

# Lessons Learned: What Successful COVID-19 Immunization Efforts Taught Us About Improving Vaccine Coverage Among Older Canadians for Other Vaccine-Preventable Diseases



# National Institute on Ageing

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## **Mailing Address:**

National Institute on Ageing  
Ted Rogers School of Management  
350 Victoria St.  
Toronto, Ontario  
M5B 2K3  
Canada

## About the National Institute on Ageing

The National Institute on Ageing (NIA) is a public 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 perspectives, including those of financial, physical, psychological, and social well-being.

The NIA is focused on leading cross-disciplinary, evidence-based, and actionable research to provide a blueprint for better public policy and practices needed to address the multiple challenges and opportunities presented by Canada's ageing population. The NIA is committed to providing national leadership and public education to productively and collaboratively work with all levels of government, private and public sector partners, academic institutions, ageing-related organizations, and Canadians.

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 2014.

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: Independent, Productive and Engaged Citizens; Healthy and Active Lives; Care Closer to Home; and Support for Caregivers.

## Authors

**Natalie Iciaszczyk, MA, JD**

Policy Analyst, National Institute on Ageing,  
Ryerson University

**Cameron Feil, MSc**

Research Coordinator, National Institute on  
Ageing, Ryerson University

**Samir K. Sinha, MD, DPhil, FRCPC, AGSF**

Director of Health Policy Research, National  
Institute on Ageing, Ryerson University;  
Director of Geriatrics, Sinai Health System  
and University Health Network; Professor of  
Medicine, Family & Community Medicine,  
Health Policy, Management and Evaluation,  
University of Toronto

# Table of Contents

<b>Introduction</b>	<b>06</b>
<b>COVID-19 and Vaccination Coverage in Canada</b>	<b>08</b>
<b>What Are Influenza, Pneumonia and Shingles and How Do They Impact Older Canadians?</b>	<b>11</b>
<b>Influenza, Pneumonia and Shingles Vaccination Coverage Rates Among Older Canadians</b>	<b>21</b>
<b>Lessons Learned from Canada’s COVID-19 Rollout</b>	<b>23</b>
<b>Recommendations to Increase Influenza, Pneumococcal and Shingles Vaccine Uptake Among Older Canadians</b>	<b>28</b>
<b>Conclusion</b>	<b>38</b>
<b>References</b>	<b>39</b>

## Introduction

The COVID-19 pandemic has prompted important discussions about the critical role vaccines play in individual and community health. There continues to be a significant gap, however, both in public knowledge and in immunization rates for other vaccine-preventable diseases. This issue is particularly acute for older Canadians, who are at higher risk of serious health outcomes from many vaccine-preventable illnesses.

One factor that could contribute to low vaccine uptake is that while most Canadians believe they are up-to-date on their recommended vaccinations, many are not.

**In 2016, 88% of Canadians responding to a Public Health Agency of Canada (PHAC) survey reported that they were up-to-date on their recommended vaccinations. However, only 3% of respondents had received all of their recommended vaccinations.<sup>1</sup>**

Vaccination rates against several vaccine-preventable diseases also remain far too low among older Canadians. In particular, Canada is failing to adequately vaccinate its older population against influenza, shingles, and pneumococcal disease (a common cause of pneumonia). Known as the “Big 3” of vaccine-preventable diseases, these illnesses cause thousands of preventable deaths each year, especially among older Canadians.<sup>2</sup>

In contrast to Canada’s inadequate program of vaccination for older adults against the “Big 3”, its COVID-19 vaccine rollout has reflected a markedly different outcome, helping its population achieve one of the world’s highest vaccination rates against the virus.

As of November 6, 2021, 89% of Canada’s eligible population, aged 12 years and older, has received at least one dose of a COVID-19 vaccine, while 85% are fully vaccinated.<sup>3</sup> The COVID-19 vaccine rollout has been especially successful among older Canadians. Canada has fully vaccinated 91% of its population aged 60 years and older against COVID-19 and achieved both early and comprehensive COVID-19 vaccination coverage for this group. However, vaccine coverage among older Canadians against preventable diseases such as influenza, shingles, and pneumococcal disease has remained comparatively low. This raises critical questions around why Canada hasn’t been able to reach the same high vaccination coverage levels for older adults, or to meet PHAC’s own target vaccination rates, for these and other vaccine-preventable diseases over the past decade.

There is considerable overlap in age-related risk factors for COVID-19 and other vaccine-preventable diseases, including influenza, shingles, and pneumococcal disease. For example, a study comparing the effect of 46 clinical conditions on death after a COVID-19 infection found that age is by far the most important predictor of mortality in COVID-19 patients.<sup>4</sup> Older age has also been shown to be the greatest risk factor and predictor of hospitalization and death following influenza

infections<sup>5,6,7</sup> and pneumococcal-related infections.<sup>8,9,10</sup> Similarly, several Canadian studies on shingles have found that older adults not only have higher incidence rates of infections, but also shingles-related complications (PHN), hospitalizations, and deaths than younger individuals.<sup>11,12,13</sup>

This report compares vaccination uptake rates for COVID-19 vaccines with those for other vaccine-preventable diseases including influenza, shingles, and pneumococcal disease among older Canadians. Uptake rates for the latter three vaccines are much lower and in the case of influenza and pneumococcal disease, have yet to achieve PHAC's target vaccination rates of 80% among adults aged 65 years and older. This report also analyzes Canada's COVID-19 vaccine rollout and identifies five important factors that contributed to the record high rates of vaccination that have been achieved among older Canadians. Analyzing the strategies adopted throughout the COVID-19 vaccine rollout also demonstrates that the relatively low uptake of influenza, pneumococcal, and shingles vaccines among older adults in Canada is unlikely to be the product of vaccine hesitancy. Rather, it is likely due to a lack of concrete actions taken to improve education, awareness, and reduce barriers to vaccination.

Based on these findings, the NIA has identified seven evidence-based recommendations to improve vaccine uptake by older adults and reduce the burden of vaccine-preventable diseases in Canada. Following the high uptake of COVID-19 vaccines among older Canadians, there is a unique and clear opportunity

for future vaccination efforts to capitalize on the successes of the COVID-19 rollout. Significantly increasing vaccine coverage in Canada is an achievable goal that would strengthen community and individual health and well-being, especially for older adults.



## COVID-19 and Vaccination Coverage in Canada

COVID-19 is an infectious disease caused by the novel SARS-CoV-2 virus. While symptoms vary from person to person, common indicators include a worsening cough, shortness of breath or difficulty breathing, high temperature, chills, fatigue, body aches and loss of smell or taste.<sup>14</sup>

Older adults are the demographic at highest risk of contracting COVID-19 and of experiencing serious, and even fatal, health consequences.

### **Overwhelming evidence continues to demonstrate that age remains the number one risk factor predicting morbidity and mortality from COVID-19.**

Recent research shows that advanced age results in roughly twice as high a likelihood of death when compared to 46 clinical conditions that also increase the risk of death from COVID-19, making it the most important predictor of COVID-19 mortality.<sup>15</sup> Similarly, a 2020 NIA-led study found that the risk of dying from COVID-19 was 14 times higher for community-dwelling older adults than younger Canadians. For residents in long-term care and retirement homes, the risk was more than 1,000 times higher, at that time.<sup>16</sup>

The devastating impacts of COVID-19 on this group have made it clear that widespread immunization is critical to protect older Canadians against this disease.

**Since the beginning of the pandemic, Canada has recorded more than 1.7 million cases of COVID-19 and more than 29,000 deaths. About 93% of these fatalities have occurred among Canadians aged 60 years and older.<sup>17</sup>**

Canada can be proud of the fact that it has achieved a comprehensive level of COVID-19 vaccination coverage among older adults. As of November 6, 2021, 93% of Canadians aged 60 years and older have received at least one dose of a COVID-19 vaccine and 91% have been fully vaccinated with both doses.<sup>18</sup> It bears noting that 90% coverage was achieved in a short period of time—from mid-December 2020 to mid-July 2021—demonstrating that achieving high vaccination coverage for older adults is possible in a timely manner. A high demand for COVID-19 booster shots is also expected as these efforts get underway across Canada in the coming months.

In its preliminary guidance released in November 2020, the National Advisory Committee on Immunization (NACI) recommended that initial COVID-19 vaccine doses be prioritized for the following groups: residents and staff in long-term care homes, retirement homes and other congregate settings for older persons, adults aged 70 years and older starting with those over 80 years of age, front-line healthcare workers,



and adults living in Indigenous communities.<sup>19</sup> On December 14, 2020, Canada's COVID-19 vaccine rollout began. All Canadian jurisdictions, including the 10 provinces and three territories followed NACI's early recommendation of prioritizing initial vaccine doses for residents and staff of long-term care homes,<sup>20</sup> which had become the epicenters of the COVID-19 pandemic.<sup>21</sup>

By late February 2021, all Canadian jurisdictions had begun to administer COVID-19 vaccines to community-dwelling older adults despite significant variation in long-term care home vaccination coverage.<sup>22</sup> During the initial months, there were also considerable differences in the decisions, policies and structures to enable vaccine rollouts for community-dwelling older adults across Canada's provinces and territories. This caused further regional variation in vaccine coverage among older adults. Yet despite initial differences in the speed at which older adults were vaccinated across jurisdictions, Canada successfully vaccinated the majority of its older population relatively quickly.

**Only seven months after beginning the vaccine rollout, nearly every province and territory in Canada had vaccinated more than 90% of its population aged 60 years and older—both in long-term care settings and the community—with at least one dose of a COVID-19 vaccine.<sup>23</sup>**

On September 28, 2021, NACI released updated guidance recommending that long-term care residents and older adults living in other congregate-care settings receive a booster dose of a COVID-19 vaccine at least six months after completing a primary COVID-19 vaccine series.<sup>24,25</sup> Long-term care residents, and older adults in congregate care settings, are at increased risk of infection and experiencing severe outcomes due to their advanced age and underlying medical conditions. These are the primary reasons older adults were prioritized to receive Canada's first vaccinations at the start of the COVID-19 vaccine rollout in December 2020.<sup>26</sup> NACI now recommends booster shots, as emerging evidence has demonstrated that long-term care residents and older adults living in other congregate care settings may experience both waning antibodies and vaccine protection over time.<sup>27</sup>

On October 29, 2021, NACI released new interim guidance on booster doses of COVID-19 vaccines.<sup>28</sup> NACI now strongly recommends that additional populations at highest risk of severe illness from COVID-19 and waning protection after completing a full COVID-19 vaccine series receive a booster dose. In doing so, NACI has expanded the populations for whom it recommends boosters to include all adults aged 80 years and older, in addition to adults living in long-term care and other congregate settings.<sup>29</sup> NACI also recommended that other populations that may be at increased risk of severe illness and lower protection over time since vaccination may also be offered a booster dose of a COVID-19 vaccine, including adults aged 70-79 years.<sup>30</sup> NACI recommends

that COVID-19 booster shots be offered at least six months after completion of a primary COVID-19 vaccine series.<sup>31</sup>

NACI also recently recommended that COVID-19 vaccines can be administered at the same time, or any time before or after, other vaccines, including live, non-live, adjuvanted, and non-adjuvanted vaccines.<sup>32</sup> NACI had previously recommended that COVID-19 vaccines be given at least 28 days before or 14 days after other vaccines as a precaution. After reviewing the evolving available evidence, NACI determined that a precautionary approach is no longer necessary around the co-administration of COVID-19 with other vaccines.<sup>33</sup> Allowing the simultaneous administration of COVID-19 vaccines with other immunizations will facilitate routine and upcoming vaccination programs. This includes the rollout of the 2021-22 fall and winter influenza vaccination campaign.<sup>34</sup>



# What Are Influenza, Pneumonia and Shingles and How Do They Impact Older Canadians?

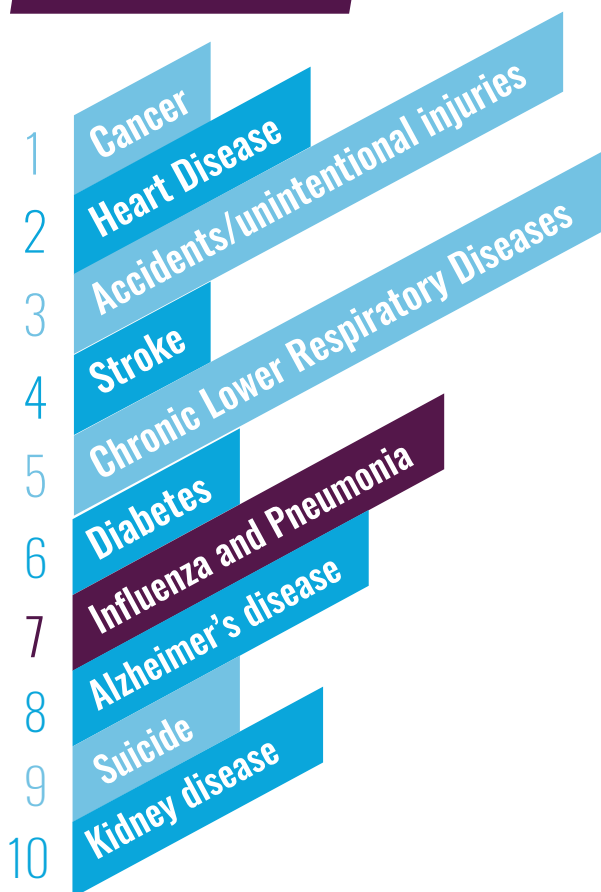
## Influenza

There are four types of influenza: A, B, C, and D. Influenza A and B are most responsible for the seasonal influenza epidemics seen annually in Canada and across the world. While influenza infections occur year-round, most infections occur during “flu season”, which in Canada runs from November to April.<sup>35</sup> Typical flu symptoms include fever, cough, sore throat, runny or stuffy nose, body aches, headache, chills, and fatigue.

Influenza causes an estimated 12,200 hospitalizations and 3,500 deaths in Canada every year.<sup>36</sup> In fact, influenza is one of Canada’s top causes of death.

**Together with pneumonia, influenza typically ranks as the seventh leading cause of death in Canada,<sup>37</sup> including among Canadians aged 85 years and older.**

**Figure 1: Top 10 Causes of Death (2019)<sup>37</sup>**



Before the COVID-19 pandemic, it was also the leading cause of death in Canada among vaccine-preventable diseases.<sup>38</sup>

However, similar to COVID-19, older adults are more vulnerable to influenza and the virus is a significant cause of morbidity and mortality in older Canadians. This is because individuals with weakened immune systems and underlying chronic medical conditions are at increased risk of contracting the virus, experiencing secondary complications, and having their underlying conditions worsened by influenza.<sup>39,40</sup>

While adults aged 65 years and older accounted for about 18% of Canada’s population, they accounted for 21% of Canada’s laboratory confirmed type A and B influenza cases during the 2019-20 influenza season.<sup>41</sup> Yet older Canadians accounted for the clear majority of Canada’s influenza-related deaths, with 70% of all reported

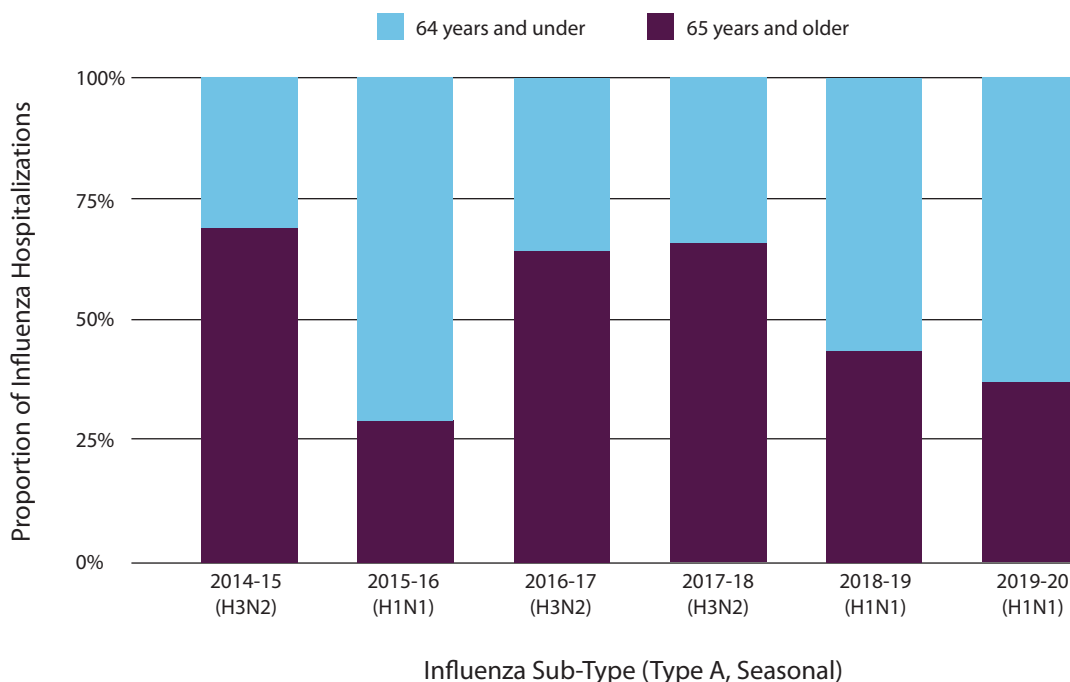
influenza deaths during the 2019-20 influenza season occurring among individuals aged 65 years and older.<sup>42</sup>

Comparing hospitalizations due to seasonal influenza also demonstrates the disproportionate impact the virus has on older Canadians. Over the past five flu seasons, Canadians aged 65 years and older accounted for 53% of all seasonal influenza (predominant A subtype) hospitalizations, compared to 47% for all people aged 64 years and younger (Figure 2).<sup>43</sup> Further, the prevalence of high-risk medical conditions such as heart disease, diabetes, lung disease, kidney disease, and cancer—all of which are more common among older adults—increases the probability of experiencing complications from influenza infections. For those aged 20 to 64, approximately 30% of influenza complications are linked to one of these medical conditions. This figure rises to approximately 53% among

those aged 50 years and older and to over 70% among those aged 65 years and older.<sup>44</sup>

Yet the negative consequences of influenza are often underestimated, particularly among older Canadians. One major reason is that it is difficult to accurately determine the extent and degree to which influenza leads to other health complications. For example, when people seek medical attention for influenza-related complications, they are not always tested for influenza. The same is true for deaths determined to be the result of complications or the exacerbation of a pre-existing condition. The result of this lack of testing is that health consequences attributable to influenza are often not traced back to the illness.<sup>45,46</sup> Despite its severity, popular misconceptions regarding the seriousness of influenza persist. Many Canadians dismiss symptoms or consequences as being no more serious than a common cold.

