Canadian Geriatrics Society

CLINICIAN'S GUIDE TO IMMUNIZATION IN OLDER ADULTS

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Abstract

Vaccines play a key role in protecting our health from vaccine preventable diseases. Older adults have specific vaccine recommendations. This article will discuss these recommendations, provide cases to work through and provide directions on where to find further information. This article does not cover travel vaccines.

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Introduction

Vaccines play a key role in protecting our health from vaccine preventable diseases. Adults, and older adults, may need boosters for vaccines they have previously received, and may need vaccines to protect themselves from diseases that are more common in the adult population. Keeping up to date with vaccinations is necessary to protect those in the patients' proximity who are not eligible for vaccination (e.g, babies, pregnant women and immunocompromised individuals) and to maintain herd immunity within the population. In general, vaccines are less efficacious in individuals who have underlying active disease or who are taking medications that can compromise their immunity. Therefore, all medical professionals should remind their older adult patients that their loved ones should also keep up with their immunizations.

Recommendations regarding which vaccinations to give older adults are made by the National Advisory Council of Immunizations (NACI), which reports to the Public Health Agency of Canada (PHAC). For more information, please visit www.phac-aspc.gc.ca.

This article will provide details about the four vaccinations (influenza, herpes zoster, pneumococcal, Tdap) available to older adults in Canada and will present two clinical cases to help consolidate the knowledge. Of note, should you have an older adult patient with no immunization records (e.g., newly immigrated to Canada), you should consider this individual not immunized and you should follow guidelines according to their age and risk factors (refer to the Canadian Immunization guide: Part 3 – Vaccinations of specific populations).

This article does not address travel vaccines. For travel vaccines medical professionals are encouraged to refer to travel specific resources (the Centre for Disease Control (CDC) website is a preferred resource). In addition, provinces have different coverage policies and we encourage you to check with your provincial health authority to see what is covered for your patients. This article will not cover measles, mumps, rubella, polio HPV, Hep A/B or meningococcal vaccines as they are not considered part of the routine older adult vaccination schedule.

Case 1

Mrs. T comes to see you in your office. She is a 79-year-old female who lives independently at home. She takes a low dose thiazide for blood pressure and Metformin twice daily for Diabetes. Her friend was recently hospitalized with pneumonia and Mrs. T is concerned. She recalls getting 'some type of vaccination' when she was 65 and wonders if she needs a booster. Mrs. T transferred to your practice five years ago and you do not have any records of her vaccination history, but she reports she got all of her 'normal childhood vaccinations'. What do you advise?

Case 2

Mr. M is a frail 85-year-old male, currently residing in assisted living. You are doing your weekly rounds of the facility and the annual influenza vaccination has just come out. You decide to review his vaccination history. He has an extensive past medical history, including coronary artery disease, stroke with residual left-sided weakness, Type 2 DM and he was recently diagnosed with Giant Cell Arteritis. He is currently on Prednisone 40 mg daily. You notice that he received PNEUMOVAX®23 (Pneu-P-23) when he first moved into the facility four years ago, but has never received the herpes zoster vaccination. What do you advise?

Influenza

There are many influenza vaccines available in Canada. These are both live and attenuated, some are trivalent and some are quadrivalent, and as of 2017/18 a high dose trivalent attenuated is available.
PHAC recommends that individuals over the age of 65 receive the vaccination every year. A new influenza vaccine is released each year based on the World Health Organization's recommendations of circulating influenza strains.

Influenza is a respiratory infection caused primarily by the influenza A and influenza B viruses. It is a seasonal virus and in Canada it is typically most prevalent over the winter months. Common symptoms include sudden onset of high fever, chills, myalgias, sore throat, cough, coryza, fatigue and decreased appetite. Seniors and those living in nursing homes are at higher risk of developing complications such as viral pneumonia, secondary bacterial pneumonia and worsening of underlying medical conditions[1].

Influenza causes worldwide epidemics each year, causing roughly 1 billion cases of influenza, about three to five million cases of severe illness and about 250,000 to 500,000 deaths[2]. In Canada, it is ranked as one of the top ten causes of death[3]. Although there is an annual difference in incidence of influenza, it is estimated that in Canada there are 12,200 hospitalizations per year because of influenza and approximately 3,500 deaths[4,5]. It is also known that cases are often under-reported as people do not always seek medical attention.

