduates. There is an ethical element to this discussion: “In the absence of contraindications, refusal by health care workers who have direct patient contact to be immunized against influenza implies failure in their duty of care to patients” (Canadian Immunization Guide: Evergreen Edition, http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/12vol38/acs-dcc-2/index-eng.php#Toc324425257

Nursing students (and pharmacy students) in parts of Canada are participating in giving influenza vaccination to health care personnel and to seniors. This practice has several benefits: students learn about the efficacy of the influenza vaccine and how immunity develops; they learn how to screen prospective participants; they gain practice in administering the vaccine as an intramuscular injection; and they provide health information post vaccination.

**History of Pandemic Influenza**

When influenza occurs worldwide, does not follow seasonal variations, occurs primarily in healthy adults 20 to 50 years old, and accounts for millions of deaths, this is considered a pandemic. Pandemics occur when the influenza virus has changed so dramatically, often through interactions with animal strains, that very few individuals have immunity.

One of the early pandemics occurred in 1918: Spanish flu (H1N1). The end result was up to 40 million deaths, with healthy adults between 20 and 50 years of age being most affected (World Health Organization, 2003).

In 1957, the Asian flu (H2N2) pandemic occurred due to a dual infection with human and avian influenza. In North America, initial outbreaks affected children and young adults, with a second wave affecting adults older than 65 years of age. A vaccine was not ready until July 1957, so only 7 million were immunized. In total, over 1 million deaths occurred worldwide, primarily due to secondary bacterial pneumonia.

In 1968, the Hong Kong flu (H3N2) resulted in more than 1 million deaths worldwide, with those older than age 65 most affected. In 1997, Hong Kong reported the first known occurrences of transmission of avian flu (H5N1) from birds to humans. There were 18 cases and six deaths.
Concerns about a pandemic are rising because of an unprecedented increase in the number of countries with avian flu H5N1 in chickens (Hong Kong) and other poultry in Thailand, Vietnam, Cambodia, Indonesia, Russia, and Europe. The overall goals of planning for a pandemic are to minimize serious illness, the number of deaths, and the degree of societal disruption. In Canada, federal, provincial/territorial and local level agencies have agreed to have a common committee structure and common planning assumptions.

What to Expect
It is not a question of if an influenza pandemic will occur, it is a question of when it will occur. Influenza pandemics occur three to four times in a 100-year period. Once cases are reported, it will take from 1 to 5 months to reach a full-scale pandemic. There will be simultaneous outbreaks with multiple waves and up to 50% of populations will be clinically ill (including health care professionals). There will be severe shortages of vaccine, drugs, hospital beds, and ventilators. It will likely be at least 3 to 4 months before a vaccine is available. It is expected that two doses of the vaccine, 1 month apart, will be required. Health Canada will establish priority groups to receive the vaccine. Once the vaccine is available, vaccine administration will become the priority, taking health care workers away from direct care services. Issues will include finding additional personnel (e.g., [pharmacists], nursing students, [pharmacy students] nursing [and pharmacy] faculty members, and retired nurses) as well as space for vaccine administration. Individual nurses [and pharmacists] can play a role in planning for a pandemic by:

- Yearly flu vaccination and other self care
- Being flexible and prepared to do some things differently

[The Canadian Pharmacists Association (CPhA) website: http://www.pharmacists.ca/cpha-ca/assets/File/education-practice-resources/PandemicGuideEN.pdf outlines some of the roles that pharmacists can play in a pandemic including the prescribing and provision of medication, frontline surveillance and alert, counselling on medications, illness and masks, assisting in triage and monitoring drug utilization. Alberta pharmacists may hold immunization clinics. Individual pharmacists can prepare by being vaccinated and performing self-care as well as being willing to participate in more global preparedness. Pharmacists can also assist in pandemic preparedness by:

- Participating in local and national preparedness activities
- Raise awareness and advocate for people to be prepared
- Develop business continuity plans, and ensure that your hospital or pharmacy has an emergency plan in place
- Obtain training to assist in direct patient care (Public Health Agency of Canada).]

Countries such as Canada and the United States began to stockpile antivirals such as Tamiflu (oseltamivir), which is in a capsule form. With recent reports of a strain of avian flu that is resistant to Tamiflu, stockpiling of a second antiviral, Relenza (zanamivir), which is a powder that is inhaled,
may be required. It is thought that antivirals may be useful to slow the spread of influenza during a pandemic until an effective vaccine can be developed.

Laboratories around the world geared up to increase production capabilities to keep up with current demands for the yearly flu vaccines and antivirals and to be ready to begin development and production of a vaccine once a pandemic begins.

→ Did you know? Different strains for influenza result in about 3,500 Canadian deaths each year.†