

The Overlooked Issue of Shingles Infections in Older Canadians, And How to Address It!



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Disclaimer: The NIA has developed this document to provide a summary of general information about the burden of shingles infection and the benefit of the shingles vaccine, as well as provide evidence-informed recommendations to support uptake of the vaccine. The NIA's work is guided by the current evidence. This document can be reproduced without permission for non-commercial purposes, provided that the NIA is acknowledged.

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About the National Institute on Ageing

The National Institute on Ageing (NIA) is a policy and research centre based at Ryerson University in Toronto. The NIA is dedicated to enhancing successful ageing across the life course. It is unique in its mandate to consider ageing issues from a broad range of important perspectives, including those of financial, physical, psychological, and social wellness.

The NIA is also focused on leading cross-disciplinary research to better understand the issues that can lead to the development of evidence-informed actionable insights that can meaningfully contribute towards shaping the innovative policies, practices and products that will be needed to address the multiple challenges and opportunities presented by Canada's coming of age. The NIA is committed to providing national leadership in promoting a collaborative approach that also seeks to continually establish municipal, provincial, federal and global partnerships with other academic centres, and ageing-related organizations.

The NIA further serves as the academic home for the National Seniors Strategy (NSS), an evolving evidence-based policy document co-authored by a group of leading researchers, policy experts and stakeholder organizations from across Canada and first published in October 2015. The NSS outlines four pillars that guide the NIA's work to advance knowledge and inform policies through evidence-based research around ageing in Canada that include Independent, Productive and Engaged Citizens; Healthy and Active Lives; Care Closer to Home; and Support for Caregivers.

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List of Acronyms

Advisory Committee on Immunization Practices (ACIP)

Canadian Health Survey on Seniors (CHSS)

Centers for Disease Control and Prevention (CDC)

Chronic Obstructive Pulmonary Disease (COPD)

Coronavirus Disease 2019 (COVID-19)

First Nations Health Authority (FNHA)

Herpes Zoster (HZ)

Herpes Zoster Ophthalmicus (HZO)

Human Immunodeficiency Virus (HIV)

Inflammatory Bowel Disease (IBD)

Joint Committee on Vaccination and Immunization (JCVI)

Live Attenuated Vaccine (LZV)

National Advisory Committee on Immunization (NACI)

National Association of Pharmacy Regulatory Authorities (NAPRA)

National Drug Schedules (NDS)

Post-Herpetic Neuralgia (PHN)

Public Health Agency of Canada (PHAC)

Recombinant Subunit Vaccine (RZV)

United States (US)

Vaccine Efficacy (VE)

Varicella Zoster Virus (VZV)

World Health Organization (WHO)

Table of Contents

Executive Summary	07
Background and Context	09
Vulnerable Populations at Greatest Risk of Developing Shingles	11
The Burden of Shingles in Canada	16
Understanding Shingles Vaccines	18
Who Should Get Vaccinated Against Shingles?	22
Vaccination Administration	23
Vaccination Outcomes in Canada	26
International Examples of Shingles Vaccine Coverage and Administration	29
Vaccine Hesitancy	33
An International Comparison of Barriers Towards the Uptake of the Shingles Vaccine	34
Evidence-Based Recommendations	38
Concluding Thoughts	43
References	44

Executive Summary

Canada's National Advisory Committee on Immunization (NACI) recommends that all adults aged 50 years and older be offered the recombinant zoster vaccine to provide protection against shingles, unless there are contraindications (Public Health Agency of Canada [PHAC], 2018).

Despite this universal coverage recommendation, only 27% of Canadians aged 50 years and older reported having received a shingles vaccine, with rates varying considerably across Canada's provinces and territories (PHAC, 2021c; Statistics Canada, 2021b).

Shingles (herpes zoster) is an infection that usually presents as a painful rash (Sampathkumar et al., 2009). It is caused by the reactivation of the varicella zoster virus, which is also the virus responsible for chickenpox infections (PHAC 2013; PHAC 2018). The most common complication of a shingles infection is post-herpetic neuralgia (PHN), a painful condition that remains active for more than 90 days from rash onset (PHAC, 2018; PHAC, 2022). Unfortunately, there is no cure for shingles. Current treatment options are aimed principally at managing pain and other symptoms (National Institute on Aging, 2021).

Shingles infections often occur as an individual's immune system weakens, which makes older adults, those who are

immunocompromised, and/or living with chronic conditions more vulnerable to the risk of infection and complications (Kawai & Yawn, 2017; PHAC, 2018). Canadian studies have found that older adults, have higher rates of infection as well as shingles-related complications (PHN), hospitalizations, and deaths (Letellier et al., 2018; Marra et al., 2016a; PHAC, 2018).

Despite shingles not being a public health reportable condition in Canada and there being no national surveillance program, it was recently predicted that over 90,000 new cases occur annually among adults aged 50 years and older (Drolet et al., 2019). This has resulted in an annual impact of between \$67 - 82 million on Canadian health care systems, largely associated with the higher prevalence of shingles in older adults and its related complications such as PHN (Bennett & Watson, 2009; Boivin et al., 2010; Brisson et al., 2008).

The Canadian vaccine landscape is fragmented. While Ontario, Yukon, and Prince Edward Island provide free shingles vaccines for different older adults age groups, Alberta is the only other jurisdiction with a publicly funded program (solid organ transplant recipients aged 18 years and older) (Government of Alberta, 2022a; Government of Prince Edward Island, 2022a; Government of Yukon, n.d.; Ministry of Health, n.d.; PHAC, 2019b). All other provinces and territories require residents to pay around \$200 - \$300 out-of-pocket for the vaccines (HealthLinkBC, 2019; PHAC, 2019b). There are also significant differences in Canada's provinces and territories regarding who can administer these vaccines and where they can be purchased.

Based on the prevalence of shingles in older adults, the costs to health systems in managing the disease, and the patchwork of vaccination coverage provincially and territorially, there is additional work to be done to improve the prevention of shingles in Canada.

The NIA has developed eight evidence-informed policy recommendations and practice approaches that can be used by health authorities and organizations to support vaccination efforts and increase overall prevention of shingles across Canada.

- 1. Promote a Life-Course Vaccination Schedule that Includes Older Adults**
- 2. Improve the Surveillance of Shingles Cases Across Canada and its Implications on Canadian Healthcare Systems**
- 3. Improve Reporting and Monitoring of Shingles Vaccination Rates**
- 4. Provide the Shingles Vaccination Free of Cost to all Eligible Canadians Aged 50 Years and Older**
- 5. Adhere to Canada's Current NACI Statement for Shingles Vaccination**
- 6. Provide Clinician Education and Support for Pharmacists, Primary Care and Other Health Care Providers to Deliver Vaccinations**
- 7. Recommend the Administration of Shingles Vaccine in Conjunction with Other Vaccines, Where Applicable, Including the Influenza and COVID-19 Vaccines to Improve Uptake and Compliance**
- 8. Harmonize Vaccination Administration Across and Within Canada's Provinces/Territories**

Background and Context

What is Shingles?

Shingles, also known as herpes zoster, is an infection that usually presents as a painful rash caused by the varicella zoster virus (VZV) (Sampathkumar et al., 2009). This virus is also responsible for varicella (chickenpox) infections, which usually occur during childhood (World Health Organization [WHO], 2014). Cases of shingles commonly appear on the chest, followed by the face (Sampathkumar et al., 2009). The majority of people will only experience one case of shingles during their lifetime, but it is possible for this infection to appear multiple times in the same individual, especially among those who may be immunocompromised (National Centre for Immunisation Research and Surveillance [NCIRD], 2019d; Russell et al., 2014).

How do you get Shingles?

Cases of shingles are caused by the reactivation of the dormant VZV virus from an earlier chickenpox infection (PHAC 2013; PHAC 2018). Cases of shingles often occur when an individual's immune system weakens, most commonly due to the normal ageing process of immunosenescence; this is the natural suppression or weakening of our immune system as we age (PHAC 2018). Those with shingles can transmit VZV only to individuals who have never experienced chickenpox infections or obtained a varicella or chickenpox vaccination (NCIRD, 2019a). Transmission of the VZV virus only occurs during the blister-phase of a presenting shingles-associated rash, and largely through direct contact (NCIRD, 2019a; PHAC, 2020).

What are the Symptoms of Shingles?

At the beginning stages of a shingles infection, individuals usually feel itching, tingling, or pain prior to the rash becoming visible (NCIRD, 2019c). The rash then appears with blisters, usually as a strip on one part of the body, following the path of an underlying nerve (PHAC, 2013). Rashes may also appear on the head, known as 'herpes zoster ophthalmicus' (HZO) (Davis & Sheppard, 2019). Unlike chickenpox, where presenting blisters can be at different stages, shingles lesions usually all present at the same stage, as they are localized around the same nerves (Davis & Sheppard, 2019). The blisters dry and scab over in seven to 10 days, with the rash fully clearing within weeks, but may sometimes leave behind scars (PHAC, 2013; NCIRD, 2019e). It is important to note that sometimes rashes may be widespread across the body or there may not be a rash at all, a condition known as 'zoster sine herpette' (NCIRD, 2019c; Schutzer-Weissmann & Farquhar-Smith, 2017). Other infectious symptoms may include chills, upset stomach, malaise (discomfort), headache, and fever (NCIRD, 2019c; Wollina, 2017).

What are the Complications of Shingles?

Beyond the discomfort of symptoms, there are also major complications that individuals can face from this infection, the most frequent being 'post-herpetic neuralgia' (PHN) (PHAC, 2018). This is a painful condition that affects the nerve fibers and skin, and can remain for more than 90 days beyond the onset of the rash (PHAC, 2022). Not all individuals

experience the same type of pain. Some feel constant discomfort, whereas others may experience intermittent or evoked pain (Schutzer-Weissmann & Farquhar-Smith, 2017). The pain from PHN can also be so intense that it can significantly impact one's quality of life and daily activities (PHAC, 2018; NCIRD, 2019a). Populations with a greater risk of contracting PHN include those living with chronic conditions and/or immunocompromised, and older adults (PHAC, 2022).

When a case of shingles occurs on a person's face, and especially involving the eye, known as 'herpes zoster ophthalmicus' (HZO), it can lead to scarring, chronic pain, and vision loss (PHAC, 2013; PHAC, 2018). Studies noted how HZO and shingles are significantly associated with an increased risk of cerebrovascular events (ex. stroke), with the latter also significantly associated with cardiac events (ex. coronary artery disease) (Erskine et al., 2017). Other complications may include: central nervous system infections (infections of the brain or spinal cord), neuromuscular diseases (ex. pneumonia, hepatitis), nerve palsies (lack of nerve function), and bacterial superinfections (resistant secondary infections) (Erskine et al., 2017; NCIRD, 2020a; PHAC, 2022). Fortunately, the risk of death from contracting shingles is quite low (PHAC, 2018).

What are the Treatments for Shingles?