The influenza vaccine is associated with decreased physician visits, hospitalizations and deaths in high-risk adults[1]. It is known that the immune response generated by vaccination is decreased in the elderly and by the presence of immune compromising conditions[1]. As per the updated NACI guidelines for 2017/18, the high dose trivalent inactivated vaccine is expected to offer superior protection to adults over the age of 65 compared with the standard dose[6].

Current Canadian guidelines recommend:

- Adults over the age of 65 and those residing in nursing homes receive annual vaccination with influenza vaccine.
- Individuals in close contact with individuals over the age of 65 and those in nursing homes, such as staff and family members, should also be immunized as the vaccine will likely be more immunogenic in them and there will be a decrease in overall transmission[1].

Pneumococcal Vaccine

There are two available pneumococcal vaccines in Canada. PREVNAR®13, a pneumococcal 13-valent conjugate vaccine (Pneu-C-13) and PNEUMOVAX®23, a pneumococcal polysaccharide 23-valent vaccine (Pneu-P-23). Each vaccine provides coverage against 13 and 23 different serotypes (with some overlap) of *Streptococcus pneumoniae.*

S. Pneumoniae

S. pneumoniae is the cause of invasive pneumococcal disease (IPD) and is a major cause of community acquired pneumonia (CAP). *S. pneumoniae* lives in the nasopharynx of humans and is transmitted by direct oral contact, respiratory droplets or indirect contact with respiratory secretions of infected or colonized persons. When *S. pneumoniae* migrates to the lungs it can cause pneumonia. Early symptoms of CAP include rigors, high temperatures and productive cough. *S. pneumoniae* pneumonia is the most common presentation among adults and is a common complication following influenza. IPD is a severe form of infection when *S. pneumoniae* enters the bloodstream and causes bacteremia or enters the central nervous system and causes bacterial meningitis. IPD is more common in children less than two years[7,8].

Pneumococcal infections are a major cause of morbidity and mortality worldwide. The World Health Organization (WHO) estimates 500,000 deaths per year. In Canada, PHAC reported 3178 cases of IPD in 2014[9]. The highest incidence was observed in adults aged 60 and older with 21.5 cases per 100,000 population[10]. Case fatality rate for pneumococcal pneumonia ranges between 5-7% and is highest among the elderly[9]. Case fatality rates for IPD range between 15-20%, often in those older than 65 years of age or who have an underlying illness or treatment contributing to an immunocompromised state[11,12].

A Cochrane review in 2013 demonstrated that PNEUMOVAX®23 was associated with a substantial reduction in both IPD and pneumococcal pneumonia[13]. PNEUMOVAX®23 vaccine efficacy is more than 80% against IPD among healthy young adults and ranges from 50-80% in the elderly and high-risk groups[9].

The efficacy of PREVNAR®13 is extrapolated from the CAPiTA trial conducted in the Netherlands. CAPiTA compared PREVNAR®13 to placebo in nearly 85,000 immunocompetent adults ≥65 years of age in the Netherlands who were enrolled between 2008 and 2010 who had not received a pneumococcal vaccine previously and who had no prior history of pneumococcal disease.[14] CAPiTA found 46% efficacy (95% CI 22-63%) of PREVNAR®13 against vaccine-type pneumococcal pneumonia, 45% efficacy (95% CI 14-65%) against vaccine-type non-bacteremic pneumococcal pneumonia and 75% efficacy (95% CI 41-91%) against vaccine-type invasive pneumococcal disease[14].

However, the study is limited in that it was not a head to head study with PNEUMOVAX®23 and it was conducted before the Netherlands used PREVNAR®13 as part of their childhood series of immunizations. Other countries that have introduced a pneumococcal conjugate vaccine into their childhood series of immunizations have seen a dramatic reduction in IPD incidence in adults of strains covered by the childhood conjugate vaccine secondary to herd immunity[15,16].

Current Canadian guidelines recommend:

- Adults require a one-time dose of Pneu-P-23 after the age of 65.
- If they have received Pneu-P-23 before the age of 65, they should receive a booster at least five years after.
- All adults with medical conditions resulting in high risk of IPD (see Table 1 below) should receive one dose of Pneu-C-13 at least one year after any previous dose of Pneu-P-23[7].
- NACI has provided interim guidance in 2016 recommending that ALL adults over age 65 may receive one dose of Pneu-C-13 at least one year after any previous dose of Pneu-P-23[17]. If Pneu-C-13 has been given first, Pneu-P-23 should be given eight weeks later.