**Figure 2: Estimated annual seasonal influenza hospitalizations by age in Canada<sup>47</sup>**



## Vaccination remains the best overall way to prevent influenza.

Most standard influenza vaccines are made to protect against three ‘flu’ viruses: two strains of influenza A (H1N1 and H3N2) and one strain of influenza B. These are called ‘trivalent’ influenza vaccines. There are also ‘quadrivalent’ influenza vaccines that include an additional influenza B strain, designed to protect against four different ‘flu’ viruses.<sup>48</sup>

In addition to standard influenza vaccines, there are also enhanced influenza vaccines. Enhanced influenza vaccines aim to encourage the body to create a stronger immune response. This is why they are being recommended for, and made increasingly available to, adults aged 65 years and older, for whom standard influenza vaccines are typically less effective. There are two types of enhanced vaccines: high-dose influenza vaccines and adjuvanted influenza vaccines. High-dose influenza vaccines contain four times the antigen content of standard influenza vaccines to generate a stronger immune response. Adjuvanted influenza vaccines include an additional substance to generate a stronger immune response.

NACI currently recommends that adults aged 65 years and older receive the trivalent high-dose influenza vaccine. This recommendation is based on clear evidence showing that the high-dose trivalent version offers better protection to adults aged 65 years and older compared to the standard dose equivalent.<sup>49</sup> However, as of this year, the trivalent high-dose vaccine is no longer being distributed in Canada and has been replaced with a quadrivalent high-dose influenza vaccine. In response to this development, NACI issued a discretionary recommendation that for adults aged 65 years

and older—those for whom the high-dose trivalent vaccine is recommended—the high-dose quadrivalent may be considered as an option.<sup>50</sup>

A trivalent adjuvanted influenza vaccine is also currently authorized by Health Canada for use in adults aged 65 years and older, but NACI’s most recent guidance does not make any explicit recommendation regarding its use in older Canadians. NACI states that while there is fair evidence that the adjuvanted trivalent vaccine may be effective at reducing hospitalization for influenza and influenza complications in older adults compared to the unvaccinated, there is insufficient evidence that it is more effective than the standard-dose trivalent vaccine. NACI’s current position on adjuvanted influenza vaccines appears to be based on a literature review conducted in 2018, comparing the efficacy and effectiveness of high-dose and adjuvanted trivalent influenza vaccines in adults aged 65 years and older.<sup>51</sup> The same literature review also concluded that there is no identified evidence on how the high-dose trivalent vaccine directly compared to the adjuvanted trivalent vaccine.<sup>52</sup> Yet, more recent evidence from the United States suggests that the adjuvanted trivalent influenza vaccine is comparably effective to the trivalent high-dose influenza vaccine among adults aged 65 years and older.<sup>53</sup> Adjuvanted trivalent influenza vaccines have also been found to be more effective at preventing influenza-related hospitalizations among older adults than quadrivalent standard-dose vaccines.<sup>54,55</sup>

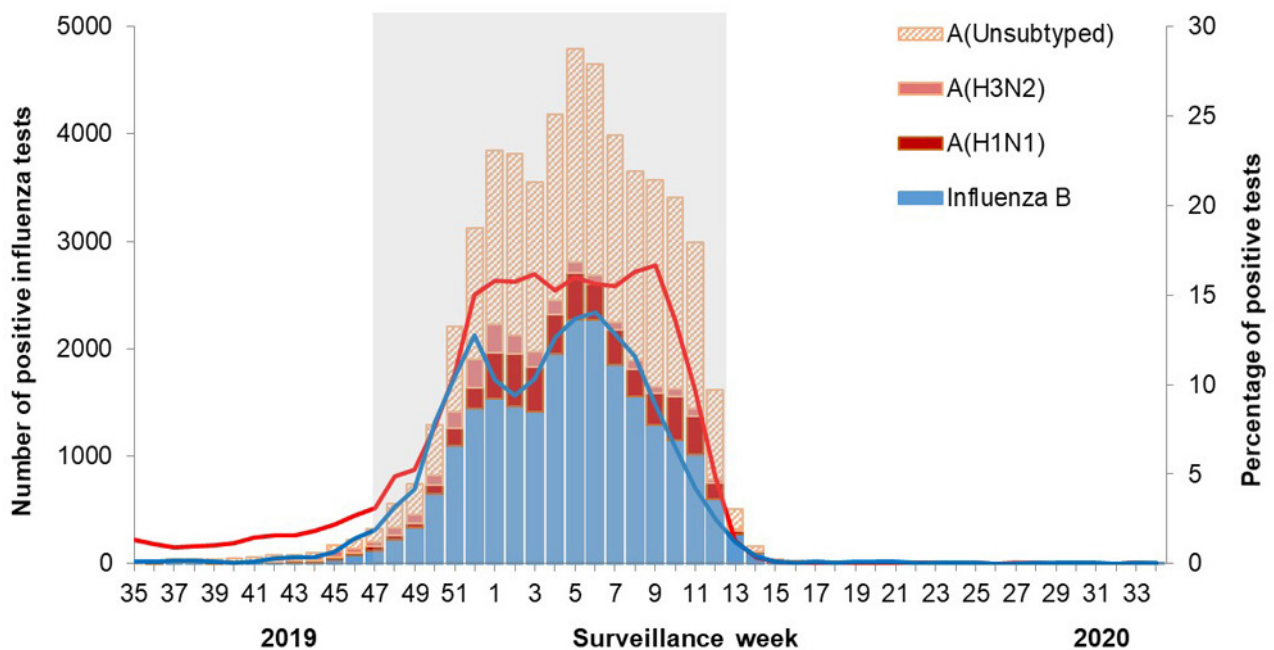
It should be noted that the use of adjuvanted influenza vaccines has been widely adopted in other countries as part of their influenza vaccination campaigns targeting older adults. For example, the United States approved the

use of adjuvanted vaccines in 2015, and they were first used during its 2016-17 influenza season.<sup>56</sup> Similarly, England introduced the use of an adjuvanted trivalent influenza vaccine, for all adults aged 65 years and older, during its 2018-19 influenza season. The country has since continued to recommend and publicly fund adjuvanted influenza vaccines for older adults due to higher effectiveness for individuals aged 65 years and older compared to standard dose influenza vaccines.<sup>57</sup>

In light of the evidence that has emerged since NACI's 2018 literature review, both

high-dose and adjuvanted influenza vaccines appear to offer older adults better protection compared to standard influenza vaccines. This makes the use of either enhanced vaccine a preferred choice for adults aged 65 years and older. However, in the absence of any enhanced vaccine, a standard influenza vaccine should still be used.<sup>58</sup> The best time to get the influenza vaccine remains between October and December, before the virus starts significantly spreading in the community over the course of the fall and winter (See Figure 3 below).<sup>59</sup>

**Figure 3: Number of positive influenza tests and percentage of positive tests by type, subtype and week, Canada, 2019-20 season<sup>60</sup>**



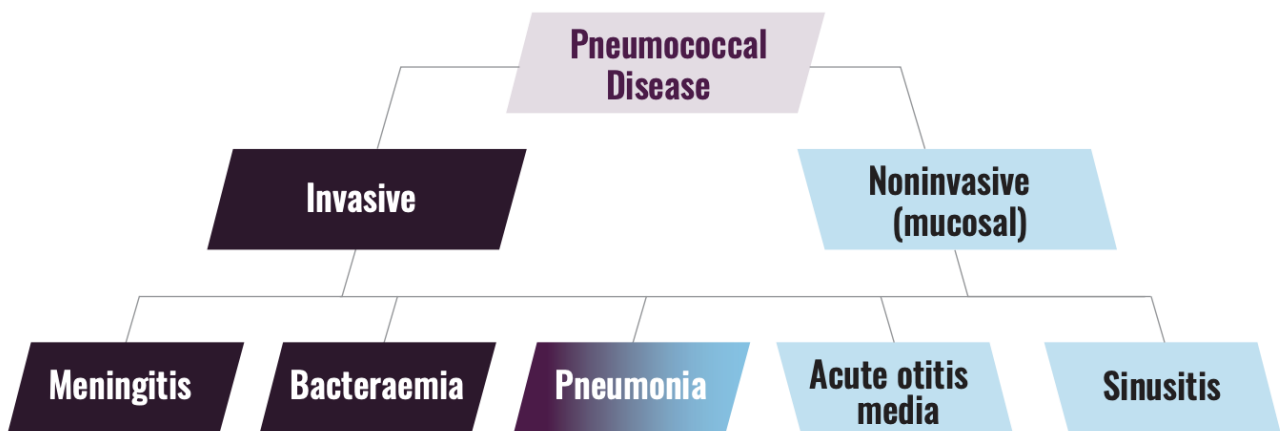
## Influenza vaccines change annually because the virus is constantly evolving.

A new vaccine is developed for each influenza season to provide protection against the expected dominant strains of influenza A and B.<sup>61</sup> This is why the vaccine's effectiveness can vary from year to year. During the 2019-20 season, the estimated effectiveness of the influenza vaccine against any type of influenza was 53%.<sup>62</sup> Regardless, influenza vaccines have consistently been shown to significantly reduce primary care and hospital visits, along with deaths among older adults. In addition, unlike other vaccines, the influenza vaccine appears to be equally effective among older adults compared to younger populations.<sup>63</sup>

## Pneumococcal Disease and Pneumonia

Pneumococcal disease is any disease caused by the bacteria called *Streptococcus pneumoniae* (also known as *S. pneumoniae*) and can range from ear and sinus infections to pneumonia.<sup>64</sup> While pneumonia is only one possible manifestation of pneumococcal disease (see Figure 4), it is the most common, especially among older adults.<sup>65</sup> *S. pneumoniae* is also the cause of invasive pneumococcal disease (IPD), a more serious condition where the bacteria enters parts of the body where it is not typically found such as the bloodstream or central nervous system.<sup>66</sup> *S. pneumoniae* can be transmitted through direct mouth-to-mouth contact, coughing or sneezing, or through indirect contact with someone who carries the bacteria asymptotically, such as talking.<sup>67</sup>

**Figure 4: Pneumococcal Disease<sup>68</sup>**





Pneumonia is a common lung infection that can have many symptoms, including difficulty breathing, coughing, fever, fatigue, nausea and vomiting, chest pain, changes in heartbeat, confusion or delirium, and diarrhea.<sup>69</sup> Pneumonia can be caused by bacteria, viruses (including influenza and COVID-19), and more rarely by fungal infections.<sup>70</sup> The most common cause of bacterial pneumonia is a bacteria called *S. pneumoniae*.<sup>71</sup> While there can be other causes of pneumonia, *S. pneumoniae* is one of the common causes of pneumonia acquired in the community.<sup>72</sup> Recent studies of hospitalized Canadian adults demonstrate that 14% to 23% of community-acquired pneumonia (CAP) were attributable to *S. pneumoniae*,<sup>73</sup> but even these data are likely to be an underestimate due to the limited availability of specific diagnostic tests.<sup>74</sup>

Pneumococcal vaccines are recommended to protect individuals against pneumococcal disease—any infection caused by the *S. pneumoniae* bacteria. While these vaccines protect against cases of pneumonia caused by the *S. pneumoniae* bacteria—otherwise known as pneumococcal pneumonia—they do not protect against all forms of pneumonia. Yet, because the most common outcome of pneumococcal disease is pneumonia, pneumococcal vaccines play a significant role in reducing the burden of pneumonia. Moreover, they help protect against many other types of diseases caused by *S. pneumoniae*, including IPD.

Helping to reduce the burden of pneumonia in Canada through vaccinations against pneumococcal disease is critical.

**Pneumonia is among the top ten causes of emergency department (ED) visits in Canada, with estimates suggesting that there were more than 135,500 pneumonia-related ED visits in 2019-20.<sup>75</sup>**

Pneumonia is also one of Canada's top killers. Together with influenza, pneumonia has been among the 10 leading causes of death in Canada over the last two decades.<sup>76</sup> In 2019, influenza and pneumonia were together the seventh leading cause of death in the country, accounting for 6,893 deaths.<sup>77</sup>

Pneumonia also has a disproportionate effect on older Canadians. There are increased rates of pneumonia in older adults when compared to those under age 65, with residents of long-term care homes having even higher rates.<sup>78</sup> Estimates of the annual incidence of pneumonia among those aged 65 years and older vary from 2.5 to 4.4%, up to four times that of those aged under 65 years. In comparison, estimates suggest that the annual incidence rate for adults aged 65 years and older living in a long-term care home range from 3.3 to 11.4%.<sup>79</sup> Older adults also have the highest incidence of pneumococcal pneumonia—cases of pneumonia caused by *S. pneumoniae*—acquired in the community.<sup>80</sup>

The incidence of pneumonia among older adults is also expected to increase as the Canadian population continues to age in the coming years. In 2010, there were 388 cases of pneumonia per 100,000 people among Canadians aged 70-74 years and 1,125 cases



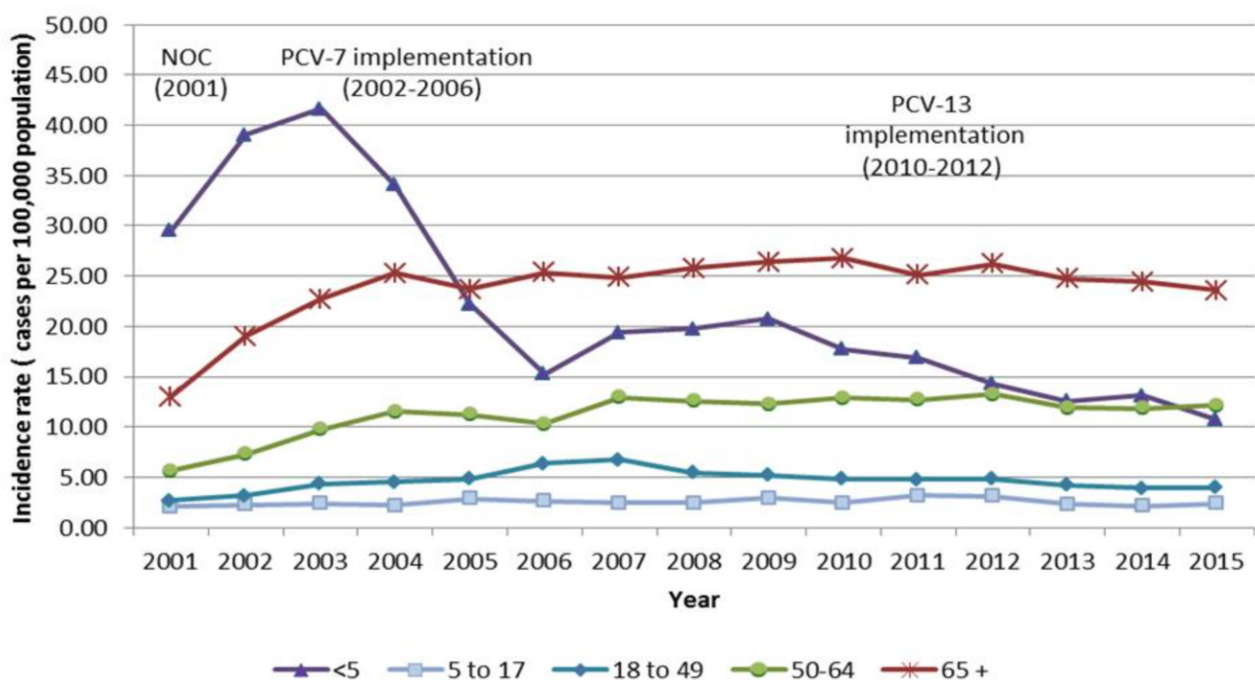
per 100,000 people among Canadians aged 75 years and older. By 2021, the incidence of pneumonia is forecast to increase to 429 and 1,400 cases per 100,000 people among those aged 70-74 years and those aged 75 years and older, respectively.<sup>81</sup>