There is currently no cure for shingles. Current treatment options aim to manage the associated pain and symptoms that infections can cause (National Institute on Aging, 2021). The infection is often treated at home through various medications and over-the-counter products (ex. lotions to reduce itching) (National Institute on Aging, 2021; NHS 24, 2021). Antiviral medications (ex. famciclovir, valaciclovir, acyclovir) are usually prescribed to lessen the duration and severity of symptoms and also to reduce certain complications (NCIRD, 2019e; Opstelten et al., 2008). This treatment should be started as soon as possible (within 72 hours of onset of rash), to ensure it is most effective (NCIRD, 2019e; WHO, 2014). For those with severe complications or who are immunocompromised, intravenous antiviral therapy is recommended (WHO, 2014). Numerous medications are used for managing pain and swelling with agents such as corticosteroids, opioids, and NSAIDs (e.g. ibuprofen) often used to treat severe pain (NHS 24, 2021; PHAC, 2013; WHO, 2014).

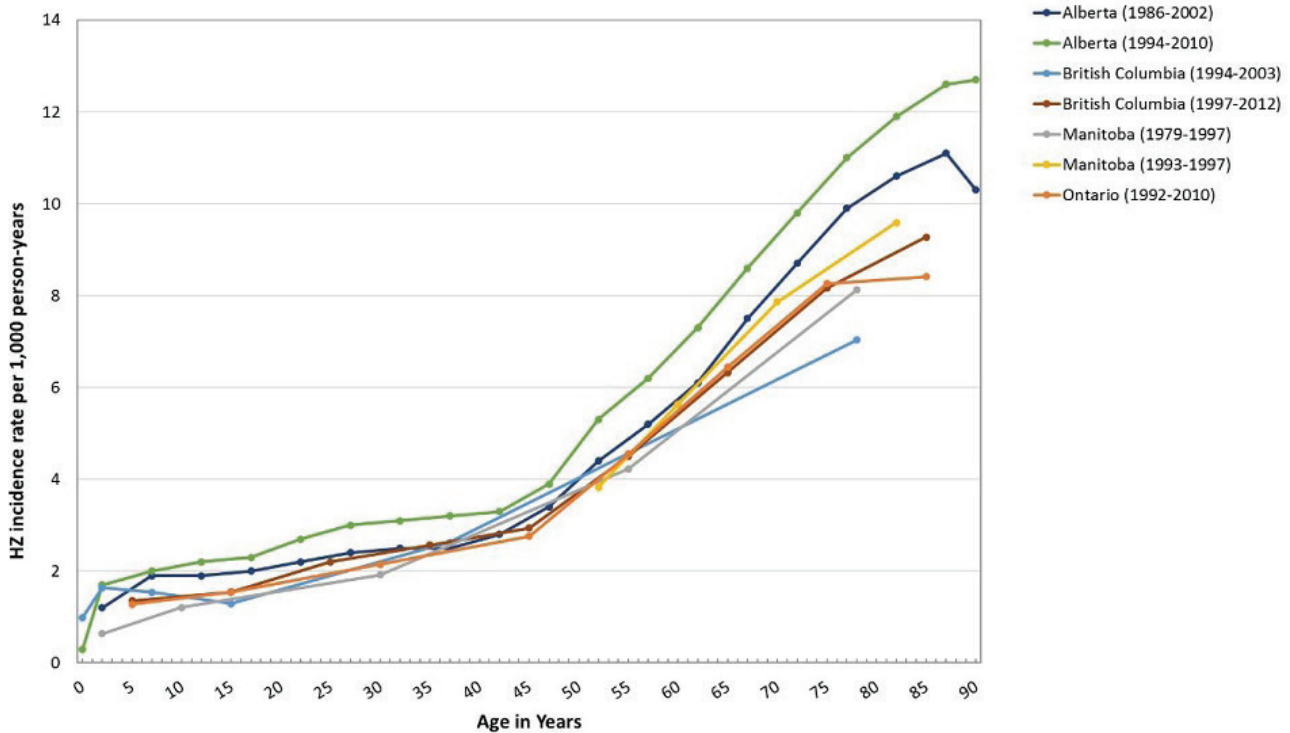
Vulnerable Populations at Greatest Risk of Developing Shingles

Older Adults

As previously noted, older age is a risk factor for developing shingles, as the immune system tends to naturally weaken as people age, a process known as ‘immunosenescence’ (PHAC, 2022). This process, decreases the body’s specific immunity against VZV, increasing the risk for developing a shingles infection (Brosio et al., 2018; NCIRD, 2020a).

This is evident in the fact that over two-thirds of shingles cases occur among adults aged older than 50 years (PHAC, 2022). The incidence of shingles also increases with age, with Canadian studies noting four to six cases per 1,000 persons per year for adults aged 50 years and older, and eight to 13 cases per 1,000 persons per year in adults aged 80 years and older (PHAC, 2018) (Figure 1).

Figure 1: Age-Specific Shingles Incidence Rates per 1,000 Person-Years Reported Among Published Studies From Canadian Provinces and/or Territories.



From “Updated Recommendations on the Use of Herpes Zoster Vaccines,” by Public Health Agency of Canada, 2018. Copyright 2018 by the Minister of Health. Reprinted with permission.

Please note: where rates were reported for a range of ages, age was plotted based upon median age of the age category. For age categories that included a non-discrete age range, (i.e. ages less than or greater than a designated age), the category minimum and maximum ages were presumed to be 0 and 90 years, respectively.

Shingles-associated hospitalization rates in Canada are highest for those aged 65 years and older (PHAC, 2018). In regard to complications, there is a significant association between age and the development of PHN (NCIRD, 2019c).

With each passing decade a person’s risk of experiencing post-herpetic neuralgia (PHN) increases between 1.22 and 3.11 times (Forbes et al., 2016).

Provincial data have found that the death rates are drastically higher for those aged 65 years and older compared to the overall population (Letellier et al., 2018) (Table 1).

Table 1: Shingles-Associated Death Rates Across Provincial Studies

	All Ages	Adults Aged 65 Years and Older
Death Rate (per 1 000 000 Years of Person Life)	0.7 – 1.2	5.5 – 8.6

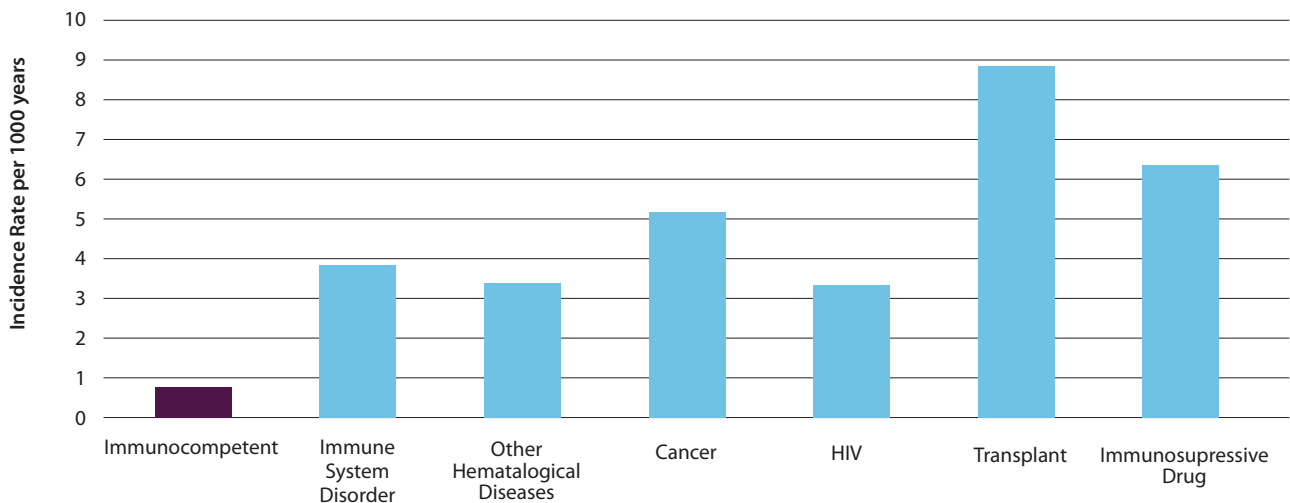
Data from Edgar et al. (2007), and Letellier et al. (2018).

Immunocompromised Individuals

As noted earlier, an increased risk of developing a case of shingles is often related to the decline of the body's specific immunity against VZV (NCIRD, 2020a). This makes populations who are immunocompromised, either because of a medical condition or treatment, more vulnerable to developing shingles (NCIRD, 2019d). Examples of conditions that result in elevated risk include, autoimmune diseases (such as rheumatoid arthritis and systemic lupus erythematosus), cancer, human immunodeficiency virus (HIV), as well as being a bone marrow or solid organ transplant recipient (Kawai & Yawn, 2017; NCIRD, 2020a). Examples of immunosuppressive medication include biologics, steroids, or transplant-related drugs (Marra et al., 2016b; NCIRD, 2020a).

A recent systematic review noted that the risk of shingles infections varied greatly among adults depending on their underlying immunocompromising condition. Transplant recipients, for example, were shown to be more vulnerable than HIV patients (McKay et al., 2019) (Figure 2). Also, those who are immunocompromised are at risk for rashes that last longer, more complications, and symptoms that spread across the body (NCIRD, 2020a; PHAC, 2022). This is demonstrated in numerous studies that note an increase in the risk of PHN complications, such as persistent long-term pain, for those who are immunocompromised (Chen et al., 2014; Forbes et al., 2016). Rates are also higher among those with immune-altering conditions (Chen et al., 2014).

Figure 2: Annual Shingles Incidence Rates (Within Hospitals) of Adult (18 Years and Older) Patients by Immunocompromising Conditions in Ontario, Canada



Data from Buchan et al. (2020).

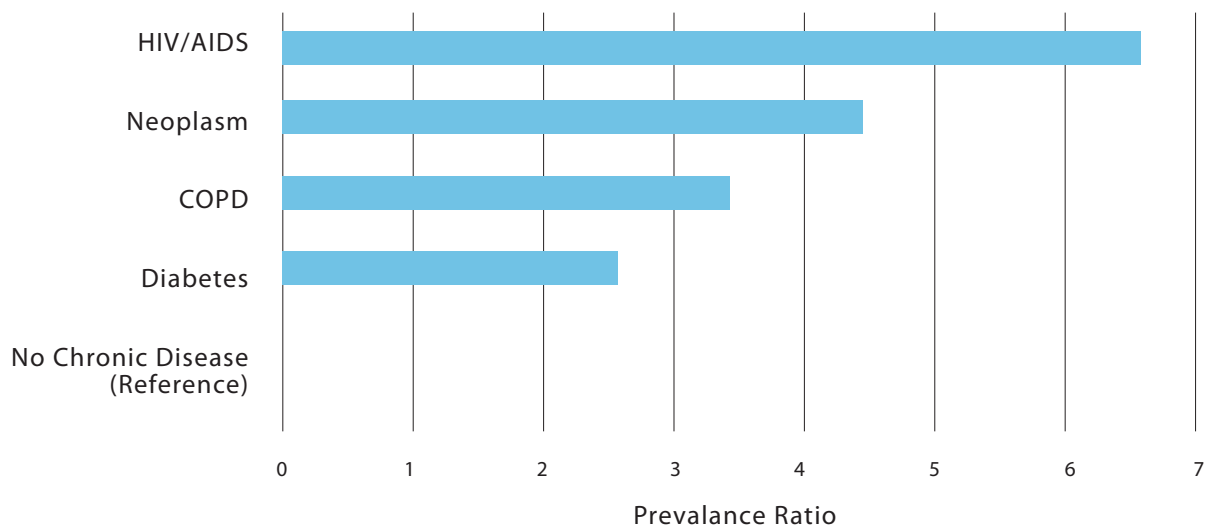
Living with Chronic Conditions

Numerous chronic conditions have been found to be associated with an increase incidence of shingles infections including asthma, inflammatory bowel disease (IBD), and chronic obstructive pulmonary disease (COPD) (Kawai & Yawn, 2017) (Figure 3).