Table 1: Medical conditions associated with high risk of IPD as per PHAC guidelines

Non-immunocompromising conditions	Immunocompromising conditions
• Chronic cerebrospinal fluid (CSF) leak • Chronic neurologic condition that may impair clearance of oral secretions • Cochlear implants, including children and adults who are to receive implants • Chronic heart disease • Diabetes mellitus • Chronic kidney disease • Chronic liver disease, including hepatic cirrhosis due to any cause • Chronic lung disease, including asthma requiring medical care in the preceding 12 months	• Sickle cell disease, congenital or acquired asplenia or splenic dysfunction • Congenital immunodeficiencies involving any part of the immune system • Immunocompromising therapy, including use of long-term corticosteroids, chemotherapy, radiation therapy and post-organ transplant therapy • HIV infection • Hematopoietic stem cell transplant (recipient) • Nephrotic syndrome • Malignant neoplasms, including leukemia and lymphoma • Solid organ or islet transplant (candidate or recipient)

Herpes Zoster

There is one available vaccine in Canada, called ZOSTAVAX® a live vaccine of varicella zoster. At the time of publication, the non-live vaccine of varicella zoster, SHINGRIX® has been approved by Health Canada, but NACI has not published their guidance. Available evidence suggests that SHINGRIX® is more efficacious and safer and therefor it is anticipated that vaccination schedule recommendations will change.

Herpes Zoster (HZ) or 'shingles' is caused by reactivation of the *varicella zoster virus* (VZV). VZV as a primary infection causes varicella commonly known as 'chicken pox'. After infection with varicella, VZV establishes latency in the sensory nerve ganglia and can reactivate later as HZ. VZV lives in humans and is spread by direct contact with skin lesions. VZV can also be spread by airborne route if the person has disseminated HZ and less frequently can be spread from fomites (surfaces such as clothing, utensils or furniture). If the receiver has never been exposed to VZV, they will get varicella[18].

HZ infection is characterized by a painful unilateral vesicle eruption usually in a dermatomal distribution. The acute phase can be complicated by vision-threatening eye infections, meningitis, encephalitis, nerve palsies, Guillain-Barré Syndrome and secondary bacterial infections. After the acute infection, 20-30% of adults (more common over the age of 80) can develop post-herpetic neuralgia (PHN), which is characterized by prolonged and debilitating neurogenic pain that persists for more than 90 days from the onset of the rash[18].

Age is the most important risk factor for development of HZ and two-thirds of cases occur in individuals over 50 years of age[18]. Reasons for this include decreased immunity over time following their initial varicella infection and the loss of components of VZV specific cell mediated immunity as a result of the natural aging process[19].

HZ occurs worldwide and increases in incidence in those over age 65. Recent studies in Canada have estimated the lifetime risk of HZ to be as high as 30% in the general population[18]. It is estimated that each year there are 130,000 new cases of HZ, 17,000 cases of PHN and 20 deaths. The risk of mortality from VZV is low[18].

Individuals over the age of 60 who receive one dose of ZOSTAVAX® have a 51% reduction in incidence of HZ, with significant differences between age groups. There is a 64% reduction in incidence in those between the ages of 60-69, a 41% reduction in those between the ages of 70-79 and an 18% reduction in incidence in those over 80[20]. Currently, efficacy has not been studied in the past seven years and is an area of ongoing research[18].

Current Canadian guidelines recommend:

- Adults over the age of 60 without contraindications should receive one dose of HZ vaccine and it can be administered to individuals over the age of 50 with a prior history of HZ at least one year following the last episode of HZ.
- ZOSTAVAX® is a live vaccine and contraindications are to do with primary or acquired immune deficiencies. Please see Table 2 below for contraindications. It is advised that if you are unsure whether it is safe to give the vaccine to consult a medical expert in vaccinations or immunodeficiency.
- Refer to an ophthalmologist prior to giving ZOSTAVAX® to someone with a history of Herpes Zoster Ophthalmicus (HZO) to ensure the virus has cleared before vaccinating[18].
- Please review PHAC guidelines to see if SHINGRIX® has been added to the vaccination schedule.