Older adults are also disproportionately likely to suffer from severe illness due to pneumonia. In Canada, the incidence of hospitalization due to pneumonia for individuals aged 65 years and older is 1,537 per 100,000 people, according to national estimates from 2009-10.<sup>82</sup> Comparatively, the incidence of pneumonia-related hospitalization for the entire Canadian population is 347 per 100,000 people. In addition, hospitalization rates for pneumonia among Canadians aged 75 years and older are almost five times higher than among Canadians aged 65-69 years. This serves to

demonstrate the burden of pneumonia among the oldest members of our society.<sup>83</sup>

Older adults also have the highest incidence of IPD, confirming that older Canadians are disproportionately impacted by pneumococcal disease. In 2015, the incidence of IPD among adults aged 65 years and older was 23.6 cases per 100,000 people (Figure 5). Moreover, the oldest Canadians are the most impacted—the incidence among individuals aged 85 years and older was 42 cases per 100,000 people in 2015.<sup>84</sup> More recent data from Ontario confirms this trend. In 2019, there were 532 cases of invasive pneumococcal disease in Ontario. While the incidence rate for Ontarians of all ages was 8.7 cases per 100,000 people, it was 20.8 cases per 100,000 people for Ontarians aged 65 years and older.<sup>85</sup>

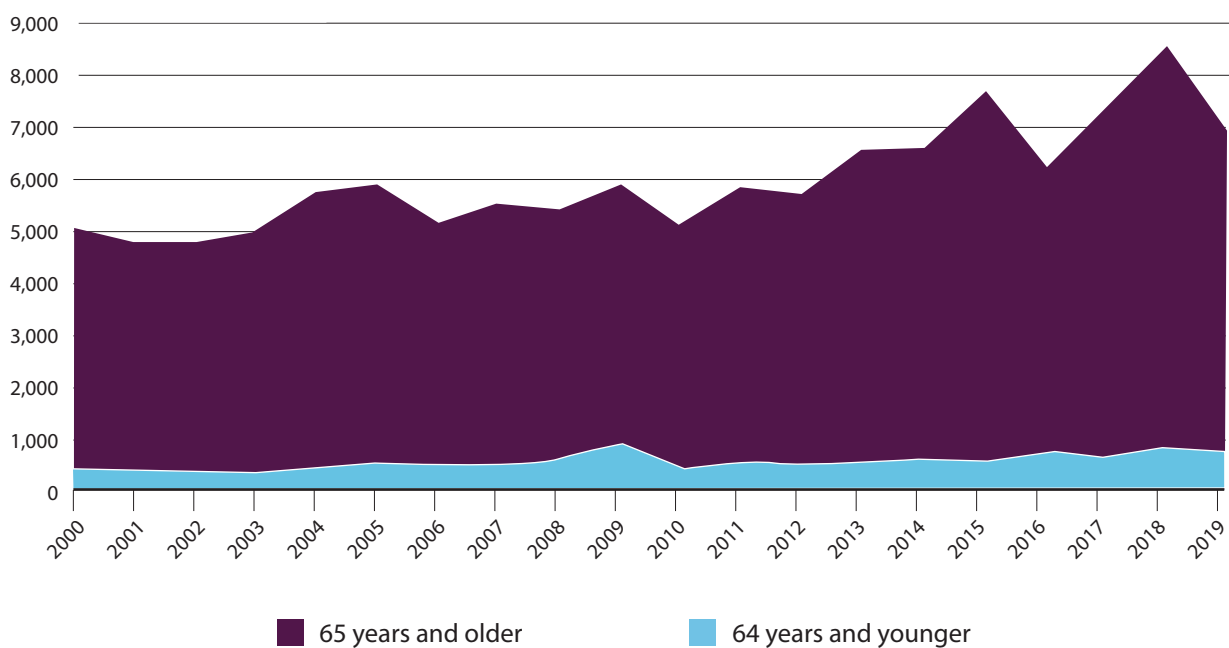
**Figure 5: Incidence of IPD among Canadians, 2011-2015, CNDSS<sup>86</sup>**



Overall, cases of pneumonia are also much more likely to lead to death in older Canadians. As noted earlier, together with influenza, pneumonia is the seventh leading cause of death in Canada, responsible for 6,893 deaths in 2019. Yet as Figure 6 shows, the overwhelming majority of deaths from pneumonia and influenza consistently occur among Canadians aged 65 years and older. In 2019, 89% of deaths from pneumonia and influenza were among Canadians aged 65 years and older. The oldest Canadians account for the largest share, with more than half (3,836) of the deaths in 2019 occurring among individuals aged 85 years and older.<sup>87</sup>

The burden of pneumonia in Canada is also significantly underestimated due, in part, to the fact that there is not enough data and the limited availability of specific diagnostic tests.<sup>88</sup> Currently, there is a lack of consensus on what the appropriate use of diagnostic tests should be for pneumonia. Moreover, hospitalizations are also likely to be underestimated because reported rates include only cases where pneumonia is listed as the primary diagnosis and exclude cases where pneumonia is recorded as a secondary diagnosis.<sup>89</sup>

**Figure 6: Deaths from influenza & pneumonia by age in Canada, 2000-2019<sup>90</sup>**



There are several pneumococcal vaccines in use in Canada, with two types of vaccine available for adults. The pneumococcal polysaccharide vaccine contains 23 pneumococcal serotypes (PPV23) and the pneumococcal 13-valent conjugate vaccine contains 13 pneumococcal serotypes (PCV13).<sup>91</sup> Health Canada reports an efficacy of 50% to 80% for the 23 valent vaccines among older adults.<sup>92</sup>

NACI recommends the routine administration of the PPV23 vaccines to all adults aged 65 years and older and all residents of long-term care homes. This includes recommending the vaccine for adults in these groups, even if they have no current risk factors. This recommendation is due to IPD being more common among older adults. For older adults who wish to seek additional protection, NACI says that PCV13 can be considered for those who are aged 65 years and older and who have never received a pneumococcal vaccine.<sup>93</sup>

## Shingles

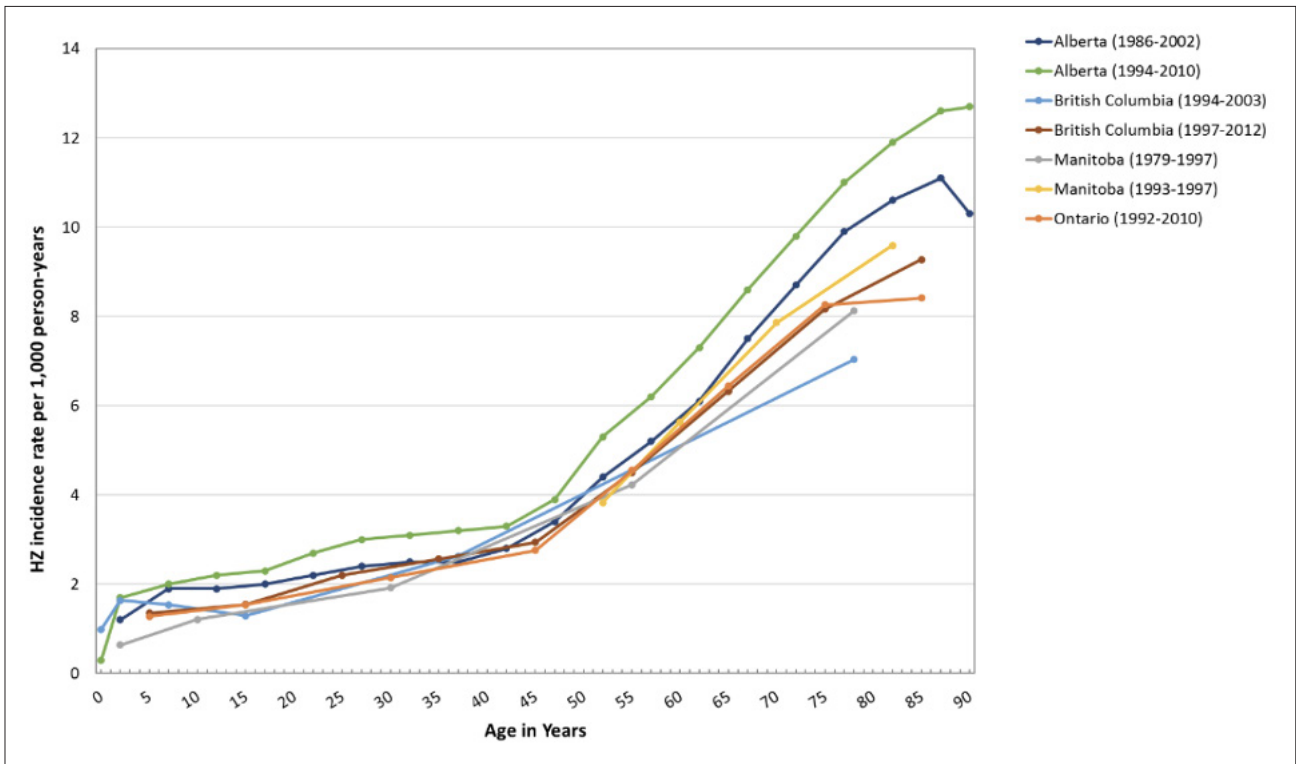
Shingles (also known as herpes zoster) is an infection caused by the reactivation of the varicella zoster virus, the virus also responsible for chickenpox infections.<sup>94</sup> The infection usually presents as a painful rash, commonly appearing on the chest, followed by the face.<sup>95</sup> While any person who has had chickenpox is at risk of developing shingles, the infection occurs most frequently among older adults and immunocompromised persons.<sup>96</sup> The most common complication of a shingles infection is post-herpetic neuralgia, a painful condition that can remain for more

than 90 days from the onset of the rash.<sup>97</sup>

It is estimated that there are approximately 130,000 new cases of shingles in Canada every year, leading to 17,000 cases of post-herpetic neuralgia and 20 deaths.<sup>98</sup> Almost one in three Canadians will develop shingles in their lifetime and over two-thirds of shingles cases occur in individuals aged 50 years and older.<sup>99</sup> There is currently no cure for shingles, reinforcing the importance of prevention via vaccination.

Because shingles infections often occur when an individual's immune system is weakened, older adults are especially vulnerable and at greatest risk of infection and severe symptoms, complications, and death.<sup>100,101</sup> The incidence of shingles increases with age, with Canadian studies noting four to six cases per 1,000 persons per year for adults aged 50 years and older. The incidence further increases with age, with 8 to 13 cases per 1,000 persons per year in adults aged 80 years and older (Figure 7).<sup>102</sup> Moreover, shingles-associated hospitalization rates are also highest for Canadians aged 65 years and older.<sup>103</sup> This is consistent with international data showing that the likelihood of hospitalization increases with age, especially for those aged 65 years and older.<sup>104</sup> Although the risk of death from contracting shingles is quite low, provincial data have nevertheless found that death rates are also higher for those aged 65 years and older compared to the overall population.<sup>105</sup>

**Figure 7: Age-specific shingles incidence rates per 1,000 person-years\* reported among published studies from Canadian provinces and/or territories<sup>106</sup>**



\* Person-years is a type of measurement that takes into account both the number of people in the study and the amount of time each person spends in the study. It is an estimation of the actual time at risk. Person-years are often used as the denominator in incidence rates when individuals are at risk of developing a disease for varying periods.

Source: University of Manitoba. (2013). Retrieved from: <http://mchp-appserv.cpe.umanitoba.ca/viewDefinition.php?definition-ID=104359>

There are two shingles vaccines authorized for use in Canada, a live attenuated vaccine (Zostavax II) and a recombinant subunit vaccine (Shingrix).<sup>107</sup> The live attenuated vaccine (LZV) is administered with a single subcutaneous (under the skin) dose injection, while the recombinant subunit vaccine (RZV) requires two doses administered between two and six months apart.<sup>108</sup> Shingles vaccines significantly reduce the incidence of shingles and post-herpetic neuralgia, as well as the duration and severity of shingles infections.<sup>109</sup> However, unlike the influenza and pneumococcal vaccines, across Canada, not a single jurisdiction currently provides publicly funded shingles vaccines to its entire population of older adults for whom NACI recommends the vaccine (individuals aged 50 years and older).<sup>110</sup>

# Influenza, Pneumonia and Shingles Vaccination Coverage Rates Among Older Canadians

## Vaccination Coverage Goals and Target Groups

PHAC has established national immunization coverage targets for the influenza and pneumococcal vaccines. Canada's goal is to have 80% of those at high risk of infection and complications vaccinated against both diseases, including adults aged 65 years and older. PHAC has not established any vaccination coverage goals for the shingles (herpes zoster) vaccine.<sup>111</sup> NACI does, however, recommend that adults 50 years of age and older without contraindications be immunized with a recombinant zoster vaccine (Shingrix), one of two types of shingles vaccines currently authorized for use in Canada.<sup>112</sup> Contraindications are situations where the vaccine should not be administered because of potential risks, such as an anaphylactic reaction to the vaccine or to one of its components.<sup>113</sup>

## Vaccination Coverage in Canada

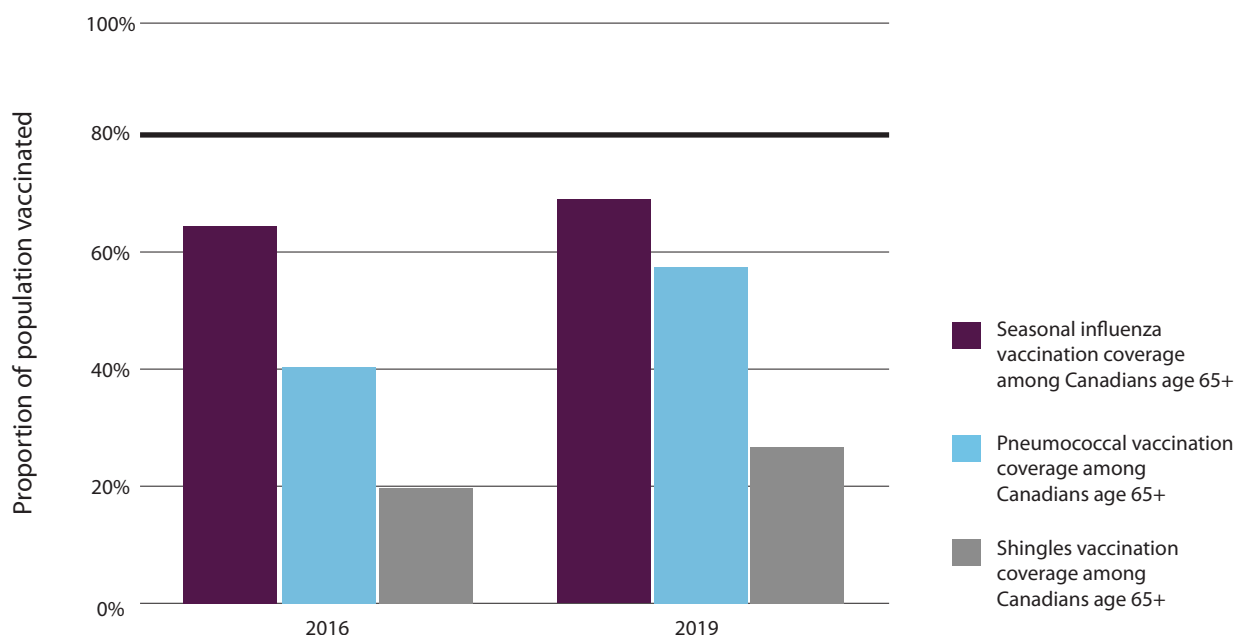
**Canada has yet to meet its national influenza and pneumococcal vaccination coverage goals (80%) among adults aged 65 years and older.**

Vaccination rates for older Canadians have consistently been well below the 80% national targets for over a decade. As Figure 8 shows,

in 2016, only 42% of Canadians aged 65 years and older reported having been “vaccinated for pneumonia”. By 2019, only 58% of Canadians aged 65 year and older reported having received the pneumococcal vaccine in adulthood (Figure 8). While reported uptake of the seasonal influenza vaccine is slightly higher in older Canadians, it also remains below the national coverage goal of 80%. As seen in Figure 8, only about 65% of Canadians aged 65 years and older reported having received a dose of the influenza vaccine during the 2015-16 influenza season. During the 2018-19 season, only 70% of Canadians aged 65 years and older reported having received the seasonal influenza vaccine (Figure 8). The most recently available estimates on influenza vaccination show that immunization rates have not increased among older Canadians, with 70% of Canadians aged 65 years and older reporting having received the influenza vaccine during the 2019-20 season.<sup>114</sup> Shingles vaccine coverage has also been very low among Canadians aged 50 years and older, the group for whom NACI recommends it. In 2016, 20% of Canadians aged 50 years and older reported having received the shingles vaccine, with coverage increasing to only 28% by 2019 (Figure 8).

**Many older Canadians who haven't been vaccinated don't think these diseases are serious enough to warrant action.**

**Figure 8: Vaccine coverage among older Canadians in 2016 and 2019<sup>115</sup>**



As Table 1 shows, perceiving the vaccine as unnecessary was among the most frequently reported reasons for not receiving the vaccine by older Canadians who had not received their influenza, pneumococcal and shingles vaccines.