The most prominent relationship has been noted around the influence of diabetes on a person’s susceptibility to, and experience

with, shingles infections (Kawai, & Yawn, 2017; PHAC, 2022; Saadatian-Elahi et al., 2020). For example, it was found that diabetes was associated with a 1.3 times increased risk for shingles (Kawai, & Yawn, 2017), possibly due to the lower immunity against VZV, in comparison to other participants (Okamoto et al., 2009). People living with diabetes also have an increased risk of developing PHN complications (Forbes et al., 2016). In general, however, chronic conditions appear to increase the likelihood of developing shingles in younger populations, compared to older populations (Russell et al., 2014).

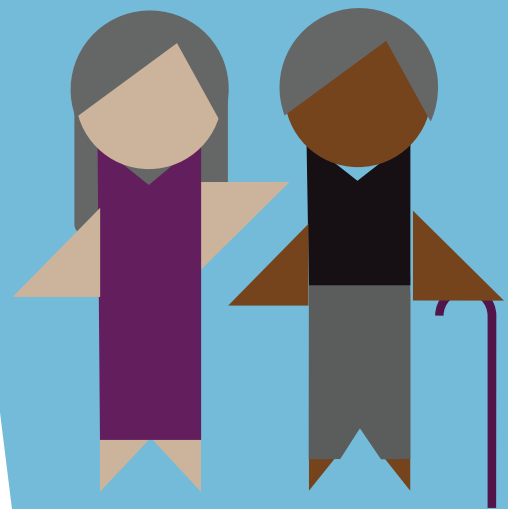
Figure 3: Prevalence Ratios of Herpes Zoster in Patients with Select Chronic Conditions in Canada



Data from Queenan et al. (2018).

Females

Numerous Canadian studies have noted higher rates of shingles in females compared to males (Marra et al., 2016a; Russell et al., 2007; Russell et al., 2014; Tanuseputro et al., 2011). A recently conducted systematic review and meta-analysis found that females are about 1.3 times more likely to experience shingles infections than males (Kawai & Yawn, 2017). The increase in risk may be linked to females' greater health-seeking behaviour or immune/hormonal responses to VZV (Kawai & Yawn, 2017; Marra et al., 2016a; Russell et al., 2014). Females also tend to have more hospitalizations and outpatient visits due to shingles, when compared to males (Tanuseputro et al., 2011). Despite research on the relationship of sex and PHN risk, findings have been inconclusive (Forbes et al., 2016).



The Burden of Shingles in Canada

The Prevalence of Shingles Infections

In Canada, shingles is not a public health reportable condition, which means that no national surveillance program exists. As a result, administrative data is primarily being used to generate provincial case estimates (while no readily available data on territorial populations appears to exist) (PHAC, 2018). Prior to the availability of shingles vaccines, the estimated lifetime risk of developing one case of shingles in Canada was 28% (Brisson et al., 2001).

In a 2008 study, it was estimated that there were 130,000 new shingles cases, 17,000 PHN cases, and 20 deaths likely occurring annually in Canada due to this disease (Brisson et al., 2008).

Provincial studies have produced similar population incidence rates—three to five cases per 1,000 persons per year (PHAC, 2018)—which is in line with rates reported across North America and Europe (Bharuchaa et al., 2017). Furthermore, in Alberta, British Columbia, and Manitoba it was noted that there has been an overall increase in the incidence of shingles over the past 30 years, as the populations in these provinces have aged (Friesen et al., 2016; Marra et al., 2016a; Russell et al., 2014). Indeed, it was recently predicted that over 90,000 new cases occur annually in Canada, among adults aged 50 years and older (Drolet et al., 2019).

Impact of Varicella Vaccination Programs

The influence of varicella (chickenpox) vaccination programs on the incidence of shingles has been explored in numerous studies to better understand the potential impact of this vaccine on future case incidences across the life course. Various Canadian studies have found that the varicella vaccine reduced shingles incidence in children aged younger than 10 years (Russell et al., 2014; Tanuseputro et al., 2011). It has been argued that this vaccine may increase the incidence of shingles in adults; by decreasing the incidence of chickenpox infections, the vaccine reduces the virus' circulation in the population, which may otherwise have improved individual immunity to VZV (Letellier et al., 2018). To date, however—through the evaluation of incidence rates before and after the implementation of varicella vaccination programs—Canadian provincial studies have shown no such increase in shingles cases (Marra et al., 2016a; Russell et al., 2014; Tanuseputro et al., 2011).

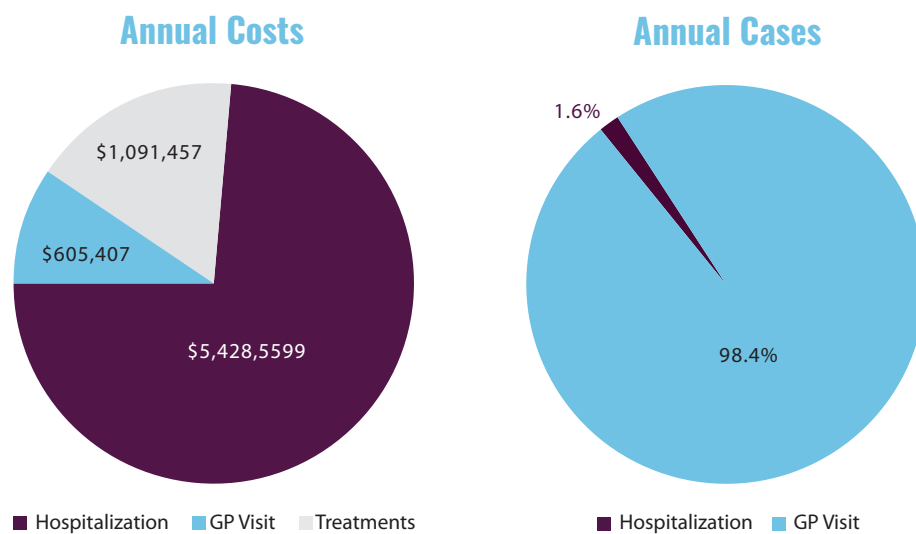
The Associated Burden and Costs of Shingles Infections in Canada

The impact of shingles infections, and its associated impact on Canadian health care systems, is estimated to be around \$67 - \$82 million annually (Bennett & Watson, 2009; Boivin et al., 2010; Brisson et al., 2008).

This is largely due to the growing prevalence of shingles in those aged older than 60 years and its associated complications, such as PHN (Brisson et al., 2008).

Interestingly, treatment costs per case have been dropping due to the greater availability of generic antiviral medications (Friesen et al., 2016; Marra et al., 2016a). However, most provincial studies have indicated an increasing incidence of primary care provider visits annually for both shingles and PHN, over the years (Brisson et al., 2001; Edgar et al., 2007; Marra et al., 2016a). Also, despite hospitalization rates have been either stable or decreasing and representing a small number of annual cases, they are still responsible for over 75% of the annual costs related to shingles (Marra et al., 2016a) (Figure 4).

Figure 4: Annual Shingles-Related Cost & Cases Distribution in British Columbia (2005 – 2012)



Data from Marra et al. (2016).

Understanding Shingles Vaccines

Currently there are two shingles vaccines authorized for use in Canada for those aged 50 years and older, a live attenuated vaccine (Zostavax II) and a recombinant subunit vaccine (Shingrix) (PHAC, 2018).

Shingles Live Attenuated Vaccine (LZV)

The live attenuated vaccine (LZV) marketed as Zostavax II in Canada, is given in one subcutaneous (under the skin) dose injection (PHAC, 2018). The LZV has the same components as the vaccine used for chickenpox (varicella vaccine), but has a stronger concentration of virus to improve the body's immunity (Davis & Sheppard, 2019; PHAC, 2018). It should not be used on individuals who have allergies to the vaccine components, who are pregnant, or for most individuals who have a suppressed immune system (PHAC, 2018). Due to a lack of data, caution should be taken by individuals who are breastfeeding (PHAC, 2022). Studies have found that the LZV can also be given at the same time as the polysaccharide vaccine for pneumococcal disease (pneumococcal 23-valent) and the quadrivalent influenza vaccine are being administered (Levin et al., 2018; Tseng, Smith, Sy, & Jacobsen, 2011). The most commonly reported adverse event associated with this vaccine is injection site reaction, which occurs more amongst adults aged younger than 60 years compared to those aged older than 60 years (PHAC, 2018).

Shingles Recombinant Subunit Vaccine (RZV)

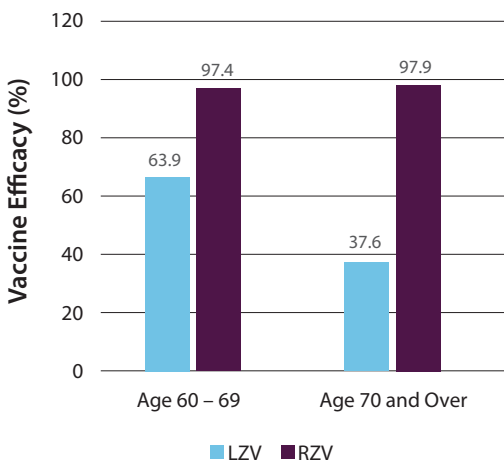
The recombinant subunit vaccine, (RZV) marketed as Shingrix in Canada, is given in two doses (PHAC, 2018). Even though the recommended interval is two to six months between each dose (PHAC, 2018), the interval can be reduced to one to two months for adults 18 years of age and older who are immunocompromised (GlaxoSmithKline Inc., 2021a). The RZV is given in two intramuscular (directly into the muscle) dose injections (PHAC, 2018). It should not be used on individuals with allergies to the vaccine components (PHAC, 2018). Due to a lack of data, caution is advised for individuals who are pregnant or breastfeeding (PHAC, 2018). The RZV can be given at the same time as the quadrivalent influenza vaccine (Schwarz et al., 2017). There is also ongoing research looking into the administration of the RZV at the same time as the pneumococcal 23-valent and Boostrix (against tetanus, diphtheria, pertussis) vaccines, with two studies already noting no safety concerns or immunologic interference when doing so (Maréchal et al., 2018; PHAC, 2018; Strezova et al., 2019). In terms of adverse events, around 80% of individuals report injection-site pain, with the most common systemic adverse events being fatigue, headache, and muscle pain (PHAC, 2018).