Table 2: Immunocompromised medical conditions and immunosuppressive medications that are contraindications to receiving ZOSTAVAX® as per PHAC guidelines

Immunocompromising medical conditions	Immunosuppressive medications
• Active untreated tuberculosis • Acute severe illness (should be postponed until resolved) • HIV infection • Congenital immunodeficiency • Malignant hematologic disorders	• 6-mercaptopurine • Alemtuzumab • Anti-thymocyte globulin • Azathioprine • Basiliximab • Cyclophosphamide • Cyclosporine • High-dose systemic corticosteroids (20 mg/day or more of prednisone or its equivalent for an adult) for 14 days or more • Leflunomide • Methotrexate • Mitoxantrone • Most cancer chemotherapies (except tamoxifen, hydroxyurea and gonadotropin release inhibitors, which are not considered immunocompromising). If three months post-chemotherapy and the cancer is in remission, the person is not considered immunocompromised • Mycophenolate mofetil • Sirolimus • Tacrolimus • Non-TNF biologic immunosuppressives used in inflammatory disease

TDap – Tetanus, Diphtheria and Pertussis vaccine

TDap is a combination vaccine, which contains tetanus toxoid, reduced diphtheria toxoid and reduced acellular pertussis vaccine. Common brand names of this vaccine available in Canada include ADACEL® and BOOSTRIX®. Td contains tetanus toxoid and reduced diphtheria toxoid and is used as a booster vaccine every 10 years. Common brand names of this vaccine available in Canada include Td Adsorbed®.

A. Diphtheria

Diphtheria is caused by exotoxin-producing strains of the bacterium *Corynebacterium diphtheriae.* *C. diptheriae* lives in humans and is transmitted person to person by respiratory spread. Diphtheria affects the mucous membranes of the upper respiratory tract. Individuals infected with diphtheria will have symptoms of mild fever, sore throat, dysphagia, general malaise and loss of appetite. Examination can reveal an adherent, asymmetrical, grayish white membrane over the tonsils and oropharynx.[21]

Globally, diphtheria is endemic in developing countries and rare in developed countries secondary to established immunization programs. The WHO reported 4,778 cases in 2015, with three cases in Canada.[22]

The case fatality rate is about 5-10%; the highest rates occur among the unimmunized who are very young and unimmunized elderly and in non-endemic countries because diagnosis is often late[21].

Individuals who have completed the primary diphtheria series (at least three doses of vaccine) have a 97% likelihood of achieving full immunity. Individuals who are not immunized or who have suboptimal immunization travelling to endemic areas (please refer to the CDC recommendations) are most at risk of contracting diphtheria[21].

Current Canadian guidelines recommend:

- Adults who have not previously received a primary series (at least three doses) of diphtheria toxoid containing vaccine should receive one dose of TDap vaccine, followed by two doses of Td vaccine, at eight weeks and six months respectively.
- Adults who have already received their primary series are recommended to receive a booster dose of a diphtheria toxoid containing vaccine every 10 years[20].

B. Tetanus

Tetanus, also known as 'lockjaw', is caused by a neurotoxin produced from the bacterium *Clostridia tetani*. *C. tetani* mainly lives in soil and is found worldwide. Infections usually occur when a wound is contaminated with soil, faeces or dust[23]. Tetanus is characterized by muscle spasms that often start in the jaw muscles and descend throughout the body. As the disease progresses, individuals get prolonged spasms, which cause complications, such as breathing difficulties, trouble swallowing and death.

Globally, tetanus most often occurs in agricultural areas and densely populated regions. It is relatively rare in developed countries, secondary to established immunization programs. The WHO reported 10,301 worldwide cases of tetanus in 2015, with four cases reported in Canada[22]. PHAC reports that in Canada between 1990 and 2010, the number of cases reported annually ranged from 1-10, with an average of four per year. During this period, persons 60 years of age and older accounted for 48% of cases[23].

Case fatality ranges from 10-80% in the unvaccinated. Mortality is highest in infants and the elderly[23]. Disease rarely occurs in the vaccinated, and when it does it is usually very mild.

Individuals who have completed the primary tetanus series of three injections have a 99% likelihood of achieving full immunity. Factors associated with decreased immunity include increasing age, birth outside Canada and lack of immunization records[23].

The vaccine is safe to use in immunocompromised adults – of note it is estimated 50% of immunity is lost in adults undergoing chemotherapy for leukemia or lymphoma[23]. However, current guidelines recommend routine use for vaccination (booster every 10 years).