**Table 1: Top three reasons for non-vaccination among unvaccinated older Canadians in 2019<sup>116</sup>**

Disease	Reason	% (95% CI)
<b>Influenza</b> (≥65)	1. I have concerns about the influenza vaccine and/or its side effects	20.1 (14.5-25.8)
	2. I don't need the flu shot/it isn't necessary	19.2 (13.6-24.9)
	3. No specific reason, just didn't get it	13.9 (9.2-18.6)
<b>Pneumococcal</b> (≥65)	1. I didn't think it was necessary	10.5 (8.2-12.8)
	2. I never heard of this vaccine	7.7 (5.7-9.7)
	3. Doctor did not mention it	6.7 (4.8-8.5)
<b>Shingles</b> (≥50)	1. I didn't think it was necessary	16.9 (14.8-18.9)
	2. I have not gotten around to it	11.3 (9.6-13.1)
	3. Cost of the vaccine	9.4 (7.9-11.0)

Source: 2018-2019 Seasonal Influenza Vaccination Coverage Survey, PHAC.

# Lessons Learned from Canada's COVID-19 Rollout

## 1. Vaccine hesitancy is low among older Canadians

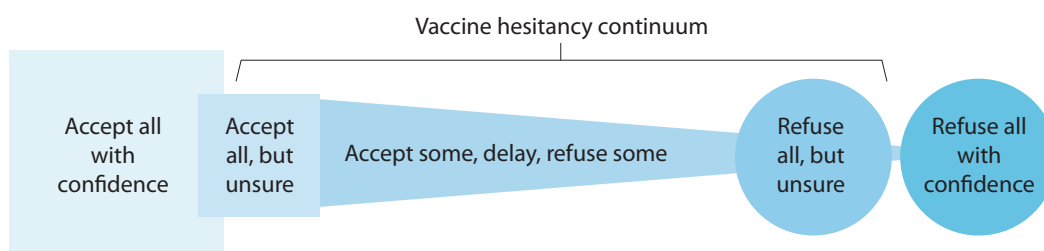
Prior to the COVID-19 pandemic, it was believed that around 19% of Canadians considered themselves to be vaccine hesitant.<sup>117</sup> Vaccine hesitancy is the 'delay in acceptance or refusal of vaccines despite availability of vaccination services.'<sup>118</sup> As seen in Figure 9, vaccine hesitancy exists on a continuum between those who accept all vaccines with no doubts and those who outright refuse all vaccinations with no doubts.<sup>119</sup> Vaccine hesitant individuals fall into heterogeneous groups between these two ends of the continuum and can be broadly categorized into three groups: those who accept all vaccines but are unsure of or not fully confident about the decision, those who accept some vaccines while refusing others or delay vaccination, and those who refuse all vaccines but may have some doubts about this decision.<sup>120</sup>

The reasons for vaccine hesitancy and vaccine uptake are complex and research shows that a

range of characteristics are involved in older adults' vaccine behaviours.<sup>122</sup> The drivers of vaccine hesitancy or acceptance include psychosocial, socio-demographic, contextual, and physical factors.<sup>123</sup> In addition, the kinds of factors that prevent or promote vaccine uptake can vary in type and significance depending on the particular disease and/or vaccine.<sup>124</sup> The vaccine hesitancy continuum reflects the fact that there are multiple forms of vaccine hesitancy and that where individuals fall on the continuum can change over time as their knowledge, attitudes and behaviours in the context of vaccines evolve.<sup>125</sup>

Canadians have shown a strong willingness to get COVID-19 vaccines. As of November 6, 2021, 89% of the eligible population has received one dose of a COVID-19 vaccine and 85% are fully vaccinated.<sup>126</sup> Yet, vaccine uptake has been even higher among older Canadians. As of November 6, 2021, 93% of Canadians aged 60 years and older have received at least one dose of a COVID-19 vaccine and 91% have been fully vaccinated with both doses.<sup>127</sup>

**Figure 9: The vaccine acceptance continuum<sup>121</sup>**



*Adapted from MacDonald and the SAGE Working Group on Vaccine Hesitancy (2015)*



## **The high uptake of COVID-19 vaccinations among older Canadians illustrates that overall, very few in this group outright refuse vaccinations.**

When barriers to vaccination are adequately addressed and rollouts are appropriately structured to increase the availability and accessibility of vaccines for older adults, only a small proportion will continue to delay or refuse their vaccinations. This finding has implications for vaccine-preventable diseases such as influenza, pneumonia, and shingles. As illustrated, these diseases have a significant impact on older adults, resulting in a substantial number of preventable hospitalizations and deaths annually. The best practices and actions from Canada's COVID-19 vaccine rollout should immediately be applied to other immunization campaigns to better protect older adults.

## **2. Providing ample education about the risks of COVID-19 to older Canadians was key to increasing awareness about the importance of vaccination**

During the COVID-19 pandemic, the risk of contracting COVID-19 and the severe health consequences for older adults living in both long-term care settings and in the community became well-known to the public. Canada's long-term care crisis highlighted that older adults in congregate settings are especially vulnerable to contracting the disease. Long-term care and retirement homes were the epicenter of the COVID-19 pandemic in Canada, accounting for nearly 70% of the

country's deaths between March 1, 2020, and February 15, 2021.<sup>128</sup> As the pandemic progressed, it became overwhelmingly clear that the virus poses its greatest risks for older populations. Older adults are at higher risk of severe illness, complications, and death from COVID-19 due to both the physiological changes associated with ageing (such as a weakened immune system) and the propensity to have multiple pre-existing health conditions.<sup>129</sup> As such, older Canadians were disproportionately impacted by the COVID-19 pandemic and to this day still account for about 62% of hospitalizations and 93% of deaths in the country.<sup>130</sup>

The potential risks and devastating impacts of COVID-19 for older adults became major points of national and international concern. Early in the pandemic, the world watched as the virus spread across Asia and then Europe, threatening Italy's healthcare system, due in part to the country's significantly older population.<sup>131</sup> Once the pandemic took hold in Canada, high rates of hospitalizations, ICU admissions and deaths among the country's older population were seen here as well. Daily news coverage also featured healthcare workers, experts and leaders pleading with the public to comply with public health measures as Canada struggled to limit the burden of COVID-19 on the hospital system. Moreover, as the pandemic continued to spread despite lockdowns and public health measures, it became increasingly understood that a successful vaccination campaign would be the only way to eventually overcome the pandemic.

The heightened visibility of the COVID-19 pandemic instilled among older Canadians an awareness about the consequences of the disease which, in turn, likely led



to an increased understanding about the importance of vaccination. Support for this comes from the fact that most older Canadians were willing to get vaccinated against COVID-19 long before vaccines were available. As the NIA showed in its report [\*If Older Canadians Want a COVID-19 Vaccine, Why is Canada Struggling to Get Them Vaccinated?\*](#), in June 2020—months before any vaccine had been fully developed, tested, and approved by Health Canada—86% of Canadians aged 65 and older reported that they would likely get a COVID-19 vaccine once one became available. Older Canadians were also more willing than younger Canadians to get a COVID-19 vaccine once Canada’s vaccination rollout began and was underway.<sup>132</sup> The same trend was true internationally, with data from 19 countries showing that older adults were more likely to report that they would get vaccinated against COVID-19.<sup>133</sup> Moreover, emerging evidence suggests that in the context of COVID-19, perceived susceptibility, perceived disease severity, and disease-related worry are among the key predictors of COVID-19 vaccine intentions.<sup>134,135,136</sup>

The high proportion of COVID-19 deaths that occurred among Canada’s older population likely led to increased fear of infection and becoming seriously ill from COVID-19. As the consequences to older adults became widely understood and repeatedly reinforced, older Canadians became acutely aware of their vulnerability and need for protection. Not only were older Canadians more willing than younger Canadians to report that they would get vaccinated early in the pandemic, but they were also more likely to follow other safety precautions such as masking and physical distancing, and to support mandatory COVID-19 testing.<sup>137,138</sup> It is therefore not surprising that once vaccines

became available, over 90% of older Canadians chose to get vaccinated within the first seven months of the rollout, achieving the highest coverage of any age group in Canada.

**If public awareness about the disproportionate impacts of influenza, pneumonia, and shingles on older adults were comparable to the public understanding of COVID-19, vaccination rates against all three of these diseases may increase significantly.**

### **3. Making COVID-19 vaccines free for all supported efforts by federal, provincial, territorial, and local government to reduce vaccination barriers for older Canadians**

Federal, provincial, territorial, and local governments made significant efforts to provide widespread access to COVID-19 vaccinations. Cost to individuals was not a concern, as COVID-19 vaccines were made free of charge to all eligible Canadian citizens. Many jurisdictions, including British Columbia, Ontario, Saskatchewan, and Quebec, did not require proof of citizenship or provincial health insurance, further reducing accessibility barriers for vulnerable populations.<sup>139,140,141,142,143</sup> While both the influenza and pneumococcal vaccines are publicly funded in most provinces, every Canadian jurisdiction requires that older adults pay for shingles vaccines out of pocket, with the exception of Ontario that funds it for adults aged 65-70 years. Yet even in the case

of influenza, only four Canadian jurisdictions make enhanced influenza vaccines available to their entire populations aged 65 years and older, despite it being the vaccine that NACI recommends for this age group. Alberta, New Brunswick, Ontario, and Prince Edward Island provide enhanced vaccines to all individuals aged 65 years and older as part of their publicly funded seasonal influenza vaccine programs.<sup>144,145,146,147</sup> In other jurisdictions, only certain groups of older adults, such as residents of long-term care settings, may be eligible for publicly funded enhanced vaccines, as is the case in British Columbia and Manitoba.<sup>148,149</sup> The result is that for older Canadians who wish to receive the additional protection afforded by enhanced influenza vaccines, many will have to pay out-of-pocket. Even then, this is only a possibility if enhanced influenza vaccines are available. In contrast, for COVID-19 vaccines, the federal government mandated that all related immunizations be delivered free of charge, purchasing them from suppliers and delivering them to provinces on a per-capita basis.

With many older adults limited in their ability to access mass vaccination clinics, several provinces and territories made additional efforts to ensure that geographic barriers were reduced. This helped enable older adults to make vaccine appointments in a timely manner. In particular, COVID-19 vaccine rollouts were expanded to include primary care providers and pharmacists, along with the development of vaccination strategies to better serve the homebound. Provinces such as Alberta, Manitoba, New Brunswick, Nova Scotia and Quebec in particular expanded vaccine delivery to primary care and pharmacies early in their rollouts.<sup>150,151,152</sup> This strategy was effective as many older adults

are registered with primary care providers and have continuous interactions with their pharmacists.

Moreover, some provinces made significant efforts to vaccinate homebound older persons. In British Columbia, homebound older persons were identified as an early priority. The province made mobile clinics in self-contained vehicles for homebound older adults with mobility issues available beginning in January 2021.<sup>153</sup> While the Ontario government struggled to launch a provincial homebound vaccination program, local jurisdictions such as Toronto and Hamilton planned their own strategies. In both areas, high demand for COVID-19 vaccines was documented among this population of older adults.<sup>154,155</sup>

#### **4. Governments made efforts to develop culturally appropriate and accessible vaccination information**

Some jurisdictions also made vaccine appointments more accessible by reducing communication and language barriers. Public health and vaccine information across Canada was predominantly communicated in English and French, despite the burden of COVID-19 being highest in low socio-economic neighbourhoods where a high proportion of residents do not speak English or French as their first language.<sup>156</sup> Saskatchewan and British Columbia made early efforts to develop culturally responsive vaccine information and booking options, followed by Ontario, Quebec, and Manitoba. British Columbia provided booking options in dozens of languages both online and over the phone.<sup>157</sup> Saskatchewan introduced a new booking system that not

only made online booking much simpler, but also allowed older adults to book over the phone or have family members and friends book on their behalf.<sup>158</sup> Later on, Ontario and Manitoba also added a phone line booking option in various languages. Ontario's systems enabled people to book their appointments in over 300 languages,<sup>159</sup> while Manitoba began offering telephone vaccine booking in over 100 languages and the option to request spoken language interpreter services for appointments scheduled at mass vaccination sites.<sup>160</sup> Quebec also launched an awareness campaign with advertisements and online information about vaccines in 21 languages.<sup>161</sup>

## **5. Integrated vaccine registries, surveillance, and monitoring of COVID-19 vaccination rates helped identify and target harder to reach populations**

To book a vaccination appointment, most provinces require individuals to pre-register for an appointment online, through the telephone, or by their primary care provider. In some provinces, including Saskatchewan, family members and friends could register and book appointments on behalf of older adults. Such a comprehensive registration system enabled older adults to be easily identified and booked in for their vaccination appointments in a timely manner.

Because registration systems were integrated at the community level, older adults who had not registered could be easily identified. For example, the Ontario COVID-19 Science Advisory Table conducted several studies using vaccination data to identify key characteristics of older adults'

vaccination uptake and recommended specific strategies to target these populations. This included targeting homebound older adults and adults living in naturally occurring retirement communities (NORCs) in high-risk neighborhoods.<sup>162, 163</sup> The continuous, real-time collection of COVID-19 vaccination rates across local, provincial, and federal health authorities is a revelation compared to how influenza, pneumococcal, and shingles vaccination rates are captured among the general population. Today, immunization rates for influenza, pneumococcal, and shingles continue to rely primarily on surveys to predict vaccination coverage rates.



# Recommendations to Increase Influenza, Pneumococcal and Shingles Vaccine Uptake Among Older Canadians

In 2016, 88% of Canadians responding to a PHAC survey reported that they were up-to-date on their recommended vaccinations. However, only 3% were found to be up-to-date on recommended immunizations.<sup>164</sup> While PHAC's target is an 80% vaccination rate among older Canadians against influenza and pneumococcal disease, only 70% of Canadians aged 65 years and older received the 2018-19 seasonal influenza vaccine and 58% received the pneumococcal vaccine in 2019. The shingles vaccination rate is only 28% among Canadians aged 50 years and older, as of 2019. With COVID-19 vaccination rates surpassing 90% among Canadians aged 60 years and older, there is a unique opportunity for other vaccination efforts to capitalize on the success of the COVID-19 rollout and improve overall vaccination coverage among older adults. In particular, vaccination strategies can build on current public awareness and acceptance of vaccines, particularly among older populations, and the infrastructure developed to effectively and efficiently deliver vaccines to older adults.

There is strong research evidence to support that past vaccine behaviour predicts future vaccine behaviour. Studies show that individuals who have previously been vaccinated against influenza have higher uptake of both the influenza vaccine in subsequent years and the pneumococcal vaccine.<sup>165,166</sup>

**Emerging evidence also suggests that the COVID-19 pandemic has already started to shift perceptions of the importance of adult immunizations.**

A number of studies have found that for some individuals who did not originally intend to get the influenza vaccine, COVID-19 has changed their minds.<sup>167,168</sup> To implement effective and efficient overall immunization strategies for their older populations, provinces and territories should build on the successes of Canada's COVID-19 rollout.

Based on the lessons learned from Canada's COVID-19 vaccine rollout, the NIA has identified seven recommendations to increase vaccine uptake among older adults for other vaccine-preventable diseases, including influenza, pneumonia, and shingles.

## **1. Increase public awareness about the importance of vaccination for older adults and the burden that vaccine-preventable diseases place on health systems**

Although there is widespread agreement that vaccination is a key preventive measure against infectious diseases, uptake of influenza, pneumococcal and shingles vaccinations still remain well below target levels.

## **Drawing on the experiences of Canada's COVID-19 rollout reveals that a key way to improve vaccine uptake among older adults is to increase awareness about the risks of a disease and the importance of prevention through vaccination.**

Research supports that an important predictor of vaccination behaviour is the risk people associate with the disease a vaccine protects against.<sup>169,170,171</sup> When the perceived risks of illness seem low, whether because the risk of contracting the disease are seen as low, the symptoms of the disease are considered to be mild, or there is little fear or worry about the disease, individuals are more likely to remain unvaccinated.<sup>172,173,174,175,176</sup> When the perceived risk of illness increases, vaccine intention and uptake is higher.<sup>177,178</sup>

In order to improve vaccination rates there is a need to improve education about the risks of vaccine-preventable diseases. Low perceived risk of disease has been found to be a significant barrier to vaccination among older adults across vaccine-preventable diseases, including influenza, pneumonia, and shingles.<sup>179,180</sup> Many older Canadians continue to think that all three of these diseases are not serious enough to warrant action. A perception that the vaccine is unnecessary ranked among the top three reasons older Canadians provided for not receiving influenza, pneumococcal disease and shingles vaccines, as of 2019 (Table 1). In another study, just under 60% of respondents agreed or strongly agreed with the statement 'it is important for adults to receive all recommended vaccinations',<sup>181</sup> signaling that the risks of vaccine-preventable diseases are still underappreciated by Canadians.

Public awareness of adult vaccines remains inadequate in Canada, particularly when compared to childhood vaccines. Another important action governments can take is provide comprehensive information and additional resources about vaccinations for older adults, and particularly for those against influenza pneumococcal disease and shingles. For example, Canada currently does not provide many resources at the national level to improve public awareness about shingles and its associated vaccination.<sup>182</sup> PHAC also has limited resources devoted to increasing public awareness about shingles, having posted only a single fact sheet on the issue.<sup>183</sup> Current public health messages on immunization also need to do a better job of reflecting the values and needs of older adults.<sup>184</sup> Public campaigns on vaccination should consistently educate the older population on the role vaccination plays in maintaining overall good health and effectively preventing illness in older age.<sup>185</sup>

## **2. Increase public confidence in the safety and efficacy of vaccines**

Improving vaccination coverage among older adults will also require improving public understanding of how vaccines work, their safety, and common side effects. This is especially the case in the context of influenza vaccination, where concerns about the vaccine and/or its side effects are the most frequently reported reason for non-vaccination among older Canadians (Table 1).