Comparing the Effectiveness of Both Vaccinations

Despite both vaccines being shown to be effective, safe, and able to create an immune response, differences in their respective overall level of effectiveness are evident (PHAC, 2018). In regards to their level of vaccine efficacy (VE) against developing future cases of shingles infections, the RZV’s VE has been found to be higher and decreases more slowly over time and across age groups, compared to the LZV (PHAC, 2018; Tricco et al., 2018). For example, three years after vaccination, the RZV’s VE against shingles has not been shown to vary between ages, whereas the LZV’s VE decreased considerably from the group aged 60 to 69 years to the group aged 70 years and older (Lal et al., 2015; Oxman et al., 2008; PHAC, 2018) (Figure 5).

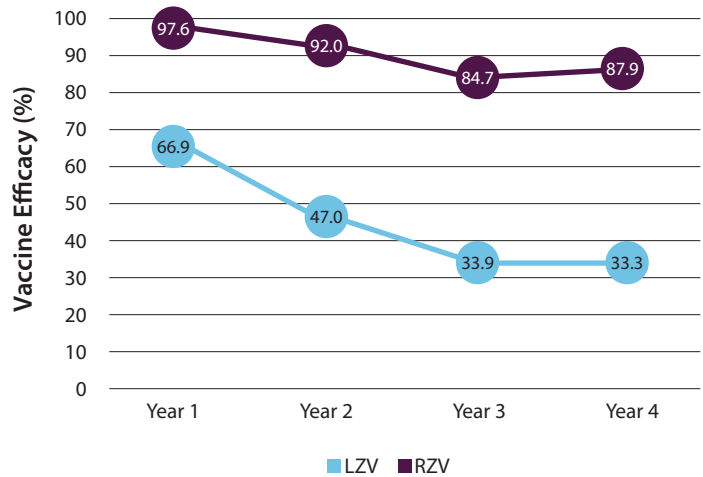
Also, over four years the VE rates in the RZV against shingles in adults aged 70 years and older does not appear to vary, unlike the VE rates in the LZV, which decreased by more than half in that time frame (Cunningham et al., 2016; PHAC, 2018; Tseng et al., 2016) (Figure 6). Studies have found, however, that the RZV is associated with more adverse injection site events than for the LZV, due to the adjuvant component (PHAC, 2018; Tricco et al., 2018). This aspect of the vaccine naturally induces a strong immune response to create such reactions (PHAC, 2018), with the adjuvant specific to the RZV creating a greater amount of these symptoms compared to other types (Leroux-Roels et al., 2016). It is important to note that these reactions are only short term (two to three days) (PHAC, 2018).

Figure 5: Three-Year Vaccine Efficacy Comparison



Lal et al. (2015). Oxman et al. (2008).

Figure 6: Vaccine Efficacy Comparison Over Time Among Individuals Aged 70 and Older



Cunningham et al. (2016). Tseng et al. (2016).

Studies have noted how immune responses to the LZV appear to decrease with age, whereas the RZV has not seen many changes to its immune response with age (PHAC, 2018).

After being vaccinated, immune responses have been shown for up to only three years with the LZV and up to nine years with the RZV (PHAC, 2018).

It has further been found that the RZV is more cost-effective, as it has achieved lower cost per quality-adjusted-life-years than the LZV (Drolet et al., 2019). This means the RSV provides more years of better health for individuals, also known as Quality Adjusted Life Years, at a lower cost than the LZV. When it comes to calculating the number of people needed to vaccinate to avoid a case of shingles, PHN, HZO, or hospitalization at various ages, the RZV appears to require fewer people vaccinated across in comparison to the LZV (Drolet et al., 2019). Also, as age increases, the difference in the number of people who have to be vaccinated increases more significantly, because the LZV appears to have reduced VE in older populations (Drolet et al., 2019) (Table 2).

Table 2: Estimated Number of People Needed to Vaccinate (NNV) With Shingles Vaccines to Prevent Shingles-Related Events, By Age at Vaccination

		LZV	RZV
Preventing Shingles	65 years old	21	8
	80 years old	64	31
Preventing PHN	65 years old	64	31
	80 years old	97	50

Data from Drolet et al. (2019).

The Availability and Coverage of Shingles Vaccinations in Canada

In Canada, LZV (marketed as Zostavax), in the freezer-stable form, was first approved for use in 2008, among adults aged 60 years and older (PHAC, 2018). In 2011, it was replaced with a refrigerator-stable product, LZV (marketed as Zostavax II), that was approved for adults aged 50 years and older (PHAC, 2018). RZV (marketed as Shingrix) was approved for adults aged 50 years and older in 2017 (PHAC, 2018) and for adults aged 18 years and older who may be at an increased risk due to being immunocompromised in 2021 (GlaxoSmithKline Inc., 2021b).

Initially, the LZV was not included in any provincial/territorial routine immunization schedule (meaning the cost of vaccination was not covered by the government) (PHAC, 2013), but could be purchased privately (PHAC, 2018). In 2016, Ontario became the first province to provide the LZV as part of its publicly funded vaccination program (PHAC, 2018). Under its current program, the province has now made the RZV (since fall 2020) available for free for those aged 65 to 70 years (Ministry of Health, n.d.). Yukon also began publicly funding the RZV for the same age group, starting in January 2021 (Government of Yukon, 2020; Waddell, 2021). The territory has expanded eligibility to adults aged 65 years and older from December 2021, but have changed the eligibility to adults aged 65 to 79 years in January 2023 (Government of Yukon, n.d.). Alberta has publicly funded the RZV since September 2021, but only for solid organ transplant recipients aged 18 years and older (Government of Alberta, 2022a). Most recently, as of February 2022, Prince Edward Island began allowing Islanders aged 65 years and older to book a free RZV vaccine at community pharmacies (Government of Prince Edward Island, 2022b). The province has expanded eligibility to adults aged 60 years and older from November 2022 (Government of Prince Edward Island, 2022a).

Some provinces have faced obstacles in the implementation of a publicly-funded shingles vaccine program. In the Nova Scotia legislature, two bills have been brought forward to provide full coverage of the RZV to certain residents, however, the bills haven't been passed at this point (Nova Scotia House of Assembly, 2019; Nova Scotia House of Assembly, 2022).

Beyond provincial programs, British Columbia's First Nations Health Authority (FNHA) recently started covering the costs of the RZV, primarily for First Nations residents aged 65 to 69 years (First Nations Health Authority [FNHA], 2020; FNHA, n.d.). Similarly, at the national level, the Non-Insured Health Benefits (NIHB) program has started to cover the RZV for eligible First Nations and Inuit clients, primarily those aged 65 to 70 years and those on active cancer treatment, since January 2021 (Indigenous Services Canada, 2021). Veterans Affairs Canada also covers the RZV for eligible members aged 50 years and older across Canada (Veteran Affairs Canada, 2019).

The majority of residents in all other provinces and territories still need to purchase either shingles vaccine out of pocket (PHAC, 2019b), with coverage available through only some supplemental pharmaceutical benefit plans (3sHealth, 2019; "Dalhousie University", 2019).

Who Should Get Vaccinated Against Shingles?

What is the National Advisory Committee on Immunization?

The National Advisory Committee on Immunization (NACI) is a national committee consisting of many experts in the fields of pediatrics, infectious diseases, immunology, nursing, pharmacy, and public health among other specialties (Government of Canada, 2022b). NACI makes recommendations around the use of vaccines to the Public Health Agency of Canada (PHAC) (Government of Canada, 2022b).

Current NACI Recommendations

In 2018, NACI provided updated national recommendations in regards to shingles vaccination (PHAC, 2018). They recommended that the RZV be offered to those aged 50 years and older, with the exception of certain groups with contraindications (PHAC, 2018). The vaccine was also recommended for those previously vaccinated with the LZV, or who had experienced a previous episode of shingles (PHAC, 2018). As a discretionary recommendation, immunization for the latter two groups may be considered at least one year after either being vaccinated with the LZV or experiencing a shingles episode (PHAC, 2018). NACI also advised to only consider the LZV for immunocompetent adults 50 years of age and older (without contraindications), when the RZV is unavailable, inaccessible or should not be used (PHAC, 2018). Another

discretionary recommendation noted that the RZV may also be considered for immunocompromised adults aged 50 years and older (PHAC, 2018).

Certain recommendations pertaining to LZV use from the previous statement in 2014 have been carried forward in the latest guideline (PHAC, 2018). This includes how the LZV may be provided to adults aged 50 years and older with a previous history of shingles (at least one year after the last episode) (PHAC, 2014). Also, there is insufficient evidence to recommend booster doses of the shingles vaccine or to provide any stance on the use of this vaccine for those with prior HZO (PHAC, 2014). Thirdly, the recommendation continues to be that Pneumovax™23 (a vaccine to prevent pneumococcal disease) may be administered at the same time as the LZV, at a different body injection site (Merck Sharp & Dohme Corp., 2019; PHAC, 2014).

Vaccination Administration

Shingles vaccines can be obtained from physician offices, pharmacies, and travel clinics, depending on the province/territory (HealthLinkBC, 2019; Ministry of Health, 2021; MyHealth.Alberta.ca, n.d.) (Table 3). The vaccine can be administered by all of the following health care professionals across Canada: physicians, other primary care providers, and pharmacists (except in the Northwest Territories and Nunavut) (Busby, 2018; HealthLinkBC, 2019; Ministry of Health, 2021).

In regards to the large-scale publicly-funded programs, Yukon allows individuals to have the free shingles vaccine obtained and administered at a pharmacy (CanAge, 2022; Government of Yukon, 2021). Prince Edward Island also announced that as of February 2022, free vaccine appointments are able to be booked at community pharmacies (Government of Prince Edward Island, 2022b). In Ontario, the free shingles vaccine can only be obtained and administered from the individual's primary care provider (PHAC, 2019b; Ministry of Health, n.d.). Whereas, the paid shingles vaccine can be obtained at a pharmacy, and

also be administered by a pharmacist (Ministry of Health, 2021; Canadian Pharmacists Association, 2021). Generally, the LZV costs around \$200, whereas the RZV costs around \$300 (\$150/dose) (HealthLinkBC, 2019). There may be an additional injection fee when the vaccine is administered in settings outside a physician's office (e.g. pharmacies), which costs around \$10 to \$20 (The Canadian Foundation For Pharmacy, 2019).

On July 2021, the National Association of Pharmacy Regulatory Authorities (NAPRA) approved the RZV to be moved to Schedule II status (National Association of Pharmacy Regulatory Authorities [NAPRA], 2021). NAPRA administers the National Drug Schedules (NDS) program, which is adopted in various capacities by all provinces and territories (except Quebec) (NAPRA, n.d.a). The move of the RZV to Schedule II status, allows the vaccine to be provided by pharmacists, without requiring a prescription (NAPRA, n.d.c). Apart from British Columbia, this move is automatically enforced within the drug schedules of all other provinces and territories (NAPRA, n.d.b).