Current Canadian guidelines recommend:

- Adults who have not previously received a primary series (at least three doses) of tetanus toxoid-containing vaccine should receive one dose of TDap vaccine followed by two doses of Td vaccine.
- Adults who have already received their primary series are recommended to receive a booster dose of a tetanus toxoid-containing vaccine every 10 years[23].

C. Pertussis

Pertussis, also known as 'whooping cough', is a respiratory illness caused by the bacterium *Bordetella pertussis. B. pertussis* lives in humans, is transmitted via respiratory droplets and is highly communicable.

Pertussis or whooping cough has three stages of infection. The first stage is characterized by coryza, low-grade temperature and a mild cough. After one to two weeks of worsening cough, the paroxysmal stage begins. The paroxysmal stage is characterized by bursts of rapid coughing ending with an inspiratory whoop and occasional post-tussive vomiting. This can last for up to 10 weeks. The convalescent stage is similar to the paroxysmal stage, but less severe, and is characterized by a slow gradual recovery[24].

Pertussis is endemic worldwide, even in areas with established vaccination programs. The WHO reported 123,210 cases worldwide in 2015, with 3510 cases reported in Canada[22]. Canada last had an outbreak of Pertussis in 2012, in which the incidence increased seven-fold[25]. While all ages were affected, children under the age of one and between the ages of 10 and 14 were most likely to be infected[25]. Case fatality is rare – one to four deaths related to pertussis occur each year in Canada, typically in infants who are too young to be immunized or unimmunized or partially immunized children[25].

Individuals who have received the primary series (three injections) with an acellular pertussis vaccine have an 85% chance of achieving immunity, which increases to 90% after the first booster[24].

Current Canadian guidelines recommend:

- Adults who have not received their primary series (at least three doses), require one vaccination with TDap.
- Adults who have completed their primary series in childhood require one booster in adulthood.
- NACI also strongly recommends that those who have not received their booster, and anticipate having regular contact with an infant, should receive TDap, ideally two weeks before contact with the infant[25].

Conclusion

Vaccinations play an important role in maintaining the health of older adults and their close contacts. Each adult over the age of 65 should receive an annual influenza vaccine, receive verification that they are up to date with their tetanus and diphtheria boosters, be offered HZ vaccine (if no contraindications) and receive at least one dose of Pneu-P-23 and if applicable be offered Pneu-C-13. These recommendations are summarized in Table 3.

Table 3:

Vaccine	Frequency
Influenza	Annually
Pneu-P-23 (only available as PNEUMOVAX®23 in Canada)	One dose > age 65. If received a dose prior to age 65, booster five years later.
Pneu-C-13 (only available as PREVNAR®13 in Canada)	One year after any PNEUMOVAX®23 dose. One year after PNEUMOVAX®23 if has medical condition listed in Table 1.
HZ vaccine (only available as ZOSTAVAX® in Canada)	One dose >60 One dose >50, if HZ condition at least one year ago. See contraindications in Table 2.
TDap	One booster dose per adult lifetime.
Td	Every 10 years.

Case 1

Given her lack of vaccination history, Mrs. T should receive a booster of tetanus, diphtheria and pertussis by giving her one dose of TDap now and ensure she receives a Td booster every 10 years. She may have received immunization for pneumococcus or herpes zoster five years ago. Given her history of diabetes, she should receive Pneu-P-23 followed by Pneu-C-13 one year later. Given her age, she should receive immunization for Herpes Zoster as there is no danger in giving two doses five years apart. If available, she should be offered the influenza vaccine.

Case 2

With his current vaccination history, you should also see if Mr. M has received his one-time adult booster of TDap and 10 year booster of Td. Given his medical comorbidities (diabetes and long-term steroids), he should receive one dose of Pneu-C-13 as well as the influenza vaccination. Given his prednisone use, his response to vaccines may be attenuated. While in this particular case his prednisone course is anticipated to be long term, in someone with a shorter course, it may be advisable to postpone immunizations until the prednisone course is finished.

Given his likely long-term immunocompromised condition he should not receive ZOSTAVAX® at this time. However, given the risk of Herpes Zoster, it would be entirely appropriate to consult an expert in immunizations or immunology for further review.

Consult NACI guidelines to see if any new guidance about SHINGRIX® has been added.

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