Due to the rapid development and use of novel mRNA technology, people around the world were initially skeptical of the safety of the COVID-19 vaccines. There was substantial initial

skepticism despite the vaccines undergoing clinical trials and rigorous evaluations by independent third parties, such as NACI. To combat the skepticism, local organizations, leaders, and public health authorities, along with provincial and the federal governments focused their messaging on the safety and effectiveness of the vaccines. Much of the public information compared the risks of the vaccine to the risk of contracting COVID-19 and experiencing the potential health consequences. Getting the vaccine not only reduces transmission but also improves the probability of not requiring hospitalization and dying.

In addition, the communication of the vaccine's impacts has been integral to promoting vaccine uptake among older adults. The positive results of Canada's—and other international jurisdictions'—vaccine rollouts, including extremely low adverse reactions, and reducing hospitalizations and deaths, have also been leveraged by governments to contextualize the safety and effectiveness of vaccines.

In the case of influenza, there needs to be greater public awareness about why the vaccine needs to be redeveloped annually and reassurances made about its safety, despite the short timeframes for testing. Similarly, more information needs to be shared about the benefits of receiving an influenza vaccine, even if the virus mutates. Like COVID-19 vaccines, it is important to contextualize the risks in terms of the potential outcomes of not being vaccinated compared to being vaccinated. For example, in addition to highlighting how being vaccinated reduces incidences of death, public campaigns can also publicize that vaccination reduces hospitalizations and additional visits to

primary care providers to manage other non-fatal complications and other consequences.

### **3. Provide influenza, pneumococcal, and shingles vaccination free of cost to all older Canadians**

Another factor that shapes vaccine behaviours are the financial costs associated with individual immunizations. It is well established that the price of vaccines can function as a barrier to getting immunized.<sup>186</sup> Public funding, conversely, can remove financial barriers to immunization and promote vaccine uptake. For example, studies have found that the likelihood of getting vaccinated against influenza is considerably higher for individuals eligible for government-funded vaccines than for individuals who are ineligible for funding.<sup>187</sup> In Canada, influenza vaccination rates have increased since publicly funded programs to offer free vaccination have been introduced. Residents from jurisdictions that have universal funding for influenza vaccination are more likely than those without a universal funding policy to have been vaccinated.<sup>188,189</sup>

**To increase vaccination uptake among older adults, public coverage for vaccines should follow NACI's recommendations and be available to those for whom it is recommended free of charge.**

From an economic perspective, providing access to these vaccines without charge has the potential to yield considerable returns for Canada's health care systems by reducing

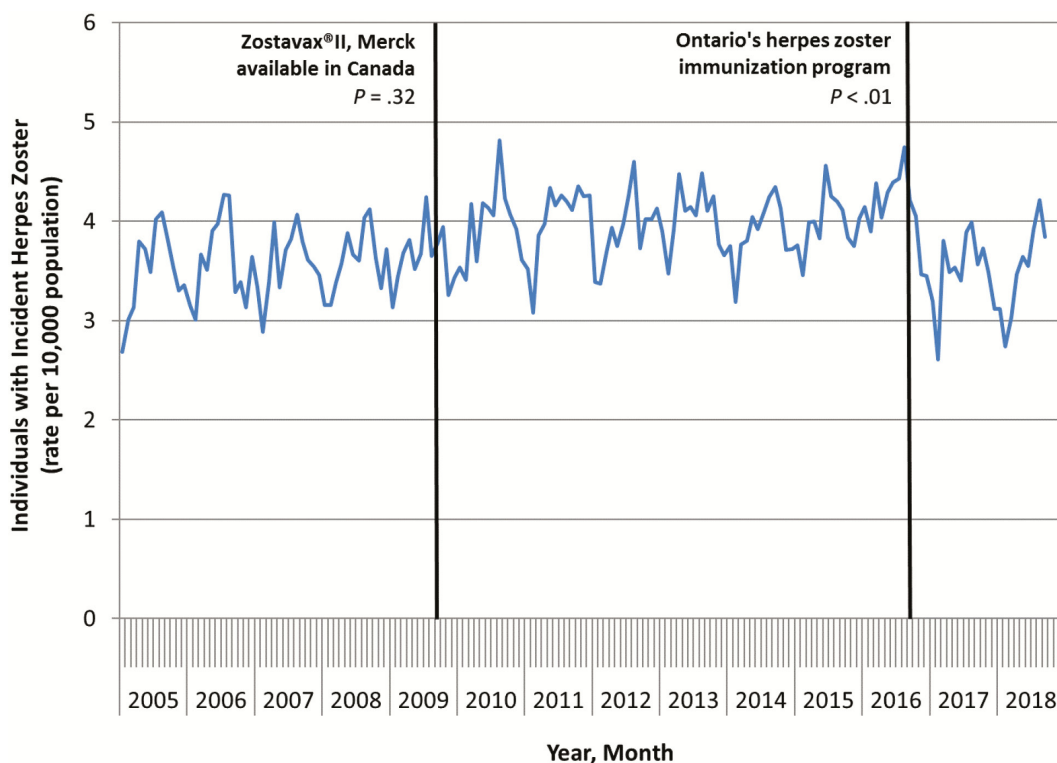


hospitalizations resulting from the big 3 preventable diseases which, in turn, can reduce costs.<sup>190,191,192</sup> While all of the provinces and territories cover the costs of influenza and pneumococcal vaccines for their older adults, the shingles vaccine is not publicly funded in most jurisdictions across Canada. Only Ontario has a well-established program to offer the shingles vaccine free of charge to individuals aged 65-70 years,<sup>193</sup> while Yukon recently implemented a program to fund the vaccine for this same age group, as of January 2021.<sup>194</sup> Prince Edward Island plans to provide coverage beginning in 2022.<sup>195</sup> All other provinces and territories require residents to pay between \$200 and \$300 for their shingles vaccines.<sup>196,197,198</sup> It is therefore not surprising that the cost of the shingles vaccine is among

the top reasons for non-vaccination reported by Canadians aged 50 years and older who have not gotten the shingles vaccine (Table 1). Provinces and territories should include the shingles vaccine in their publicly funded vaccination programs and make it available free of charge for their populations aged 50 years and older.

A recent study published by Ontario's Institute for Clinical Evaluative Sciences (ICES) compared medically attended<sup>199</sup> herpes zoster among individuals aged 65-70 years, before and after the introduction of the publicly funded immunization program.<sup>200</sup> A herpes zoster vaccine was first approved by Health Canada in August 2008 and made available for out-of-pocket purchase in September 2009.

**Figure 10: Incidence of medically attended herpes zoster before and after the implementation of a publicly funded immunization program among adults aged 65-70 years in Ontario from 2005 to 2018**



Ontario began offering the vaccine free of charge to all residents aged 65-70 years in September 2016. Between January 2005 and August 2016 (the study period before the vaccine became publicly funded in Ontario) medically attended herpes zoster among individuals aged 65-70 years increased by 77% in Ontario, from 2.7 to 4.8 per 10,000 people (Figure 10). After the implementation of the program in September 2016, the monthly incidence of medically attended herpes zoster in this population decreased by 19.1%, from 4.8 to 3.8 cases per 10,000 people.<sup>201</sup> The results from this study clearly demonstrate that eliminating financial barriers to the shingles vaccine can reduce incidences of the disease among older adults.

Every province and territory should also fund access to enhanced influenza vaccines for their entire population aged 65 years and older. Older adults tend to respond less strongly to standard-dose influenza vaccines and are simultaneously at increased risk of infection and severe complications. Access to enhanced vaccines is especially important for this group.

**While all provinces and territories in Canada currently offer publicly funded influenza vaccines for older adults,<sup>202</sup> only Alberta, New Brunswick, Ontario, and Prince Edward Island provide access to enhanced vaccines as part of their publicly funded vaccination programs for their entire older adult populations.**

For the upcoming 2021-22 influenza season, Alberta, New Brunswick, and Prince Edward Island will provide high-dose influenza vaccines to all adults aged 65 years and older, while Ontario has purchased and will offer either the high-dose or adjuvanted influenza vaccines.<sup>203, 204, 205, 206</sup> Some provinces also fund enhanced influenza vaccines but only for certain groups of older adults, such as British Columbia and Manitoba, where the high-dose vaccine is offered free of charge to individuals aged 65 years and older who live in long-term care, assisted living, and in Indigenous communities.<sup>207, 208</sup> Provinces and territories should continue to expand the accessibility and availability of enhanced influenza vaccines by making both high-dose and adjuvanted influenza vaccines publicly funded for all older adults. Public coverage for both high-dose and adjuvanted influenza vaccines would ensure that all older Canadians can reliably access vaccines that better protect them each year. This would help to reduce the burden of influenza among Canada's most vulnerable population.

#### **4. Expand access to vaccines and vaccinations through pharmacies, primary health care providers, community clinics, and targeted homebound vaccination programs**

Issues with transportation to vaccination clinics, as well as physical disability or limited physical activity, are barriers to vaccination that have been identified in research.<sup>209, 210, 211</sup> Canada should expand vaccine access points, and leverage community-based resources, to increase the accessibility and equity of



**Table 2: Pharmacists' vaccination authority across Canada, 2020**

	Influenza		Pneumococcal		Herpes zoster (shingles)	
	Pharmacists have authority to administer this vaccine	Pharmacists may access and administer publicly funded vaccines	Pharmacists have authority to administer this vaccine	Pharmacists may access and administer publicly funded vaccines	Pharmacists have authority to administer this vaccine	Pharmacists may access and administer publicly funded vaccines
Alberta	✓	✓	✓	✓	✓	✗
British Columbia	✓	✓	✓	✓	✓	✗
Manitoba	✓	✓	✓*	✓	✓	✗
New Brunswick	✓	✓	✓	✗	✓	✗
Newfoundland and Labrador	✓	✓	✓	✗	✓	✗
Northwest Territories	✗	✗	✗	✗	✗	✗
Nova Scotia	✓	✓	✓	✗	✓	✗
Nunavut	✗	✗	✗	✗	✗	✗
Ontario	✓	✓	✓	✗	✓	✗
Prince Edward Island	✓	✓	✓	✗	✓	✗
Quebec	✓	✓	✓	✗	✓	✗
Saskatchewan	✓	✓	✓	✗	✓	✗
Yukon	✓	✓	✗	✗	✓	✗

Adapted from Canadian Pharmacists Association (2020).

\* Pneumococcal authority in Manitoba only includes polysaccharide-containing vaccines

of vaccination. In particular, primary care providers, pharmacies and programs designed to reach homebound older adults should be effectively integrated into all vaccine rollout strategies.

**One means of increasing access to vaccines for older Canadians is to expand the role of pharmacists in providing vaccinations as part of a broader immunization strategy across all provinces and territories.<sup>212</sup>**

Pharmacists can now administer the influenza and shingles vaccine in all Canadian jurisdictions, other than the Northwest Territories and Nunavut. However, in the case of pneumococcal vaccines, pharmacists are not yet licensed to administer the vaccines in all three territories.<sup>213</sup> Yet, even though all 10 of Canada's provinces now authorize pharmacists to administer the influenza, pneumococcal and shingles vaccines, most provinces do not provide pharmacists with access to publicly funded pneumococcal and shingles vaccines (Table 2). Specifically, only British Columbia, Alberta, and Manitoba have integrated pharmacies into their publicly funded pneumococcal vaccination programs. No province or territory has done so for shingles (Table 2).<sup>214</sup> Across all of Canada's provinces and territories, pharmacists should be able to administer publicly funded vaccinations to their entire target populations. This will reduce confusion about where to receive vaccines and remove access barriers, which will promote uptake by a larger population of eligible Canadians.

Primary care physicians, nurses, pharmacists, and specialists should also be discussing vaccination options with their patients, given that studies have found that professionals play a significant role in increasing vaccination rates.<sup>215,216</sup> Primary care providers are especially influential for older adults. Through their relationships with their older patients, primary care providers can help improve knowledge about influenza, the vaccine, and its potential side effects.<sup>217</sup> According to the evidence, one of the greatest predictors of older adult vaccination uptake is if their primary care physician is vaccinated themselves. Vaccinated primary care providers are more likely to remember to educate and recommend vaccines to their patients compared to those who are unvaccinated. For COVID-19 specifically, older adults in Ontario who were rostered (76.8%) or assigned (86.5%) to a primary care physician had a much higher probability of being vaccinated against COVID-19 vaccine compared to those who did not have frequent contact with a primary care provider (45.9%).<sup>218</sup>

Strategies to address barriers related to knowledge, skill, attitudes, procedures, and funding that may exist in primary care and pharmacy settings, should also be implemented to assist primary care providers and pharmacists to ensure their patients can be vaccinated. In the case of influenza, annual vaccination should also be prioritized as a standard of care for older adults in primary care.<sup>219</sup> Health care providers must continue to reinforce the importance of vaccination in preventing morbidity and mortality due to complications associated with infections such as influenza, pneumonia, and shingles among older adults.

Vaccination campaigns targeting older adults must also incorporate outreach strategies to

target homebound individuals. Many older Canadians have substantial issues accessing care due to complex and interrelated health problems that render them frail and homebound. While Canadian data on the number of homebound older adults are unavailable, estimates suggest that there may be at least 100,000 older homebound Canadians.<sup>220</sup> These individuals are poorly served by current models of care and vaccine delivery, given that mobility limitations and chronic health conditions limit their ability to access doctor's offices, pharmacies, and vaccination clinics. As such, vaccination campaigns must integrate programs designed to reach homebound individuals to increase coverage among older adults.

Jurisdictions and governments that implemented homebound strategies during the COVID-19 rollout now have detailed data on homebound older adults. This information can be used to support annual uptake of influenza vaccines and increase coverage of pneumococcal and shingles vaccines among older adults. Specifically, efforts should focus on developing a mixed delivery system, where primary care providers, homecare nurses, and community paramedics can administer in-home vaccinations. Capitalizing on these efforts, outreach strategies can also be extended to neighborhoods with high concentrations of older adults, otherwise known as Naturally Occurring Retirement Communities (NORCs). Targeting NORCs would provide the opportunity to increase awareness about vaccination, while simultaneously improving the convenience related to getting vaccinated.

## **5. Create more culturally targeted information campaigns that speak to older adults from diverse backgrounds**

During the COVID-19 vaccine rollout, the federal government, along with most provinces and territories, took swift action to ensure that vaccine information, education materials, and booking options were available in many dozens of languages and mediums. Currently on PHAC's website, information on influenza, pneumococcal, and shingles vaccines are only available in English and French. This is also the case across most of Canada's provinces and territories, as language options for information are limited.

Both the federal and provincial governments must make vaccine information available to all by translating the information into several languages. For example, provincial and local health authorities should translate public information campaigns promoting these vaccines in a variety of languages beyond French and English. This tactic would be particularly effective in neighborhoods with a high concentration of ethnic minorities and immigrants, as proven throughout the COVID-19 pandemic.

## **6. Capitalize on ongoing COVID-19 vaccination efforts to administer other recommended vaccinations to older adults**

Another strategy that can be used to improve vaccination coverage among older adults is to

administer scheduled recommended vaccines at the same time as COVID-19 vaccines. Doing so would make getting vaccinated more convenient for older adults, one of the primary factors that impacts the uptake of vaccines.<sup>221</sup>

Just like various access barriers, research shows that overall inconvenience limits vaccine uptake. Inconvenience can emerge when vaccination is not seen as important enough to actively overcome access barriers and individuals—even those generally willing to vaccinate—choose to remain unvaccinated rather than deal with these barriers.<sup>222</sup>

NACI's recent recommendations on providing COVID-19 booster shots to long-term care residents and older adults living in other congregate settings, and the concomitant administration of COVID-19 vaccines with other vaccines, should be leveraged to make the administration of influenza, pneumococcal and shingles vaccines more convenient for older adults. Any upcoming efforts to administer COVID-19 booster shots in long-term care and congregate settings should capitalize on this opportunity to provide residents with other recommended vaccinations. By mid-November 2021, all 13 of Canada's provinces and territories announced that they plan to offer a third dose of COVID-19 vaccines to long-term care residents.<sup>223, 224, 225, 226, 227,228, 229, 230, 231, 232, 233, 234,</sup>

<sup>234a</sup> Each of these jurisdictions should take this as an opportunity to co-administer other recommended vaccinations to long-term care residents.

Given that NACI recently expanded its recommendations for COVID-19 booster vaccines to include community-dwelling older adults aged 70 years and older, concerted efforts should also be made to improve vaccination rates for other vaccine-

preventable diseases within this group. Similarly, if in the future NACI continues to update its COVID-19 booster guidance and expand eligibility to younger groups of community-dwelling older adults, then strategic efforts should be made to offer and co-administer other vaccines with booster COVID-19 vaccine doses. Providing influenza, pneumococcal and shingles vaccines at the same time as COVID-19 booster shots would help overcome inconveniences such as transportation to a clinic or physical limitations that have contributed to a low uptake among some older adults thus far. As of November 9, 2021, every province and territory in Canada have announced plans to offer COVID-19 boosters to their populations of community-dwelling older adults.<sup>235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 245a, 245b</sup>

Finally, any future vaccination appointments scheduled for community-dwelling older adults who have yet to complete a full COVID-19 vaccine series should also provide the opportunity to get up-to-date on other recommended vaccines.