Table 3: Current Shingles Vaccine Coverage Policies

Province/ Territory	Who can Administer the Vaccine?	Where can you get it?	Public Funding Coverage?	Price*
Alberta 	Physicians, pharmacists, nurses (Alberta Health Services, 2018; MyHealth.Alberta. ca, n.d.)	Immunization clinics, travel clinics, some family physician offices, some pharmacies (Alberta Health Services, 2018)	RZV: Solid Organ Transplant Recipients 18 and older (Government of Alberta, 2022a)	LZV: \$210 to \$223 RZV: \$310 - \$384 (Lahring, 2018)
British Columbia 	Pharmacists, physicians, nurses (First Nations Health Authority, 2019)	Pharmacies, travel clinics, physician office (HealthLinkBC, 2019; ImmunizeBC, 2021)	RZV: First Nations age 65 to 69 (FNHA, 2020)	LZV: \$206 - \$220 RZV: \$293 - \$308
Manitoba 	Physicians, nurses, pharmacists (Busby, 2018; Interlake- Eastern Regional Health Authority, 2018)	Physician clinics and pharmacies (Interlake-Eastern Regional Health Authority, 2018)	N/A (Manitoba.ca., n.d.)	LZV: \$180 - \$221 RZV: \$290 - \$308 (Alden-Bugden, 2015)
Newfoundland and Labrador 	Physicians, nurses, pharmacists (CBC News, 2014)	Pharmacies, travel clinics (Alpha Group, Inc, 2019)	N/A (Sanofi Pasteur, 2019)	LZV: \$205 - \$230 RZV: \$280 - \$320
New Brunswick 	Physicians, nurses, pharmacists (Guardian Valley Pharmacy, n.d.)	Pharmacies (Guardian Valley Pharmacy, n.d.)	N/A (PHAC, 2019b)	LZV: \$221 - \$250 RZV: \$322 - \$360
Northwest Territories 	Physician, nurses (Canadian Pharmacists Association, 2021)	Public health unit (Health and Social Services Authority, n.d.)	N/A (PHAC, 2019b)	LZV: Do Not Carry RZV: \$260 - \$280
Nova Scotia 	Physicians, nurses, pharmacists (CBC News, 2014)	Pharmacies, travel clinics (Nova Scotia Health Authority, 2020; Pharmacy Association of Nova Scotia, n.d.)	N/A (Davie, 2019)	LZV: \$200 - \$235 RZV: \$307 - \$340 (Nova Scotia Health Authority; 2015)

Nunavut 	Physician, nurses (Canadian Pharmacists Association, 2021)	Pharmacies (CTV News, 2018)	N/A ("1. Introduction," 2014)	LZV: \$195 - \$300 RZV: \$380 - \$428
Ontario 	Family doctor, pharmacists, or other primary care provider (e.g. nurse practitioner) (Busby, 2018; Ministry of Health, 2021)	Primary care clinics (publicly funded), pharmacy (Ministry of Health, 2021)	RZV: 65 to 70 Only (Ministry of Health, n.d.)	LZV: \$215 - \$226 RZV: \$314 - \$322
Prince Edward Island 	Physicians, nurses, pharmacists (CBC News, 2014)	Pharmacies (Fraser, 2018)	RZV: Aged 60 and older (Government of Prince Edward Island, 2022a)	LZV: \$200 - \$252 RZV: \$240 - \$341 (Fraser, 2018; Yarr, 2019)
Quebec 	Physicians, nurses, pharmacists (Gouvernement du Québec. (2021)	Pharmacies, CDL labs, travel clinics (Concordia University, n.d.)	N/A (Familiprix, 2018)	LZV: \$222 - \$283 RZV: \$250 - \$340 (Labos, 2018)
Saskatchewan 	Physicians, nurses, pharmacists (Saskatchewan College of Pharmacy Professionals, n.d.; Saskatchewan Health Authority, 2021)	Public health units, travel clinics, physician clinics, pharmacies (CTV News, 2018; Saskatchewan, n.d.; Saskatchewan Health Authority, 2021)	N/A (Saskatchewan Health Authority, 2021)	LZV: \$228 - \$230 RZV: \$302 - \$370 (Saskatchewan Health Authority, 2019)
Yukon 	Physician, nurses, pharmacists (Canadian Pharmacists Association, 2021)	Community health centre, pharmacies (CTV News, 2018; Yukon Council on Aging, n.d.)	RZV: 65 to 79 Only (Government of Yukon, n.d.)	LZV: \$268 RZV: \$294 - \$405

* The costs of shingles vaccines were obtained by directly calling at least three or more pharmacies, travel clinics, and public health units in every province and territory by NIA researchers

Vaccination Outcomes in Canada

Population Coverage Estimates

There has been a notable lack of national data on shingles vaccine coverage in Canada, as it is not a reportable illness and there are no established national vaccination targets (PHAC, 2018; PHAC, 2019b).

PHAC has only recently started gathering coverage data on shingles vaccines (on a bi-yearly basis) through the Seasonal Influenza Vaccination Coverage Survey

(PHAC, 2019c; PHAC, 2021c).

The first set of findings noted that 28% of participants aged 50 years and older have reported receiving shingles vaccines (2018-2019), which has not changed (27%) in the latest survey findings (2020 – 2021) (PHAC, 2019c; PHAC, 2021c).

Also, Statistics Canada has gathered data (in 2019 and 2020) through the Canadian Health Survey on Seniors (CHSS), but for a slightly different age group (65 years and older) (Statistics Canada, 2021a). Contrary to the PHAC data, there was a small increase in the percentage of participants having reported receiving shingles vaccines, from 34% in 2019 to 38.7% in 2020 (Statistics Canada, 2021b).

In regards to provincial level data, there have been two sources of information that have shown the cumulative coverage rates, one as of 2016 from Merck & Co., Inc. (Bresnitz, 2017) and another as of 2020 from Statistics Canada (2021b) (Figure 7). Prior to delving into this information, it is important to keep in mind that the sources represent slightly different age groups and may have used differing data collection processes (Bresnitz, 2017; Statistics Canada, 2021b). Firstly, both datasets found that provinces varied significantly in rates, with Ontario still having the highest amount of uptake (53.4% in 2020), whereas Newfoundland and Labrador and Quebec still have the lowest amount of uptake (23.4%, 22.8% in 2020) (Bresnitz, 2017; Statistics Canada, 2021b). Interestingly, despite all provinces having increased in uptake since 2016, the discrepancies between the provinces have increased as well (Bresnitz, 2017; Statistics Canada, 2021b). The province of Ontario had an increase of 24.2%, whereas all other provinces had an average increase of just 14.5% (from 9.7% to 20.9%) (Bresnitz, 2017; Statistics Canada, 2021b). This could be explained by how Ontario is the only province to provide free shingles vaccine (until Alberta in 2021), improving accessibility of the vaccines (Government of Alberta, 2022a; Ministry of Health, n.d.). Also, with Ontario's program having just been implemented in 2016 (when the first set of data was collected), it was only in Statistics Canada (2021b) data that the long-term impact of this program is highlighted, with the increased discrepancy (Government of Alberta, 2022a; Ministry of

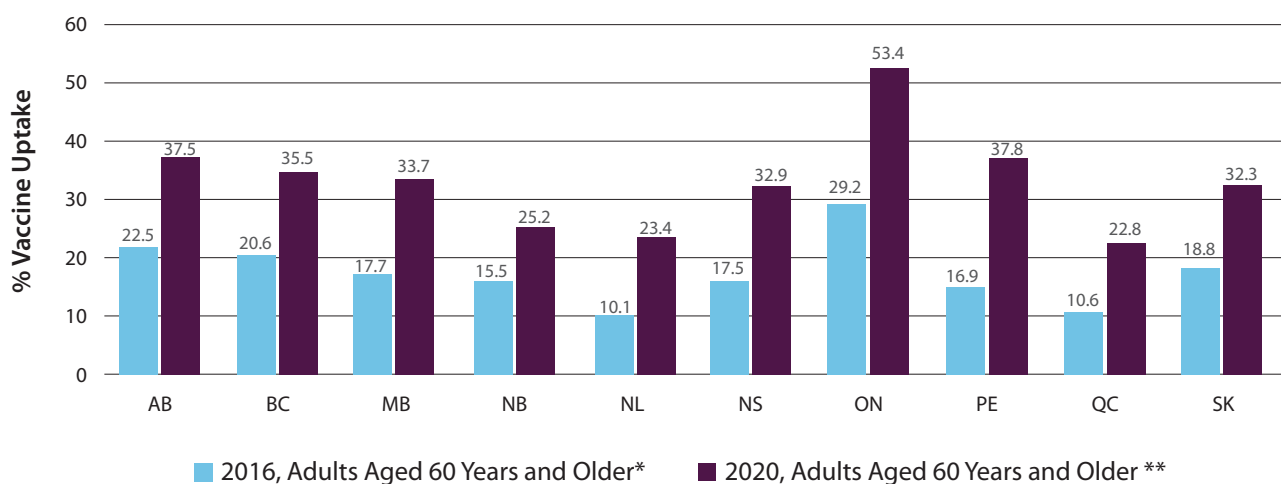
Health, n.d.). Please note, even though Alberta had implemented a publicly funded shingles program after the 2020 data collection had been completed (Statistics Canada, 2021b), it is assumed the vaccine uptake for the province would not have significantly changed as it was targeted to a specific population group (solid organ transplant recipients aged 18 years and older) (Government of Alberta, 2022a).

Another possible accessibility factor for provincial variations in uptake is whether pharmacists are able to administer the shingles vaccine in their province/territory. For example, Newfoundland and Labrador only approved this function in 2014 (CBC News, 2014), whereas Quebec did not enhance pharmacists' abilities to administer vaccines

until 2020 (National Assembly of Quebec, 2020), possibly explaining both provinces' low coverage rates in both sets of data (Bresnitz, 2017; Statistics Canada, 2021b).

Despite a lack of information on vaccine uptake within territories, it is speculated that at the time of the Bresnitz (2017) data and Statistics Canada (2021b) survey, all three territories would generally have lower coverage rates. This is due to none of the territories allowing pharmacists to administer the shingles vaccine, until Yukon became the only territory in January 2021 (Canadian Pharmacists Association, 2021). Also, with Yukon's recent publicly funded program in January 2021 (Waddell, 2021), that was further expanded in December 2021 (Government of Yukon, n.d.), it could be expected that this

Figure 7: Comparison of Shingles Vaccine Uptake by Province Among Older Adults



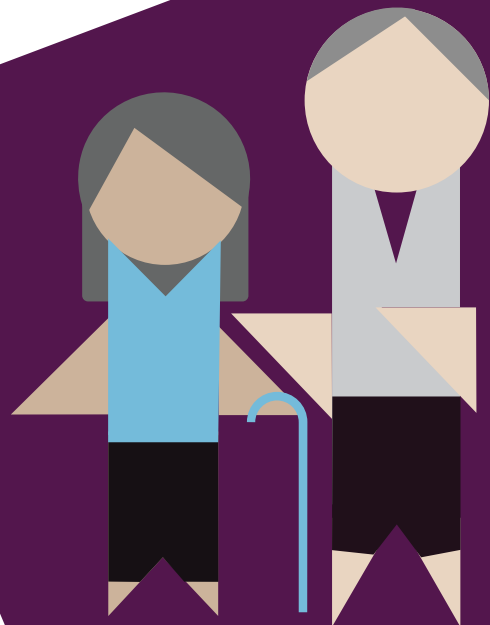
* Based on Data Presented from Merck & Co., Inc. (Bresnitz, 2017)

** (Statistics Canada, 2021b)

territory has substantially increased their vaccine uptake in the past year.