## **7. Develop an integrated national vaccine registry and surveillance systems to effectively monitor vaccine uptake**

COVID-19 vaccine uptake was monitored by each province and territory. Provinces and territories were responsible for identifying and targeting their eligible populations for vaccination. These established approaches should be expanded to identify, target, and monitor older adults for influenza, pneumococcal, and shingles vaccination.

There is no central agency or report that documents influenza, pneumococcal, and shingles vaccination rates in Canada and there is no standard definition for how to report these rates. Reporting should be mandatory and should be clearly defined so that rates can be reported, monitored, and improved upon across Canada. Public health bodies can take the lead in determining how vaccination rates should be measured and reported.<sup>246</sup> They should also assist in developing guidelines for how to put in place monitoring systems and repositories to track progress.

Canada currently lacks the capacity to monitor actual influenza, pneumococcal, and shingles vaccination rates. Instead, estimates of vaccination rates are calculated from general surveys. For example, pneumococcal vaccination rates generally come from the National Immunization Coverage Survey (aNICS), which is self-reported and has a low response rate. As a result, estimated vaccination rates cannot be confidently generalized to the population.<sup>247</sup>

Provincial and territorial health authorities should work with the federal government to expand Canada's immunization infrastructure

and better monitor influenza, pneumococcal, and shingles vaccine uptake among older adults. Specifically, the vaccine registries and monitoring systems used to track COVID-19 vaccination rates should be applied to other vaccination strategies. Registries should be leveraged to identify hard-to-reach older adults and the digital health infrastructure currently being implemented across several provinces (to enable vaccine passports) should be adopted to further facilitate vaccine uptake through patient reminders, education, and appointment booking.



## Conclusion

**The COVID-19 pandemic has made it clear that older Canadians are willing to get vaccinated.**

The near universal COVID-19 vaccination rates achieved among older Canadians have helped to debunk any misconceptions about vaccine hesitancy and general anti-vaccination sentiments among this group. While older Canadians have demonstrated their willingness to get vaccinated—when the need is clear and vaccines are accessible—vaccination rates against influenza, shingles and pneumococcal disease have remained disappointingly low. Today, Canada continues to fall short of PHAC’s long-established national vaccination targets for older adults.

The COVID-19 vaccine rollout highlighted important gaps in our understanding of how to promote vaccine uptake for other diseases among older Canadians. Yet the rollout also provided important lessons that can be applied to future vaccination campaigns to improve coverage.

**By applying the evidence-based recommendations the NIA has outlined in this report, provincial, territorial, and federal governments can start to more effectively address their long-standing vaccination gaps and reduce the burden of vaccine-preventable diseases.**

## References

- <sup>1</sup> Government of Canada. (2018). Vaccine uptake in Canadian adults: Highlights from 2016 aNICS.
- <sup>2</sup> CanAge. (2021). Adult Vaccination in Canada - Cross-Country Report Card 2021. Retrieved from: <https://www.canage.ca/wp-content/uploads/2021/03/VaccineReportCard-2021-02-23-FINAL-1.pdf>
- <sup>3</sup> Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. November 15, 2021. Retrieved from: <https://health-infobase.canada.ca/covid-19/vaccination-coverage/>
- <sup>4</sup> Estiri, H., Strasser, Z. H., Klann, J. G., Naseri, P., Waghlikar, K. B., & Murphy, S. N. (2021). Predicting COVID-19 mortality with electronic medical records. *NPJ digital medicine*, 4(1), 1-10.
- <sup>5</sup> Martínez, A., Soldevila, N., Romero-Tamarit, A., Torner, N., Godoy, P., Rius, C., ... & Surveillance of Hospitalized Cases of Severe Influenza in Catalonia Working Group. (2019). Risk factors associated with severe outcomes in adult hospitalized patients according to influenza type and subtype. *PLoS One*, 14(1), e0210353.
- <sup>6</sup> Coleman, B. L., Fadel, S. A., Fitzpatrick, T., & Thomas, S. M. (2018). Risk factors for serious outcomes associated with influenza illness in high-versus low-and middle-income countries: systematic literature review and meta-analysis. *Influenza and other respiratory viruses*, 12(1), 22-29.
- <sup>7</sup> Quandelacy, T. M., Viboud, C., Charu, V., Lipsitch, M., & Goldstein, E. (2014). Age- and sex-related risk factors for influenza-associated mortality in the United States between 1997–2007. *American journal of epidemiology*, 179(2), 156-167.
- <sup>8</sup> Navarro-Torné, A., Dias, J. G., Hrubá, F., Lopalco, P. L., Pastore-Celentano, L., Gauci, A. J. A., & Invasive Pneumococcal Disease Study Group. (2015). Risk factors for death from invasive pneumococcal disease, Europe, 2010. *Emerging Infectious Diseases*, 21(3), 417.
- <sup>9</sup> Chen, H., Matsumoto, H., Horita, N., Hara, Y., Kobayashi, N., & Kaneko, T. (2021). Prognostic factors for mortality in invasive pneumococcal disease in adult: a system review and meta-analysis. *Scientific reports*, 11(1), 1-7.
- <sup>10</sup> Albrich, W. C., Rassouli, F., Waldeck, F., Berger, C., & Baty, F. (2019). Influence of older age and other risk factors on pneumonia hospitalization in Switzerland in the pneumococcal vaccine era. *Frontiers in medicine*, 6, 286.
- <sup>11</sup> Letellier, M., Amini, R., Gilca, V., Trudeau, G., & Sauvageau, C. (2018). Herpes Zoster Burden in Canadian Provinces: A Narrative Review and Comparison with Quebec Provincial Data. *Canadian Journal of Infectious Diseases and Medical Microbiology*, 2018, 10. <https://doi.org/10.1155/2018/3285327>
- <sup>12</sup> Marra, F., Chong, M., & Najafzadeh, M. (2016a). Increasing incidence associated with herpes zoster infection in British Columbia, Canada.(Report). *BMC Infectious Diseases*, 16(1), 589. <https://doi.org/10.1186/s12879-016-1898-z>
- <sup>13</sup> Public Health Agency of Canada. (2018). An Advisory Committee Statement (ACS) National



Advisory Committee on Immunization (NACI): Updated recommendations on the use of herpes zoster vaccines. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>14</sup> Government of Canada. (2021). Coronavirus disease (COVID-19): Symptoms and treatment. Retrieved from: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/symptoms.html>

<sup>15</sup> Estiri, H., Strasser, Z. H., Klann, J. G., Naseri, P., Waghlikar, K. B., & Murphy, S. N. (2021). Predicting COVID-19 mortality with electronic medical records. *NPJ digital medicine*, 4(1), 1-10.

<sup>16</sup> Sepulveda, E. R., Stall, N. M., & Sinha, S. K. (2020). A comparison of COVID-19 mortality rates among long-term care residents in 12 OECD countries. *Journal of the American Medical Directors Association*, 21(11), 1572-1574.

<sup>17</sup> Government of Canada. COVID-19 Daily Epidemiology Update. November 15, 2021. Retrieved from: <https://health-infobase.canada.ca/covid-19/epidemiological-summary-covid-19-cases.html>

<sup>18</sup> Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. November 15, 2021. Retrieved from: <https://health-infobase.canada.ca/covid-19/vaccination-coverage/>

<sup>19</sup> NACI. Recommendations on the use of COVID-19 vaccines. July 22, 2021. Retrieved from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/>

[recommendations-use-covid-19-vaccines.html](https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-recommendations-use-covid-19-vaccines.html)

<sup>20</sup> National Institute on Ageing. A Cautionary Tale: Canada's COVID-19 Vaccine Rollout for Older Canadians. August 2021. Retrieved from: <https://static1.squarespace.com/static/5c2fa7b03917eed9b5a436d8/t/61379dbe1d434f27c4a11757/1631034866054/A+Cautionary+Tale+-+Canada%27s+COVID-19+Vaccine+Rollout+for+Older+Canadians.pdf>

<sup>21</sup> National Institute on Ageing. A Cautionary Tale: Canada's COVID-19 Vaccine Rollout for Older Canadians. August 2021. Retrieved from: <https://static1.squarespace.com/static/5c2fa7b03917eed9b5a436d8/t/61379dbe1d434f27c4a11757/1631034866054/A+Cautionary+Tale+-+Canada%27s+COVID-19+Vaccine+Rollout+for+Older+Canadians.pdf>

<sup>22</sup> National Institute on Ageing. A Cautionary Tale: Canada's COVID-19 Vaccine Rollout for Older Canadians. August 2021. Retrieved from: <https://static1.squarespace.com/static/5c2fa7b03917eed9b5a436d8/t/61379dbe1d434f27c4a11757/1631034866054/A+Cautionary+Tale+-+Canada%27s+COVID-19+Vaccine+Rollout+for+Older+Canadians.pdf>

<sup>23</sup> Schanzer, D. L., Sevenhuysen, C., Winchester, B., & Mersereau, T. (2013). Estimating influenza deaths in Canada, 1992–2009. *PloS one*, 8(11), e80481.

<sup>24</sup> NACI. Summary of National Advisory Committee on Immunization (NACI) rapid response: Booster dose of COVID-19 vaccine in long-term care residents and seniors living in other congregate settings. September 28, 2021. Retrieved from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee->



on-immunization-naci/summary-september-28-2021-booster-dose-long-term-care-residents-seniors-living-other-congregate-settings.html

<sup>25</sup> NACI. NACI rapid response: Booster dose in long-term care residents and seniors living in other congregate settings. September 28, 2021. Retrieved from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/statement-september-28-2021-booster-dose-long-term-care-residents-seniors-living-other-congregate-settings.html>

<sup>26</sup> NACI. NACI rapid response: Booster dose in long-term care residents and seniors living in other congregate settings. September 28, 2021. Retrieved from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/statement-september-28-2021-booster-dose-long-term-care-residents-seniors-living-other-congregate-settings.html>

<sup>27</sup> NACI. NACI rapid response: Booster dose in long-term care residents and seniors living in other congregate settings. September 28, 2021. Retrieved from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/statement-september-28-2021-booster-dose-long-term-care-residents-seniors-living-other-congregate-settings.html>

<sup>28</sup> NACI. Interim guidance on booster COVID-19 vaccine doses in Canada. October 29, 2021. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/statement-guidance-booster-doses/statement-guidance-booster-doses.pdf>

<sup>29</sup> NACI. Interim guidance on booster COVID-19 vaccine doses in Canada. October 29, 2021. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/statement-guidance-booster-doses/statement-guidance-booster-doses.pdf>

<sup>30</sup> NACI. Interim guidance on booster COVID-19 vaccine doses in Canada. October 29, 2021. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/statement-guidance-booster-doses/statement-guidance-booster-doses.pdf>

<sup>31</sup> NACI. Interim guidance on booster COVID-19 vaccine doses in Canada. October 29, 2021. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/statement-guidance-booster-doses/statement-guidance-booster-doses.pdf>

<sup>32</sup> NACI. Recommendations on the use of COVID-19 vaccines. September 28, 2021. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/recommendations-use-covid-19-vaccines-en.pdf>

<sup>33</sup> NACI. Recommendations on the use of COVID-19 vaccines. September 28, 2021. Retrieved from: <https://www.canada.ca/>

content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/recommendations-use-covid-19-vaccines-en.pdf

<sup>34</sup> NACI. Recommendations on the use of COVID-19 vaccines. September 28, 2021. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines/recommendations-use-covid-19-vaccines-en.pdf>

<sup>35</sup> Government of Canada. Seasonal Influenza Vaccination Coverage Survey Results 2019-2020. November 12, 2020. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/vaccines-immunization/2019-2020-seasonal-influenza-flu-vaccine-coverage-survey-results.html>

<sup>36</sup> Schanzer, D.L., Sevenhuysen, C., Winchester, B., & Mersereau, T. (2013). Estimating influenza deaths in Canada, 1992-2009. *PloS ONE*, 8(11), e80481. <https://doi.org/10.1371/journal.pone.0080481>

<sup>37</sup> Statistics Canada. Leading Cause of Death, Total Population, by Age Group. November 26, 2020. Retrieved from: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310039401&pickMembers%5B0%5D=2.1&pickMembers%5B1%5D=3.1&cubeTimeFrame.startYear=2000&cubeTimeFrame.endYear=2019&referencePeriods=20000101%2C20190101>

<sup>38</sup> BC Centre for Disease Control. (2013). *BC Influenza Prevention Policy: A discussion of the evidence*. Vancouver, British Columbia.

<sup>39</sup> National Advisory Committee on Immunization (NACI). (2016). An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI) – Canadian immunization guide chapter on influenza and statement on seasonal influenza vaccine for 2016-2017. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/migration/phac-aspc/naci-ccni/assets/pdf/flu-2016-2017-grippe-eng.pdf>

<sup>40</sup> National Advisory Committee on Immunization (NACI). (2016). An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI) – Canadian immunization guide chapter on influenza and statement on seasonal influenza vaccine for 2016-2017. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/migration/phac-aspc/naci-ccni/assets/pdf/flu-2016-2017-grippe-eng.pdf>

<sup>41</sup> Government of Canada. Seasonal Influenza Vaccination Coverage Survey Results 2019-2020. November 12, 2020. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/vaccines-immunization/2019-2020-seasonal-influenza-flu-vaccine-coverage-survey-results.html>

<sup>42</sup> Government of Canada. Seasonal Influenza Vaccination Coverage Survey Results 2019-2020. November 12, 2020. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/vaccines-immunization/2019-2020-seasonal-influenza-flu-vaccine-coverage-survey-results.html>

<sup>43</sup> Government of Canada. Seasonal Influenza Vaccination Coverage Survey Results 2019-2020. November 12, 2020. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/vaccines-immunization/2019-2020->

seasonal-influenza-flu-vaccine-coverage-survey-results.html

<sup>44</sup> Public Health Ontario. (2017). The relationships between influenza medical risk factors and age- Technical Report. Retrieved from: [https://www.publichealthontario.ca/en/eRepository/Technical\\_Report\\_Influenza\\_risk\\_factors\\_age.pdf](https://www.publichealthontario.ca/en/eRepository/Technical_Report_Influenza_risk_factors_age.pdf)

<sup>45</sup> Ting, E. (2015). *Systematic review of the cost-effectiveness of influenza immunization programs: A Canadian perspective*. Retrieved from: <https://www.sickkids.ca/pdfs/Research/TASK/influenza-vaccination/66135-Influenza%20FULL%20REPORT%20-%20Dec%202015.pdf>

<sup>46</sup> BC Centre for Disease Control. (2013). *BC Influenza Prevention Policy: A discussion of the evidence*. Vancouver, British Columbia

<sup>47</sup> Government of Canada. (2021). FluWatch annual report: 2019-2020 influenza season. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/fluwatch/2019-2020/annual-report.html>

<sup>48</sup> Centre for Disease Control. (2021). Key Facts About Seasonal Flu Vaccine. Retrieved from: <https://www.cdc.gov/flu/prevent/keyfacts.htm>

<sup>49</sup> NACI. Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2021-2022. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/vaccines-immunization/canadian-immunization-guide-statement-seasonal-influenza-vaccine-2021-2022/naci-2021-2022-statement.pdf>

<sup>50</sup> NACI. Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2021-2022. Retrieved from: <https://>

[www.canada.ca/content/dam/phac-aspc/documents/services/publications/vaccines-immunization/canadian-immunization-guide-statement-seasonal-influenza-vaccine-2021-2022/naci-2021-2022-statement.pdf](https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/vaccines-immunization/canadian-immunization-guide-statement-seasonal-influenza-vaccine-2021-2022/naci-2021-2022-statement.pdf)

<sup>51</sup> Literature Review Update on the Efficacy and Effectiveness of High-Dose (Fluzone® High-Dose) and MF59-Adjuvanted (Fluad®) Trivalent Inactivated Influenza Vaccines in Adults 65 Years of Age and Older

<sup>52</sup> Literature Review Update on the Efficacy and Effectiveness of High-Dose (Fluzone® High-Dose) and MF59-Adjuvanted (Fluad®) Trivalent Inactivated Influenza Vaccines in Adults 65 Years of Age and Older

<sup>53</sup> Boikos, C., Imran, M., Nguyen, V. H., Ducruet, T., Sylvester, G. C., & Mansi, J. A. (2021). Effectiveness of the Adjuvanted Influenza Vaccine in Older Adults at High Risk of Influenza Complications. *Vaccines*, 9(8), 862.

<sup>54</sup> Coleman, B. L., Sanderson, R., Haag, M. D., & McGovern, I. (2021). Effectiveness of the MF59-adjuvanted trivalent or quadrivalent seasonal influenza vaccine among adults 65 years of age or older, a systematic review and meta-analysis. *Influenza and Other Respiratory Viruses*.

<sup>55</sup> Boikos, C., Imran, M., Nguyen, V. H., Ducruet, T., Sylvester, G. C., & Mansi, J. A. (2021). Effectiveness of the Adjuvanted Influenza Vaccine in Older Adults at High Risk of Influenza Complications. *Vaccines*, 9(8), 862.