Trends & Associations Related to Higher Vaccination Rates

Two provincial studies, one in Alberta and one in Manitoba (focused on IBD patients) examined associations and trends in shingles vaccination in Canada (Liu et al., 2014; Nugent et al., 2019). The annual rate of shingles vaccination among adults aged 50 years and older have been increasing every year (Liu et al., 2014; Nugent et al., 2019). Also, females have achieved consistently higher vaccine rates and coverage than men, but studies have been mixed in confirming if this is a significant association (Liu et al., 2014; Nugent et al., 2019; PHAC, 2019c). In regards to location, individuals living in urban areas have higher coverage and vaccination rates compared to those in rural settings (Liu et al., 2014). Individuals with higher income or socioeconomic status were also found to have higher rates of shingles vaccination as well (Liu et al., 2014; Nugent et al., 2019).








International Examples of Shingles Vaccine Coverage and Administration

At the international level, the World Health Organization (WHO) has not provided recommendations for the routine use of shingles vaccines, due to the lack of data on vaccines and evidence surrounding benchmarks (WHO, 2014). However, numerous countries have implemented their own

recommendations and programs, with this report specifically focusing on the experiences of the United States, England, Australia, and South Korea (Table 4). These comparisons will provide an understanding of what has been done in other countries to tackle shingles infections.

Table 4: Shingles Vaccination Around the World

	Canada 	United States 	England 	Australia 	South Korea 
Preferred Shingles Vaccine	RZV (PHAC, 2018)	RZV (Dooling et al., 2018)	RZV (JCVI PHE, 2019)	LZV (Australian Government, 2020)	LZV (Choi et al., 2015)
Age Recommended	Aged 50 years and older (PHAC, 2018)	Aged 50 years and older (Dooling et al., 2018)	Aged 60 years (JCVI PHE, 2019)	Aged 60 years and older (Australian Government, 2020)	Aged 60 years and older (Choi et al., 2015)
Funding	Private (Except Alberta, Ontario, Prince Edward Island, Yukon) <small>(Government of Alberta, 2022a; Government of Prince Edward Island, 2022a; Government of Yukon, n.d.; Ministry of Health, n.d.; PHAC, 2019b)</small>	Private (with assistance) (NCIRD, 2018a; NCIRD, 2018b)	Public & Private (NHS, 2021a; Public Health England [PHE], 2020)	Public & Private (AIHW, 2018; AMA, 2016)	Private (Yang et al., 2015)
Target/Goal	N/A	N/A*	N/A	N/A	N/A
Vaccination Coverage	27% (Aged 50 years and older) (PHAC, 2021c)	34.5% (Aged 60 years and older) (Terlizzi & Black, 2020)	76.8% (Aged 76 years) (PHE, 2021c)	31.2% (Aged 70 to 79 years)** (National Centre for Immunization, Research and Surveillance [NCIRS], 2019b) Immunization Research and Surveillance [NCIRS], 2019b) Immunization Research and Surveillance [NCIRS], 2019b)	14.3% (Aged 50 years and older) (Bresnitz, 2017)

* The previous target was a 30% vaccination coverage among adults aged 60 years and older (ODPHP, 2022)

** The Australian Immune Registry is assumed to be greatly underreported

United States

In the United States (US), the RZV (introduced in 2017, same year as Canada) had become the recommended shingles vaccine for adults aged 50 years and older by the Advisory Committee on Immunization Practices (ACIP) in 2017 (Dooling et al., 2018; PHAC, 2018). On October 2021, the RZV was also recommended for adults aged 19 years and older, who were or will be immunosuppressed or immunodeficient (Anderson et al., 2022). In regards to the LZV, it was no longer being offered to the public as of November 2020 (NCIRD, 2019f). The US, unlike Canada, initially established a national target for shingles vaccination through its Healthy People 2020 initiative, which aimed for a 30% coverage of adults aged 60 years and older by 2020 (Office of Disease Prevention and Health Promotion [ODPHP], 2022). Despite meeting this target, the objective of increasing the percentage of shingles vaccine coverage was removed in the next iteration of the initiative, Healthy People 2030 (ODPHP, n.d.).

Even though shingles vaccines in the US are privately funded, there are numerous avenues of financial support providing full or partial coverage including; Medicare (for older adults/disabilities), Medicaid (those needing financial need), private health insurance, and other vaccine assistance programs (NCIRD, 2018a; NCIRD, 2018b). This may be one of the reasons why the US, despite looking at a slightly different age range, has achieved a higher overall vaccination coverage rate, 34.5% (2018) than Canada (Table 4) (Terlizzi & Black, 2020). Numerous factors were found to correlate with higher vaccine uptake including; increased age, increased educational attainment, female gender, ethnicity (non-Hispanic white adults) and higher family income (Terlizzi & Black, 2020).

England

In England, both the LZV and RZV are licensed (UK Health Security Agency, 2021), with the latter being recommended by the Joint Committee on Vaccination and Immunization (JCVI) for immunocompromised adults (in 2018) and immunocompetent adults (in 2019) (JCVI PHE, 2018; JCVI PHE, 2019). England's shingles vaccine program differentiates from Canada by the country providing free shingles vaccine on a national level (since 2013) (PHE, 2022). The program however, still offers the LZV to adults aged 70 to 79 years (PHE, 2022), with the RZV only being offered to immunocompromised adults in this age group who are not able to take the LZV (PHE, 2021a). This delay in applying the RZV recommendations, especially with JCVI recommending in 2019 to lower the program's minimum age of vaccination (JCVI PHE, 2019), has been due to supply issues (PHE, 2022). Please note, England's universal shingles vaccination program was initially implemented differently, providing vaccination only to adults aged 70 years, with a phased catch-up program for adults aged 71 to 79 years (UK Health Security Agency, 2021).

So far, this national initiative has achieved drastically higher shingles vaccination uptake numbers, with the 76-year-old age group having achieved a coverage rate of 76.8% (PHE, 2021c). This is despite the only avenue of obtaining vaccines being from primary care clinics (NHS, 2021b). It was found how lower uptake was correlated with increased deprivation and groups of non-White ethnicities (Ward et al., 2017). The shingles vaccines may also be purchased privately at private doctor clinics, pharmacies, and other healthcare locations (Andrews, 2021). The cost

of the LZV is around £160 (Hampstead Heath Pharmacy, Travel Health & Vaccination Clinic, n.d.; Superdrug Health Clinic, 2022) and the cost of the RZV is around £500 (CityDoc, 2021; Fleet Street Clinic, 2021).

Australia

In Australia the LZV was registered in 2008 and the RZV in 2018 (NCIRS, 2019a). In the Australian Immunization Handbook, the LZV has been recommended for adults aged 60 years and older, with those aged 50 years and older only being recommended if persons in their household are immunocompromised (Australian Government, 2020). Since 2016, the LZV has been part of Australia's National Immunisation Program that provides the vaccine to adults aged 70 years without cost (Australian Institute of Health and Welfare [AIHW], 2018). There has also been a catch-up program (until October 31st, 2023) to allow adults aged 71 to 79 years to also receive the vaccine (Australian Government, 2021a). This age range was chosen due to the, incidence of the disease and risk of complications being higher for those aged older than 70 years, while the vaccine is less effective for adults aged older than 80 years (AIHW, 2018). It is important to note that unlike England's publicly-funded program, Australians are able to get the free shingles vaccine from a range of locations, not just the primary care clinics (Australian Government, 2021c; NHS, 2021b). However, there still may be a consultation fee charged by the vaccination provider for the visit (Australian Government, 2021b) which may be a barrier. For adults aged 50 to 69 years, and adults aged older than 80 years, the vaccine can be purchased for around \$200 (Australian Medical Association [AMA], 2016).

In regards to the RZV, it was rejected in 2018 to be part of the National Immunisation Program due to uncertainty surrounding cost-effectiveness (Pharmaceutical Benefits Advisory Committee, 2018). On October 2021, the Australian Technical Advisory Group on Immunisation, which provides recommendations for the Australian Immunization Handbook (Australian Government, n.d.), noted that the RZV should look to be used over the LZV for adults aged 50 years and older (Australian Technical Advisory Group on Immunisation, 2021). Despite initially facing limited global supply (Jayasinghe et al., 2020), the RZV has become privately available (around \$500) from June 2021 (Price, 2021).

Among various stakeholders, the entire shingles vaccine program was found to be well-delivered, but there were challenges with vaccine supply (especially due to initial demand) and difficulty of applying the age criteria in practice (NCIRS, 2019a; Rashid et al., 2020). Data of shingles vaccine administration is collected through the Australian Immunisation Register (AIR), comprising the majority of Australian residents (AIHW, 2018; NCIRS, 2019a). It was found in under the first two years (23 months) of the publicly funded program being implemented, 31.2% of adults aged 70 to 79 years were vaccinated (NCIRS, 2019b). However, the actual coverage rate is expected to be higher as the AIR only recorded around half the number of shingles vaccines distributed in that study period (NCIRS, 2019b). Shingles vaccination rates were noted to be higher in Indigenous adults and generally in females as well (Lin et al., 2020; NCIRS 2019a; NCIRS, 2019b). Furthermore, the impact of this

program was evidenced with a significant decline in antiviral prescription rates (13.6%/year) among a sample of adults aged 70 to 79 years (Litt et al., 2020) two years post implementation.

South Korea

In addition to the LZV (marketed as Zostavax) (introduced in 2012), the LZV (marketed as Sky Zoster) has been available since 2017, to adults aged 50 years and older (Choi, 2013; Ji-young, 2017). Sky Zoster was a domestically developed vaccine created due to the increase in the demand for the shingles vaccine and a lack of supply of Zostavax (Choi et al., 2019; Han-soo, 2019). A study comparing both vaccines on adults aged 50 years and older found no significant differences in terms of these vaccines' ability to create an immune response or the number of adverse events (Choi et al., 2019). The Korean Society of Infectious Diseases (KSID) recommends that adults aged 60 years and older receive shingles vaccination (unless there is a contraindication or precaution) (Choi et al., 2015). The KSID also advises that adults aged 50 to 59 years may be vaccinated after individual health conditions are considered (Choi et al., 2015). In terms of the RZV, despite the launch initially being delayed due to supply shortage (Hackett, 2019), the vaccine was approved for adults aged older than 50 years and immunocompromised adults aged older than 18 years (Han-soo, 2021).

As the shingles vaccines are not part of the national immunization program, it is paid for out-of-pocket and can be purchased in clinics and hospitals (Coe et al., 2018; Yang

et al., 2015). Despite the cumulative vaccine coverage among adults aged older than 50 years having increased every year, a shingles coverage rate of only 14.3% was reported in 2016 (Bresnitz, 2017). Studies have noted that high costs were the main barrier to receiving shingles vaccination (Roh et al., 2015; Yang et al., 2015). Among adults who have received shingles vaccination, significant predictors included increasing age, history of shingles, and greater knowledge of the disease and its vaccines (Roh et al., 2015).

Vaccine Hesitancy

In Canada, despite the introduction of a more effective vaccine, the national coverage is still only around 27% for those aged 50 years and older (PHAC, 2021c). One of the reasons this may be due to the low awareness of and the high costs for the majority of eligible Canadians who don't have access to publicly-funded vaccine. The SAGE Working Group on Vaccine Hesitancy defined the term 'vaccine hesitancy' as the refusal of vaccines, despite their availability (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015). They originally noted three factors influencing this concept, with two more added on in the recent past (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015; Oduwole et al., 2019):

- 1. Complacency** – low perceived risk of disease and when vaccination is not seen as a needed preventive measure.
- 2. Confidence** – refers to trust in the vaccine (effectiveness, safety), health care system (e.g. health care providers, services), and agenda of policymakers
- 3. Convenience** – issues of accessibility (e.g. physical availability, cost, literacy).
- 4. Calculation** – referring to individual's information search prior to deciding on vaccination
- 5. Collective Responsibility** – aim to protect others by vaccinating oneself

An International Comparison of Barriers Towards the Uptake of the Shingles Vaccine

Low Levels of Public Awareness About the Risks of Shingles & the Importance of Vaccination

In the past two surveys that evaluated shingles vaccine uptake among Canadian adults (2019, 2021), the most common reason stated by adults aged 50 years and older for not taking the shingles vaccination was the belief that it was not necessary (PHAC, 2019c; PHAC, 2021c).

This is in line with another national survey where just 36.3% of participants believed that shingles could be prevented by vaccination and only 74% of participants felt that the illness would have a significant impact on the body (MacDougall et al., 2015). The same findings also indicated that less than 60% of the general public agreed that it was vital to take all the recommended adult vaccinations (MacDougall et al., 2015). Similarly, a multi-national survey showed that a majority of adults aged 50 years and older had a very weak understanding of the causes, risks, and symptoms of shingles infections (Paek & Johnson, 2010). These studies demonstrate that complacency is a factor in low shingles vaccination uptake.

Many countries have implemented public health programs and developed educational resources to raise awareness about shingles. Both England and Australia have a national shingles vaccine communications strategy, to increase understanding among providers and patients (NCIRS, 2019a; PHE, 2018). Common methods of disseminating information include flyers, posters, and fact sheets that can be placed in different care settings (NCIRD, 2019b; PHE, 2021b). Other mediums include the use of online marketing (e.g. videos, social media) and free telephone information seminars (NCIRS, 2019a; National Foundation for Infectious Diseases, n.d.; National Shingles Foundation, n.d.). England has implemented weekly and monthly campaigns, using a combination of communications tactics, to raise public awareness (Deputy Director for Health Protection, 2015; Wilkinson, 2017). While PHAC has posted a single shingles fact sheet (PHAC, 2013), Canada, unlike other countries, does not provide many resources at the national level to increase public awareness, strengthen knowledge and build understanding about the seriousness of shingles and the importance of vaccination in prevention efforts (Immunize Canada, n.d.; PHAC, 2013).

Patients Remain Largely Uninformed About Shingles by their Healthcare Providers

The CanAge (2022) vaccine report noted that across provinces and territories, all but three governments (New Brunswick, Newfoundland and Labrador, Nunavut) provided information regarding shingles vaccination.

However, a Canadian national survey noted just over 20% of the public knew what vaccines they should be receiving and only 25% of the public agreed that their health care providers inform them of the vaccines recommended for them (MacDougall et al., 2015).

This is concerning as a Swiss study demonstrated that physician recommendations significantly increased shingles vaccination rates among patients aged 65 years and older (Kizmaz et al., 2019). The survey above also found that 55 – 60% of Canadian adults were willing to be vaccinated, when their health care providers recommended it (MacDougall et al., 2015). Increasing and improving conversations between health care providers and patients has the potential to reduce complacency, increase vaccine uptake, and improve confidence in vaccines and the health care system.

Internationally, countries have taken a variety of approaches to developing vaccination resources for health care providers. For example, the US has an extensive number of

tools to educate professionals around shingles vaccination (NCIRD, 2021) including a web-based training course, online immunization webinars, fact sheets, and videos to keep up to date with vaccination guidelines (Babcock et al., 2018; NCIRD, 2016; NCIRD, 2020b; NCIRD, 2022). In Canada, apart from fact sheets, there are no other resources produced for health care providers at the national level (PHAC, 2013). Research has shown that another possible avenue for health care provider communication is through educational programs for staff, which was found to greatly increase knowledge of shingles vaccines among nurse practitioners (O'Donnell et al., 2018).

Health Care Providers Find It Difficult to Keep Track of Patient Vaccination Information

Among Canadian healthcare providers, an overwhelming number (up to 83%) report having difficulty keeping up to date with their patients' vaccination histories (MacDougall et al., 2015). A large majority have insisted on a national electronic vaccine registry to keep track of vaccination information, with a smaller percentage agreeing to a system for identifying unvaccinated adults (MacDougall et al., 2015).

Numerous software reminders and other systems have been tested among pharmacy staff and physicians. For primary care providers, research studies have shown that these kinds of tools and reminders can significantly improve vaccination rates (Chaudhry et al., 2013; Sheth et al., 2017). The programs studied included a web-based clinical decision support software and an

electronic best practice alert (BPA) method that provided reminders (Chaudhry et al., 2013; Sheth et al., 2017). For example, the use of BPA on rheumatoid arthritis patients aged older than 60 years led to the significant increase in shingles vaccination rates within the study period (10.1% to 51.7%) (Sheth et al., 2017).

In pharmacies, various kinds of technological platforms were evaluated, using registry data to inform staff about patients' vaccine gaps (Bacci et al., 2019; Stolpe & Choudhry, 2019; Wehbi et al., 2019). These interfaces ranged from providing proactive recommendations to sending automated telephone prompts directly to patients (Bacci et al., 2019; Stolpe & Choudhry, 2019; Wehbi et al., 2019). Results were mixed. One study indicated increased vaccination rates, whereas the other two demonstrated an actual decrease in vaccinations (Bacci et al., 2019; Stolpe & Choudhry, 2019; Wehbi et al., 2019). Multiple explanations were offered for the poor results and was assumed to have been due to numerous reasons including technical flaws, a lack of follow-up, not connecting with patients, and pending introduction of the RZV (Stolpe & Choudhry, 2019; Wehbi et al., 2019). Another demonstration project looked to merge a notification system with motivational interviewing processes into pharmacy workflows, only to result in a decrease in shingles vaccination rates at the end of the study period (Coley et al., 2020). The project also highlighted the pending approval of the RZV as a possible reason for this decrease, alongside limited resources within pharmacies (Coley et al., 2020).

The Cost of Shingles Vaccinations Remains a Real Barrier to Uptake Amongst Canadians

A prominent reason stated in the 2019 PHAC Vaccine Uptake in Canadian Adults Survey for not getting a shingles vaccine was the cost of the vaccine itself (PHAC, 2019c). This was reinforced by another national survey, where only 13% of adult participants said they would be willing to pay for the shingles vaccine, even after a health care provider recommendation (McDougall et al., 2015).

This may even be an overestimation, as the question indicated vaccine costs were around \$100, when shingles vaccines actually cost between \$180 - \$428 (Table 3) (MacDougall et al., 2015). The impact of cost was clearly evident in a US study, where shingles vaccination coverage among adults aged 18 years and older with health insurance was found to be three times higher compared to those without insurance coverage for the vaccination (Lu et al., 2015). This evidence indicates the impact of the convenience factor (accessibility) on vaccine hesitancy in regards to shingles vaccination.

Other countries have tackled cost barriers in various ways. In England and Australia, for example, shingles vaccinations are publicly funded for adults aged 70 years, with mechanisms in place to allow adults

aged older than 70 years to be given free shingles vaccines before 80 years (Australian Government, 2021a; PHE, 2021c). In the United States (US), numerous forms of financial assistance are provided, including through Medicaid and Medicare health insurance programs, which provide full or partial coverage of costs (NCIRD, 2018a; NCIRD, 2018b). Vaccine manufacturers themselves also provide assistance to US citizens through either the Merck Patient Assistance Program or GSK Patient Assistance Program (GSK, 2020; Merck & Co., Inc., 2022). Both initiatives were created specifically to assist those who, based on the organizations' criteria, were in dire financial need (GSK, 2020; Merck & Co., Inc., 2022).

Lack of Disease and Vaccination Coverage Monitoring

In Canada, not only is shingles not a reportable disease, but there are also no vaccination coverage goals. While PHAC has set objectives for vaccination against influenza and pneumococcal disease (Government of Canada, 2021b), similar targets have not been set for shingles.

This may impede federal and provincial/territorial efforts to work in unison to improve shingles vaccination uptake rates (PHAC, 2019c). In addition, PHAC and Statistics Canada have only recently started analyzing shingles vaccination coverage at a national level (PHAC, 2019c; PHAC, 2021c; Statistics Canada, 2021b).

Other countries have implemented more thorough monitoring of their shingles vaccine coverage rates. The Centers for Disease Control and Prevention (CDC) in the US has placed shingles-related questions across various national surveys (e.g. Health and Retirement Study, the National Health Interview Survey) (Centers for Disease Control and Prevention (U.S.), 2011). The government of Australia goes beyond self-reported data and collects vaccine administration information through its Australian Immunisation Register (NCIRS, 2019b).

Evidence-Based Recommendations

Based on examination of the current evidence, and Canadian and international policies, there is more work to be done to improve the prevention of shingles in Canada. The following recommendations provide evidence-informed policy and practice approaches that can be used by PHAC, and provincial/territorial health authorities and organizations, to better support vaccination efforts. This would improve prevention efforts, reduce negative health outcomes and costs related to shingles across Canada.

1. Promote a Life-Course Vaccination Schedule that Includes Older Adults

The concept of a life-course vaccination schedule aims to advance the importance of immunization beyond children, by looking at reducing the prevalence of vaccine-preventable diseases in other age groups and vulnerable populations (Philip et al., 2018). At the national level, the Canada Immunization Guide does provide a recommended immunization schedule for all age groups (Government of Canada, 2021a). However, routine immunization schedules vary across Canada's provinces and territories (Government of Canada, 2020), including for shingles. While PHAC recommends the RZV for Canadians aged 50 years and older as part of its recommended immunization schedule (Government of Canada, 2021a), only Ontario, Yukon, Prince Edward Island, and Alberta are currently offering access to a publicly funded vaccination program ((Government of Alberta, 2022a; Government of Prince Edward Island, 2022a; Government of Yukon, n.d.; Ministry of Health, n.d.; PHAC, 2019b). It's unclear why more than half of provinces and territories

have not implemented coverage and support for the uptake of a shingles vaccination (Government of Alberta, 2022a; Government of Yukon, 2021; Neatby, 2021; PHAC, 2019b; Waddell, 2021). With such a large discrepancy, it highlights the need to push for changes in provincial and territorial vaccination schedules to meet the needs of their older vulnerable populations.