<sup>56</sup> Washington State Department of Health. (2020). Retrieved from: <https://www.doh.wa.gov/Portals/1/Documents/Pubs/348-518-SupplementalGuidance.pdf>

<sup>57</sup> Public Health England. (2021). The national influenza immunisation programme 2020 to 2021. Retrieved from: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1011773/Withdrawn\\_Inactivated\\_influenza\\_vaccine-information\\_for\\_healthcare\\_practitioners\\_2020\\_to\\_2021\\_v2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011773/Withdrawn_Inactivated_influenza_vaccine-information_for_healthcare_practitioners_2020_to_2021_v2.pdf)

<sup>58</sup> NACI. Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2021-2022. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/vaccines-immunization/canadian-immunization-guide-statement-seasonal-influenza-vaccine-2021-2022/naci-2021-2022-statement.pdf>

<sup>59</sup> Public Health Agency of Canada. (2019). Vaccine uptake in Canadian adults 2019. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/2018-2019-influenza-flu-vaccine-coverage-survey-results.html>

<sup>60</sup> Government of Canada. (2021). FluWatch annual report: 2019-2020 influenza season. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/fluwatch/2019-2020/annual-report.html>

<sup>61</sup> Petrova VN, Russell CA. The evolution of seasonal influenza viruses. *Nature Reviews Microbiology* 2017; 16:47.

<sup>62</sup> Canadian Sentinel Practitioner Surveillance Network (SPSN). Retrieved from: [http://www.bccdc.ca/resource-gallery/Documents/Statistics%20and%20Research/Publications/Epid/Influenza%20and%20Respiratory/SPSN\\_VE\\_By\\_Year\\_Table.pdf](http://www.bccdc.ca/resource-gallery/Documents/Statistics%20and%20Research/Publications/Epid/Influenza%20and%20Respiratory/SPSN_VE_By_Year_Table.pdf)

<sup>63</sup> Russell, K., Chung, J. R., Monto, A. S., Martin, E. T., Belongia, E. A., McLean, H. Q., ... & Flannery, B. (2018). Influenza vaccine effectiveness in older adults compared with younger adults over five seasons. *Vaccine*, 36(10), 1272-1278.

<sup>64</sup> Centers for Disease Control and Prevention. Pneumococcal Disease. Retrieved from: <https://www.cdc.gov/pneumococcal/index.html#:~:text=Pneumococcal%20%5Bnoo%2Dmuh%2DKOK,to%20pneumonia%20and%20bloodstream%20infections.>

<sup>65</sup> Blasi, F., Mantero, M., Santus, P., & Tarsia, P. (2012). Understanding the burden of pneumococcal disease in adults. *Clinical Microbiology and Infection*, 18, 7-14

<sup>66</sup> Government of Canada. (2016). Invasive Pneumococcal Disease. Retrieved from: <https://www.canada.ca/en/public-health/services/immunization/vaccine-preventable-diseases/invasive-pneumococcal-disease/health-professionals.html>

<sup>67</sup> Government of Canada. (2016). Invasive Pneumococcal Disease. Retrieved from: <https://www.canada.ca/en/public-health/services/immunization/vaccine-preventable-diseases/invasive-pneumococcal-disease/health-professionals.html>

<sup>68</sup> Ludwig, E., Bonnani, P., Rohde, G., Sayiner, A., & Torres, A. (2012). The remaining challenges of pneumococcal disease in adults. *European Respiratory Review*, 21(123), 57-65. Doi: 10.1183/09059180.00008911

<sup>69</sup> HealthLink BC. (2017). Pneumonia. Retrieved from: <https://www.healthlinkbc.ca/health-topics/hw63868>

<sup>70</sup> American Lung Association. (2018). What Causes Pneumonia? Retrieved from: <http://www.lung.org/lung-health-and-diseases/lung-disease-lookup/pneumonia/what-causespneumonia.html>

<sup>71</sup> American Lung Association. (2018). What Causes Pneumonia? Retrieved from: <http://www.lung.org/lung-health-and-diseases/lung-disease-lookup/pneumonia/what-causespneumonia.html>

<sup>72</sup> Government of Canada. Pneumococcal Vaccine: Canadian Immunization Guide. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-16-pneumococcal-vaccine.html>

<sup>73</sup> LeBlanc JJ, ElSherif M, Ye L, et al. Burden of vaccine-preventable pneumococcal disease in hospitalized adults: a Canadian immunization research network (CIRN) serious outcomes surveillance (SOS) network study. *Vaccine* 2017;35:3647–54

<sup>74</sup> LeBlanc, J., ElSherif, M., Ye, L., MacKinnon-Cameron, D., Ambrose, A., Hatchette, T. F., ... & McNeil, S. A. (2020). Age-stratified burden of pneumococcal community acquired pneumonia in hospitalised Canadian adults from 2010 to 2015. *BMJ open respiratory research*, 7(1), e000550.

<sup>75</sup> Canadian Institute for Health Information. (2020). NARcs Emergency Department Visits and Length of Stay, 2019-2020.

<sup>76</sup> Statistics Canada. Leading Cause of Death, Total Population, by Age Group. November 26, 2020. Retrieved from: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310039401&pickMembers>

[%5B0%5D=2.1&pickMembers%5B1%5D=3.1&cubeTimeFrame.startYear=2000&cubeTimeFrame.endYear=2019&referencePeriods=20000101%2C20190101](#)

<sup>77</sup> Ibid.

<sup>78</sup> Janssens, J.P., & Krause, K.H. (2004). Pneumonia in the very old. *Lancet Infectious Diseases*, 4(2), 112-24. Doi: 10.1016/S1473-3099(04)00931-4

<sup>79</sup> Janssens, J.P., & Krause, K.H. (2004). Pneumonia in the very old. *Lancet Infectious Diseases*, 4(2), 112-24. Doi: 10.1016/S1473-3099(04)00931-4

<sup>80</sup> LeBlanc, J., ElSherif, M., Ye, L., MacKinnon-Cameron, D., Ambrose, A., Hatchette, T. F., ... & McNeil, S. A. (2020). Age-stratified burden of pneumococcal community acquired pneumonia in hospitalised Canadian adults from 2010 to 2015. *BMJ open respiratory research*, 7(1), e000550.

<sup>81</sup> The Conference Board of Canada. (April 2017). The Economic Burden of Pneumonia in Canada: A Status Quo Forecast.

<sup>82</sup> McNeil, S.A., Qizilbash, N., Ye, J., Gray, S., Zanotti, G., Munson, S., Dartois, N., & Laferriere, C. (2016). A Retrospective Study of the Clinical Burden of Hospitalized All-Cause and Pneumococcal Pneumonia in Canada. *Canadian Respiratory Journal*, 2016. Doi: 10.1155/2016/3605834.

<sup>83</sup> The Conference Board of Canada. (April 2017). The Economic Burden of Pneumonia in Canada: A Status Quo Forecast.

<sup>84</sup> NACI. Update on the use of Pneumococcal Vaccines in Adults 65 years of age and older - A

public health perspective. November 2018. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/update-on-the-use-of-pneumococcal-vaccines-in-adult.html>

<sup>85</sup> Public Health Ontario. Infectious Disease Trends in Ontario. Retrieved from: <https://www.publichealthontario.ca/data-and-analysis/commonly-used-products/reportable-disease-trends-annually#/52>

<sup>86</sup> NACI. Update on the use of Pneumococcal Vaccines in Adults 65 years of age and older - A public health perspective. November 2018. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/update-on-the-use-of-pneumococcal-vaccines-in-adult.html>

<sup>87</sup> Statistics Canada. Table 12-10--392-01 Deaths and age-specific mortality rates, by selected grouped causes. Retrieved from: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310039401&pickMembers%5B0%5D=2.1&pickMembers%5B1%5D=3.1&cubeTimeFrame.startYear=2000&cubeTimeFrame.endYear=2019&referencePeriods=20000101%2C20190101>

<sup>88</sup> International Federation on Ageing. Pneumonia Vaccination in at-risk groups: A Canadian Perspective. December 2020. Retrieved from: <https://www.vaccines4life.com/wp-content/uploads/2020/12/Pneumonia-vaccination-in-at-risk-groups-CS.pdf>

<sup>89</sup> International Federation on Ageing. Pneumonia Vaccination in at-risk groups: A Canadian Perspective. December 2020. Retrieved from: <https://www.vaccines4life.com/wp-content/uploads/2020/12/Pneumonia-vaccination-in-at-risk-groups-CS.pdf>

<sup>90</sup> Statistics Canada. Leading Cause of Death, Total Population, by Age Group. November 26, 2020. Retrieved from: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310039401&pickMembers%5B0%5D=2.1&pickMembers%5B1%5D=3.1&cubeTimeFrame.startYear=2000&cubeTimeFrame.endYear=2019&referencePeriods=20000101%2C20190101>

<sup>91</sup> NACI. Update on the use of Pneumococcal Vaccines in Adults 65 years of age and older - A public health perspective. November 2018. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/update-on-the-use-of-pneumococcal-vaccines-in-adult.html>

<sup>92</sup> NACI. Update on the use of Pneumococcal Vaccines in Adults 65 years of age and older - A public health perspective. November 2018. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/update-on-the-use-of-pneumococcal-vaccines-in-adult.html>

<sup>93</sup> NACI. Update on the use of Pneumococcal Vaccines in Adults 65 years of age and older - A public health perspective. November 2018. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/update-on-the-use-of-pneumococcal-vaccines-in-adult.html>

<sup>94</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>95</sup> Government of Canada. Herpes zoster (shingles) vaccine: Canadian Immunization



Guide. Retrieved from: [https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-8-herpes-zoster-\(shingles\)-vaccine.html](https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-8-herpes-zoster-(shingles)-vaccine.html)

<sup>96</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>97</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>98</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>99</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>100</sup> Kawai, K., & Yawn, B. (2017). Risk Factors for Herpes Zoster: A Systematic Review and Meta-analysis. *Mayo Clinic Proceedings*, 92(12), 1806–1821. <https://doi.org/10.1016/j.mayocp.2017.10.009>

<sup>101</sup> Public Health Agency of Canada. (2018). An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI):

Updated recommendations on the use of herpes zoster vaccines. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>102</sup> Public Health Agency of Canada. (2018). An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI): Updated recommendations on the use of herpes zoster vaccines. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>103</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>104</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>105</sup> Letellier, M., Amini, R., Gilca, V., Trudeau, G., & Sauvageau, C. (2018). Herpes Zoster Burden in Canadian Provinces: A Narrative Review and Comparison with Quebec Provincial Data. *Canadian Journal of Infectious Diseases and Medical Microbiology*, 2018, 10. <https://doi.org/10.1155/2018/3285327>

<sup>106</sup> Public Health Agency of Canada. (2018). An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI): Updated recommendations on the use of herpes



*zoster vaccines*. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>107</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>108</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>109</sup> NACI. Update on the use of Herpes Zoster Vaccines. June 2018. Retrieved from: <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/updated-recommendations-use-herpes-zoster-vaccines-eng.pdf>

<sup>110</sup> Government of Canada. Provincial and Territorial Routine Vaccination Programs for Healthy, Previously Immunized Adults. December 2020. Retrieved from: <https://www.canada.ca/en/public-health/services/provincial-territorial-immunization-information/routine-vaccination-healthy-previously-immunized-adult.html>

<sup>111</sup> Government of Canada. Vaccination Coverage Goals and Vaccine Preventable Disease Reduction Targets by 2025. April 3, 2021. Retrieved from: [\[strategy/vaccination-coverage-goals-vaccine-preventable-diseases-reduction-targets-2025.html#det18\]\(https://www.canada.ca/en/public-health/services/immunization-vaccine-priorities/national-immunization-strategy/vaccination-coverage-goals-vaccine-preventable-diseases-reduction-targets-2025.html#det18\)](https://www.canada.ca/en/public-health/services/immunization-vaccine-priorities/national-immunization-</a></p></div><div data-bbox=)

<sup>112</sup> Government of Canada. Herpes zoster (shingles) vaccine: Canadian Immunization Guide. August 2018. Retrieved from: [https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-8-herpes-zoster-\(shingles\)-vaccine.html#a5](https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-8-herpes-zoster-(shingles)-vaccine.html#a5)

<sup>113</sup> Government of Canada. Canada Immunization Guide, Contraindications, precautions and concerns: Canadian Immunization Guide. January 2020. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-2-vaccine-safety/page-3-contraindications-precautions-concerns.html>

<sup>114</sup> Public Health Agency of Canada. Seasonal Influenza Vaccination Coverage in Canada, 2019-2020. Retrieved from: <https://www.canada.ca/content/dam/hc-sc/documents/services/immunization-vaccines/vaccination-coverage/seasonal-influenza-vaccine-coverage-in-canada-en.pdf>

<sup>115</sup> 2019 estimates come from the 2018-2019 Seasonal Influenza Vaccination Coverage Survey, available at: <https://www.canada.ca/en/public-health/services/publications/healthy-living/2018-2019-influenza-flu-vaccine-coverage-survey-results.html>  
2016 estimates come from the 2016 Adult National Immunization Coverage Survey, available at: [https://publications.gc.ca/collections/collection\\_2018/aspc-phac/HP40-222-2018-eng.pdf](https://publications.gc.ca/collections/collection_2018/aspc-phac/HP40-222-2018-eng.pdf)

<sup>116</sup> Government of Canada. Vaccine Uptake in Canadian Adults 2019. November 2019. Retrieved from: [https://www.canada.ca/en/public-health/services/publications/healthy-living/2018-2019-influenza-flu-vaccine-coverage-survey-results.html#\\_Results](https://www.canada.ca/en/public-health/services/publications/healthy-living/2018-2019-influenza-flu-vaccine-coverage-survey-results.html#_Results)

<sup>117</sup> Dubé, E., Bettinger, J. A., Fisher, W. A., Naus, M., Mahmud, S. M., & Hilderman, T. (2016). Improving Vaccination Rates: Vaccine acceptance, hesitancy and refusal in Canada: Challenges and potential approaches. *Canada communicable disease report*, 42(12), 246.

<sup>118</sup> World Health Organization. 2016. Addressing Vaccine Hesitancy. Retrieved from: [http://www.who.int/immunization/programmes\\_systems/vaccine\\_hesitancy/en/](http://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/)

<sup>119</sup> Government of Canada. Addressing vaccine hesitancy in the context of COVID-19: A primer for healthcare providers. Retrieved from: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/vaccines/vaccine-hesitancy-primer.html>

<sup>120</sup> Government of Canada. Addressing vaccine hesitancy in the context of COVID-19: A primer for healthcare providers. Retrieved from: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/vaccines/vaccine-hesitancy-primer.html>

<sup>121</sup> Government of Canada. Addressing vaccine hesitancy in the context of COVID-19: A primer for healthcare providers. Retrieved from: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/vaccines/vaccine-hesitancy-primer.html>

<sup>122</sup> MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, 33(34), 4161-4164.

<sup>123</sup> Nicholls, L. A. B., Gallant, A. J., Cogan, N., Rasmussen, S., Young, D., & Williams, L. (2021). Older adults' vaccine hesitancy: psychosocial factors associated with influenza, pneumococcal, and shingles vaccine uptake. *Vaccine*, 39(26), 3520-3527.

<sup>124</sup> Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior—a systematic review of influenza vaccine hesitancy, 2005–2016. *PloS one*, 12(1), e0170550.

<sup>125</sup> Government of Canada. Addressing vaccine hesitancy in the context of COVID-19: A primer for healthcare providers. Retrieved from: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/vaccines/vaccine-hesitancy-primer.html>

<sup>126</sup> Public Health Agency of Canada. (2021). Canadian COVID-19 vaccination coverage report, November 15, 2021. Retrieved from: <https://health-infobase.canada.ca/covid-19/vaccination-coverage/>

<sup>127</sup> Public Health Agency of Canada. (2021). Canadian COVID-19 vaccination coverage report, November 15, 2021. Retrieved from: <https://health-infobase.canada.ca/covid-19/vaccination-coverage/>

<sup>128</sup> Canadian Institute for Health Information. (2021). The Impact of COVID-19 on Long-Term Care in Canada: Focus on the First 6 Months. Retrieved from: <https://static1.squarespace.com/static/5c2fa7b03917eed9b5a436d8/t/6>

05ccc07515dd669a9c81ae5/1616694280553/  
impact-covid-19-long-term-care-canada-first-  
6-months-report-en.pdf

<sup>129</sup> Government of Canada. Coronavirus disease (COVID-19): Prevention and risks. Retrieved from: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks.html#people>

<sup>130</sup> Public Health Agency of Canada. Canada COVID-19 Daily Epidemiological Report November 15, 2021. Retrieved from: <https://health-infobase.canada.ca/covid-19/epidemiological-summary-covid-19-cases.html>

<sup>131</sup> Berardi, C., Antonini, M., Genie, M. G., Cotugno, G., Lanteri, A., Melia, A., & Paolucci, F. (2020). The COVID-19 pandemic in Italy: Policy and technology impact on health and non-health outcomes. *Health policy and technology*, 9(4), 454-487.

<sup>132</sup> National Institute on Ageing. (2021). If Older Canadians Want a COVID-19 Vaccine, Why Is Canada Struggling to Get Them Vaccinated? National Institute on Ageing, Ryerson University. Toronto, ON.