2. Improve the Surveillance of Shingles Cases Across Canada and its Implications on Canadian Healthcare Systems

The monitoring of shingles cases and their associated complications needs to be implemented comprehensively at the national and provincial/territorial levels. Nationally, shingles is not a reportable illness and there is no surveillance program in place for it, unlike other vaccine-preventable diseases (e.g. measles/rubella, pneumococcal disease) (PHAC, 2018; PHAC, 2021b). Provincially, academic articles have reported on the administrative data from British Columbia, Manitoba, Ontario, and Quebec (Brisson et al., 2001; Edgar et al., 2007; Letellier et al., 2018; Marra et al., 2016a; Russell et al., 2007; Russell et al., 2014; Tanuseputro et al., 2011).

There needs to be a thorough disease surveillance system in place for Canada, which has been highlighted as a recommended action in both the WHO Global Vaccine Action Plan and Immunization Agenda 2030 (WHO, n.d.; WHO, 2013). Disease surveillance plays an important role within the health system by monitoring the impact

of vaccination programs and shifts in disease epidemiology (WHO, 2013). In a study of six countries (Australia, Brazil, France, Japan, England, United States) that have been able to implement a life-course approach to vaccination, all but Japan have developed—or were developing—electronic databases to collect and share infectious disease and immunization data (Morris et al., 2019).

3. Improve Reporting and Monitoring of Shingles Vaccination Rates

Similar to shingles surveillance, there should also be improvements for reporting shingles vaccination rates at both the provincial/territorial and national levels. Canada currently monitors its shingles vaccination coverage every two years through the self-reported Seasonal Influenza Vaccination Coverage Survey (PHAC, 2021c), with 2018-2019 being the first season it was measured (PHAC, 2019c). Statistics Canada (2021a) has also provided shingles vaccination coverage data for 2019 and 2020 through the self-reported Canadian Health Survey on Seniors (CHSS).

In regards to the Seasonal Influenza Vaccination Coverage Survey, the summary of results from the 2018-2019 survey highlighted several issues. Firstly, the survey had a low response rate, which can impact the generalizability of its findings to the overall population (PHAC, 2019c). As well, the national survey does not provide a comprehensive understanding of potential factors that impact vaccination uptake. Only gender and reasons for non-vaccination are analyzed, which could mean other important factors are left unaccounted for (PHAC, 2019c). Other vaccine-preventable diseases in the

same survey, looked into age differences, where the vaccine was administered, and beliefs regarding the vaccine itself (PHAC, 2019c). It is even more concerning that the recent summary of results from the 2020-2021 survey reduced the amount of shingles-related information, by just noting the shingles vaccination coverage and the most common reason for non-vaccination (PHAC, 2021c). The CHSS has also only provided shingles vaccination coverage, but from a significantly larger number of respondents (approx. 23 500 versus 3 737) (PHAC, 2019c; Statistics Canada, 2021b).

In the US, the national survey also looks at race, ethnicity, and level of education (Terlizzi & Black, 2020). Better data is needed to enable a comprehensive understanding of possible barriers and how to ensure equitable access. This should also be complemented with a vaccination target/goal, an integral part of an accountable immunization system. While these systems are in place in Canada for influenza and pneumococcal disease, they have not been implemented for shingles vaccination rates (WHO, n.d.).

At the provincial level, Statistics Canada has recently started gathering cumulative coverage rates (Statistics Canada, 2021b) (Figure 7). However, the dataset is focused on a slightly different age group (adults aged 65 years and older) to the one noted in the current NACI recommendations (adults 50 years and older) (PHAC, 2018; Statistics Canada, 2021b). Also, there continues to be a lack of data regarding shingles vaccination coverage at the territorial level. Such information is vital, especially in further understanding the impacts of the publicly funded programs (ex. Ontario, Yukon, Alberta,

and Prince Edward Island). compared to other provinces and territories (Government of Alberta, 2022a; Government of Prince Edward Island, 2022a; Government of Yukon, n.d.; Ministry of Health, n.d.; PHAC, 2019b).

4. Provide the Shingles Vaccination Free of Cost to all Eligible Canadians Aged 50 Years and Older

It is important to better target vaccine costs, as financial barriers have been identified as a primary reason for non-vaccination against shingles among Canadian adults (PHAC, 2019c). Countries like England have shown how a publicly funded vaccine program can lead to a high uptake of the shingles vaccine (NCIRS, 2019b, PHE, 2020). Also, Australia's public program has shown that it can significantly influence a reduction in rates of shingles-related antiviral prescriptions (Litt et al., n.d.). A study in Ontario compared the period when shingles vaccination was publicly available to when it was privately available (Martins et al., 2020). The findings indicated that during the period when the vaccine was made available free of cost there was a decrease of 19% in the incidence of shingles cases and a 38% reduction in shingles-related emergency department visits and hospitalizations (Martins et al., 2020). No reduction was found during the period when the vaccine was privately available.

In regard to the most appropriate target age group, the majority of publicly-funded programs mentioned in this report (Ontario, Yukon, Australia, UK), have focused on adults aged 65 to 79 years (Government of Yukon, n.d.; Ministry of Health, 2021; NCIRS, 2019a; PHE, 2022). This is due to the heightened risk

of shingles-related complications and the limited effectiveness of the LZV over time and in older age (AIHW, 2018). Even though the RZV is more effective across time and age groups (see figure 4 and 5), it is recommended that a targeted age group approach that other programs have promoted is kept, as this remains the period when the vaccine has been shown to be most cost-effective (Drolet et al., 2019; PHAC, 2018).

5. Adhere to Canada's Current NACI Statement for Shingles Vaccination

Canada's NACI statements are based on the best available scientific knowledge, and provide recommendations at both the individual and public health levels (PHAC, 2018). The latest shingles vaccination statement advocates for the use of the RZV over the LZV for adults aged 50 years and older (PHAC, 2018). The evidence clearly indicates that the RZV is the better choice, as it has a higher rate of VE across age groups and over time, higher cost-effectiveness, a lower number of people needed to vaccinate to avoid a case of shingles, and is associated with no changes in immune response over age (Cunningham et al., 2016; Drolet et al., 2019; Lal et al., 2015; Oxman et al., 2008; PHAC, 2018; Tseng et al., 2016). The statement also noted that, depending on contextual factors (e.g. resources available), provinces and territories can look at targeted approaches (e.g. only certain age groups) to ensure implementation of vaccine programs (PHAC, 2018).

6. Provide Clinician Education and Support for Pharmacists, Primary Care and Other Health Care Providers to Deliver Vaccinations

It has been noted above that Canadians are not being well informed about recommended vaccines and have a low understanding of the importance of the shingles vaccine (MacDougall et al., 2015; PHAC, 2019c; PHAC, 2021c). Health care providers need to be educated about shingles vaccination, to ensure accurate information is given to patients. This is highlighted by a Swiss study that found physician recommendation significantly increased shingles vaccination rates among adults 65 year of age and older (Kizmaz et al., 2019). In fact, an evaluation of Australia's national shingles vaccination program suggests that provider education should be prioritized more so than patient awareness efforts (NCIRS, 2019b). Australia's program had implemented a national communications strategy for the shingles vaccination, with its target audience being both patients and health professionals (NCIRS, 2019b). Australian consumers reported, however, that most of their information on the shingles vaccine came from their own general practitioners, with only a third noting that they had seen public health communication materials (NCIRS, 2019b).

7. Recommend the Administration of Shingles Vaccine in Conjunction with Other Vaccines, Where Applicable, Including the Influenza and COVID-19 Vaccines to Improve Uptake and Compliance

NACI has previously stated that the shingles vaccines can be safely co-administered with quadrivalent influenza vaccines (PHAC, 2018). Indeed, the administration of both types of vaccines has not been shown to impact either vaccines' immune responses or to create any safety concerns (Levin et al., 2018; Schwarz et al., 2017). As the influenza vaccine is provided annually, its administration provides a good opportunity for health care professionals to ask about an older person's shingles vaccination status. Both can then be provided at the same time, if needed. Data from England and Australia's publicly-funded programs have noted that during the time of year when influenza vaccinations are administered, there has been a corresponding increase in the uptake of shingles vaccinations, likely for this reason (PHE, 2020; NCIRS, 2019b).

NACI has also recently recommended that the administration of COVID-19 vaccines does not need to be spaced out from the administration of other vaccines. Specifically, NACI states that COVID-19 vaccines can be given at the same time, or at any time before or after, other vaccines, including live, non-live, adjuvanted, and non-adjuvanted vaccines (NACI, 2021).

NACI had previously recommended giving COVID-19 vaccines at least 28 days before or 14 days after other vaccines as a precaution. It has since determined that this precautionary approach is no longer necessary. Allowing simultaneous administration of COVID-19 vaccines with other vaccines will facilitate routine and upcoming vaccination programs, including the rollout of the 2021-22 fall and winter influenza vaccination campaign (NACI, 2021).

8. Harmonize Vaccination Administration Across and Within Canada's Provinces/Territories

As evident in Table 3, the Canadian landscape around the administration of the shingles vaccination is fragmented. Despite all of the provinces enabling pharmacists to administer the shingles vaccine, some of the territories (Nunavut and Northwest Territories) have still not implemented this practice (Canadian Pharmacists Association, 2021). Even in provinces that have increased the scope of practice of their pharmacists to administer vaccinations, not all pharmacies are administering the shingles vaccine (Alberta Health Services, 2018; Alpha Group, Inc, 2019). This is further complicated in Ontario, where unlike primary care physicians or nurse practitioners, pharmacists are not able to provide the free publicly funded vaccine to eligible individuals; they can provide the same vaccine if the eligible patient pays for it at their pharmacy (Ministry of Health, n.d.; Ministry of Health, 2021). Also, it has been

observed where patients can buy shingles vaccinations in physician offices, only some provide this service (Alberta Health Services, 2018). It is not only recommended that vaccination practices be harmonized across the Canada, but also within the provinces and territories themselves. Harmonization will enable more consistent communication, reduce confusion around this vaccination, and, most importantly, ease the ability of the public to receive the shingles vaccine.

With the recent changes made by the NAPRA, allowing the RZV to be provided by pharmacists without a prescription (NAPRA, n.d.c; NAPRA, 2021), the need for harmonization in vaccine administration policies is now more relevant and important than ever before.

Concluding Thoughts

This paper has highlighted the importance of increasing shingles vaccination uptake for adult Canadians. Today, less than a third of Canadians aged 50 years and older have reported being vaccinated against shingles (PHAC, 2021c). At the time of publication, the COVID-19 pandemic adds another challenge to this issue, especially in its impact on Canadians' preventative health behaviours. For example, cancer screening tests in Ontario have decreased by around 41% (951,000 tests) from 2019 to 2020 (Walker et al., 2021). With shingles vaccination uptake already being low in Canada (PHAC, 2021c), the pandemic may have had other effects on shingles immunization rates as has been seen with other vaccinations such as influenza (PHAC, 2021c; Government of Alberta, 2022b).

This pandemic also provides some reasons for optimism, primarily due to the relatively fast uptake of COVID-19 vaccines. Despite these vaccines not having the long-term high VE information of shingles vaccines (PHAC, 2021; PHAC, 2022), a coverage rate of 80% among those aged 12 years and older was still able to be achieved (Government of Canada, 2022a; Government of Canada, 2022c). For shingles vaccines to have the same level of urgency, it will depend on the combined action of various levels of government, stakeholders, and the public.



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