<sup>133</sup> Lazarus, J. V., Ratzan, S. C., Palayew, A., Gostin, L. O., Larson, H. J., Rabin, K., ... & El-Mohandes, A. (2021). A global survey of potential acceptance of a COVID-19 vaccine. *Nature medicine*, 27(2), 225-228.

<sup>134</sup> Karlsson, L. C., Soveri, A., Lewandowsky, S., Karlsson, L., Karlsson, H., Nolvi, S., ... & Antfolk, J. (2021). Fearing the disease or the vaccine: The case of COVID-19. *Personality and individual differences*, 172, 110590.

<sup>135</sup> Dror, A. A., Eisenbach, N., Taiber, S., Morozov, N. G., Mizrachi, M., Zigron, A., ... Sela, E. (2020). Vaccine hesitancy: the next challenge in the fight against COVID-19. *European Journal of Epidemiology*, 35(8), 775–779.

<sup>136</sup> Graffigna, G., Palamenghi, L., Boccia, S., & Barelo, S. (2020). Relationship between citizens' health engagement and intention to take the COVID-19 vaccine in Italy: a mediation analysis. *Vaccines*, 8(4), 576.

<sup>137</sup> Statistics Canada. (2021). Canadian Perspectives Survey Series 3: Resuming economic and social activities during COVID-19. Retrieved from: <https://www150.statcan.gc.ca/n1/en/daily-quotidien/200708/dq200708a-eng.pdf?st=HpKfldRQ>

<sup>138</sup> Statistics Canada. (2020). Changes in Canadians' Concerns and Responses to COVID-19. Retrieved from: <https://www150.statcan.gc.ca/n1/en/pub/11-631-x/2020004/pdf/s1-eng.pdf?st=Sx8YJPE8>

<sup>139</sup> Government of Canada. Vaccines for COVID-19: How to get vaccinated. Retrieved from: <https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/vaccines/how-vaccinated.html#a2>

<sup>140</sup> ImmunizeBC. (2021). Retrieved from: <https://immunizebc.ca/ask-us/questions/covid-19/i-am-not-resident-bc-i-am-bc-right-now-am-i-eligible-get-vaccine>

<sup>141</sup> Government of Ontario. (2021). What to expect when you get a COVID-19 vaccine. Retrieved from: <https://covid-19.ontario.ca/get-covid-19-vaccine>

- <sup>142</sup> Government of Saskatchewan. (2021). COVID-19 Vaccine Eligibility. Retrieved from: <https://www.ehealthsask.ca/services/Manuals/Documents/COVID-19-Vaccine-WS-Eligibility-Non-resident.pdf>
- <sup>143</sup> Government of Quebec. (2021). What to expect at your COVID-19 vaccination appointment. Retrieved from: <https://www.quebec.ca/en/health/health-issues/a-z/2019-coronavirus/progress-of-the-covid-19-vaccination/what-to-expect-at-your-covid-19-vaccination-appointment>
- <sup>144</sup> Alberta Health Services. (2021). Fluzone High-Dose Influenza Vaccine Biological Page. Retrieved from: <https://www.albertahealthservices.ca/assets/info/hp/cdc/if-hp-cdc-highdose-inf-vac-bio-pg-07-266.pdf>
- <sup>145</sup> Government of New Brunswick. Influenza Immunization. Retrieved from: [https://www2.gnb.ca/content/gnb/en/services/services\\_renderer.10775.Influenza\\_Immunization.html](https://www2.gnb.ca/content/gnb/en/services/services_renderer.10775.Influenza_Immunization.html)
- <sup>146</sup> Public Health Ontario. (2021). Influenza Vaccines for the 2021-2022 Influenza Season. Retrieved from: <https://www.publichealthontario.ca/-/media/documents/f/2020/fact-sheet-influenza-vaccine-2020-2021.pdf?la=en>
- <sup>147</sup> Prince Edward Island. (2021). Universal Influenza Program Frequently Asked Questions From Immunizers. Retrieved from: <https://www.princeedwardisland.ca/en/information/health-and-wellness/universal-influenza-program-frequently-asked-questions-from>
- <sup>148</sup> British Columbia Centre for Disease Control. High-Dose Quadrivalent Influenza Vaccine Question and Answer Document. August 2021. Retrieved from: [http://www.bccdc.ca/resourcegallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Immunization/Vaccine%20Info/FluzoneHD\\_QandA.pdf](http://www.bccdc.ca/resourcegallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Immunization/Vaccine%20Info/FluzoneHD_QandA.pdf)
- <sup>149</sup> Government of Manitoba. High Dose Seasonal Influenza Vaccine for Eligible Seniors Aged 65 Years and Older. Retrieved from: [https://www.gov.mb.ca/health/publichealth/factsheets/flu\\_highdose\\_qanda.pdf](https://www.gov.mb.ca/health/publichealth/factsheets/flu_highdose_qanda.pdf)
- <sup>150</sup> MacVicar, Adam. (2021). "Alberta Health Services apologizes for 'frustration, worry' due to COVID-19 vaccine rollout errors". Retrieved from: <https://globalnews.ca/news/7667053/alberta-health-services-apology-covid-19-vaccination-issues/>
- <sup>151</sup> Unger, Danton. (2021). "The two priority groups for the AstraZeneca/Covishield vaccine in Manitoba". Retrieved from: <https://winnipeg.ctvnews.ca/the-two-priority-groups-for-the-astrazeneca-covishield-vaccine-in-manitoba-1.5341675>.
- <sup>152</sup> Grant, Taryn. (2021). "COVID-19 vaccines to be made available in Nova Scotia pharmacies". Retrieved from: <https://www.cbc.ca/news/canada/nova-scotia/covid-19-vaccinesto-be-made-available-in-nova-scotia-pharmacies-1.5933476>
- <sup>153</sup> Buffman, Robert. (2021). "B.C. promises more information on COVID-19 vaccine for seniors this week". Retrieved from: <https://vancouverisland.ctvnews.ca/b-c-promisemore-information-on-covid-19-vaccine-for-seniors-this-week-1.5320559>
- <sup>154</sup> Bruno, and Mulligan. (2021). "Housebound seniors worried they'll be forgotten in vaccine drive" Retrieved from: <https://toronto>.

citynews.ca/2021/03/23/housebound-seniorscovid-19-vaccine/

<sup>155</sup> Lepage, and MCallister. (2021). "Homebound seniors still waiting for COVID-19 vaccine". Retrieved from: <https://toronto.citynews.ca/2021/05/06/homebound-seniors-still-waiting-for-covid-19-vaccine/>

<sup>156</sup> Wong, Madison. (2021). "Lost in translation: Advocates on battling language barriers amid COVID-19". Retrieved from: <https://globalnews.ca/news/7820644/covid-19-language-barriers-racialized-communities/>

<sup>157</sup> Government of British Columbia. (2021). "How to get vaccinated for COVID-19". Retrieved from: <https://www2.gov.bc.ca/gov/content/covid-19/vaccine/register>

<sup>158</sup> Government of Ontario. "COVID-19 booking support". Retrieved from: <https://covid-19.ontario.ca/covid-19-vaccine-booking-support>

<sup>159</sup> Government of Ontario. "COVID-19 booking support". Retrieved from: <https://covid-19.ontario.ca/covid-19-vaccine-booking-support>

<sup>160</sup> Empire Advance. (2021). "Vaccine clinics, language interpretation for people booking appointments, getting vaccine". Retrieved from: <https://www.empireadvance.ca/news/local-news/vaccine-clinics-language-interpretation-for-people-booking-appointments-getting-vaccine-1.24312535>

<sup>161</sup> Nerestant, Antoni. (2021). "Language, cultural barriers could fuel vaccine hesitancy, Quebec community organizers warn". Retrieved from: <https://www.cbc.ca/news/canada/montreal/vaccine-covid-19-language-culture-barriers-1.5942462>

<sup>162</sup> Huynh, T., Sava, N., & Hahn-Goldberg, S. (2021). Mobile on-site COVID-19 vaccination of naturally occurring retirement communities by neighbourhood risk in Toronto. *Science Briefs of the Ontario COVID-19 Science Advisory Table*, 2, 14.

<sup>163</sup> Stall, N. M., Nakamachi, Y., & Chang, M. (2021). Mobile in-home COVID-19 vaccination of Ontario homebound older adults by neighbourhood risk. *Sci Briefs Ont COVID-19 Sci Advis Table*, 1, 19.

<sup>164</sup> Government of Canada. (2018). Vaccine uptake in Canadian adults: Highlights from the 2016 adult National Immunization Coverage Survey (aNICS). Retrieved from: <https://www.canada.ca/en/services/health/publications/healthy-living/2016-vaccine-uptake-canadian-adults-survey.html>

<sup>165</sup> Nagata, J. M., Hernández-Ramos, I., Kurup, A. S., Albrecht, D., Vivas-Torrealba, C., & Franco-Paredes, C. (2013). Social determinants of health and seasonal influenza vaccination in adults ≥ 65 years: a systematic review of qualitative and quantitative data. *BMC Public Health*, 13(1), 1-25

<sup>166</sup> Winston, C. A., Wortley, P. M., & Lees, K. A. (2006). Factors associated with vaccination of medicare beneficiaries in five US communities: Results from the racial and ethnic adult disparities in immunization initiative survey, 2003. *Journal of the American Geriatrics Society*, 54(2), 303-310

<sup>167</sup> Waite, N. M., Pereira, J. A., Houle, S. K., Gilca, V., & Andrew, M. K. (2021). COVID-19's Impact on Willingness to Be Vaccinated against Influenza and COVID-19 during the 2020/2021 Season: Results from an Online Survey of

Canadian Adults 50 Years and Older. *Vaccines*, 9(4), 346.

<sup>168</sup> Domnich, A., Cambiaggi, M., Vasco, A., Maraniello, L., Ansaldi, F., Baldo, V., ... & Grassi, R. (2020). Attitudes and beliefs on influenza vaccination during the COVID-19 pandemic: results from a representative Italian survey. *Vaccines*, 8(4), 711.

<sup>169</sup> Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior—a systematic review of influenza vaccine hesitancy, 2005–2016. *PloS one*, 12(1), e0170550.

<sup>170</sup> Betsch, C., Schmid, P., Heinemeier, D., Korn, L., Holtmann, C., & Böhm, R. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. *PloS one*, 13(12), e0208601

<sup>171</sup> Thomson, A., Robinson, K., & Vallée-Tourangeau, G. (2016). The 5As: A practical taxonomy for the determinants of vaccine uptake. *Vaccine*, 34(8), 1018-1024.

<sup>172</sup> Thomson, A., Robinson, K., & Vallée-Tourangeau, G. (2016). The 5As: A practical taxonomy for the determinants of vaccine uptake. *Vaccine*, 34(8), 1018-1024.

<sup>173</sup> Betsch, C., Schmid, P., Heinemeier, D., Korn, L., Holtmann, C., & Böhm, R. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. *PloS one*, 13(12), e0208601.

<sup>174</sup> Bish, A., Yardley, L., Nicoll, A., & Michie, S. (2011). Factors associated with uptake of vaccination against pandemic influenza: a systematic review. *Vaccine*, 29(38), 6472-6484.

<sup>175</sup> Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. *Health psychology*, 26(2), 136.

<sup>176</sup> Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior—a systematic review of influenza vaccine hesitancy, 2005–2016. *PloS one*, 12(1), e0170550.

<sup>177</sup> Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013). Vaccine hesitancy: an overview. *Human vaccines & immunotherapeutics*, 9(8), 1763-1773.

<sup>178</sup> Caserotti, M., Girardi, P., Rubaltelli, E., Tasso, A., Lotto, L., & Gavaruzzi, T. (2021). Associations of COVID-19 risk perception with vaccine hesitancy over time for Italian residents. *Social Science & Medicine*, 272, 113688.

<sup>179</sup> Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior—a systematic review of influenza vaccine hesitancy, 2005–2016. *PloS one*, 12(1), e0170550.

<sup>180</sup> Nicholls, L. A. B., Gallant, A. J., Cogan, N., Rasmussen, S., Young, D., & Williams, L. (2021). Older adults' vaccine hesitancy: psychosocial factors associated with influenza, pneumococcal, and shingles vaccine uptake. *Vaccine*, 39(26), 3520-3527.

<sup>181</sup> MacDougall, D.W., Halperin, B.A., MacKinnon-Cameron, D., Li, L., McNeil, S.A., Langley, J.M., & Halperin, S.A. (2015). The challenge of vaccinating adults: attitudes and



beliefs of the Canadian public and healthcare providers. *British Medical Journal Open*, 5, e009062. Doi: 10.1136/bmjopen-2015-009062

<sup>182</sup> Public Health Agency of Canada. (2013). Fact sheet - shingles (herpes zoster). Retrieved from: <https://www.canada.ca/en/public-health/services/infectious-diseases/fact-sheet-shingles-herpes-zoster.html>

<sup>183</sup> Public Health Agency of Canada. (2013). Fact sheet - shingles (herpes zoster). Retrieved from: <https://www.canada.ca/en/public-health/services/infectious-diseases/fact-sheet-shingles-herpes-zoster.html>

<sup>184</sup> International Federation on Ageing. (2020). Pneumonia Vaccination in at-risk groups: A Canadian Perspective. Retrieved from: <https://www.vaccines4life.com/wp-content/uploads/2020/12/Pneumonia-vaccination-in-at-risk-groups-CS.pdf>

<sup>185</sup> International Federation on Ageing. (2020). Pneumonia Vaccination in at-risk groups: A Canadian Perspective. Retrieved from: <https://www.vaccines4life.com/wp-content/uploads/2020/12/Pneumonia-vaccination-in-at-risk-groups-CS.pdf>

<sup>186</sup> World Health Organization. (2014). Report of the SAGE Working Group on Vaccine Hesitancy. Retrieved from: [https://www.who.int/immunization/sage/meetings/2014/october/1\\_Report\\_WORKING\\_GROUP\\_vaccine\\_hesitancy\\_final.pdf](https://www.who.int/immunization/sage/meetings/2014/october/1_Report_WORKING_GROUP_vaccine_hesitancy_final.pdf)

<sup>187</sup> Kelly, D. A., Macey, D. J., & Mak, D. B. (2014). Annual influenza vaccination: Uptake, barriers, and enablers among student health care providers at the University of Notre Dame Australia, Fremantle. *Human vaccines & immunotherapeutics*, 10(7), 1930-193

<sup>188</sup> Buchan, S. A., Rosella, L. C., Finkelstein, M., Juurlink, D., Isenor, J., Marra, F., ... & Kwong, J. C. (2017). Impact of pharmacist administration of influenza vaccines on uptake in Canada. *Cmaj*, 189(4), E146-E152

<sup>189</sup> Kwong, J. C., Rosella, L. C., & Johansen, H. (2007). Trends in influenza vaccination in Canada, 1996/1997 to 2005. *Health Rep*, 18(4), 9-19.

<sup>190</sup> Sisk, J. E., Moskowitz, A. J., Whang, W., Lin, J. D., Fedson, D. S., McBean, A. M., ... & Butler, J. C. (1997). Cost-effectiveness of vaccination against pneumococcal bacteremia among elderly people. *Jama*, 278(16), 1333-1339.

<sup>191</sup> Rémy, V., Largeron, N., Quilici, S., & Carroll, S. (2015). The economic value of vaccination: why prevention is wealth. *Journal of market access & health policy*, 3(1), 29284.

<sup>192</sup> Nichol, K. L., Margolis, K. L., Wuorenma, J., & Von Sternberg, T. (1994). The efficacy and cost effectiveness of vaccination against influenza among elderly persons living in the community. *New England journal of medicine*, 331(12), 778-784.

<sup>193</sup> Government of Canada. (2020). Provincial and Territorial Routine Vaccination Programs for Healthy, Previously Immunized Adults. Retrieved from: <https://www.canada.ca/en/public-health/services/provincial-territorial-immunization-information/routine-vaccination-healthy-previously-immunized-adult.html>

<sup>194</sup> Government of Yukon. (2020). Government of Yukon announces funding for shingles vaccine. Retrieved from: <https://yukon.ca/en/news/government-yukon-announces-funding-shingles-vaccine>



<sup>195</sup> Neatby, S. (2021). P.E.I. budget remains in the red, while investing in daycare, nurses, recovery. Retrieved from: <https://www.saltwire.com/prince-edward-island/news/local/pei-budget-remains-in-the-red-while-investing-in-daycare-nurses-recovery-562856/>

<sup>196</sup> There are programs at the provincial or national level that also cover the costs of the Shingrix vaccine for specific subpopulations, such the British Columbia's First Nations Health Authority (FNHA) which covers the costs of the vaccine for First Nations residents between the aged of 65 and 69, or at the national level, the Veterans Affairs Canada, which provides the vaccine to eligible members 50 years and older.

<sup>197</sup> Public Health Agency of Canada. (2019b). Provincial and territorial routine vaccination programs for healthy, previously immunized adults. Retrieved from: <https://www.canada.ca/en/public-health/services/provincial-territorial-immunization-information/routine-vaccination-healthy-previously-immunized-adult.html>

<sup>198</sup> ImmunizeBC. (2020). Shingles. Retrieved from: <https://immunizebc.ca/shingles#:~:text=The%20vaccine%20is%20given%20as,to%20ask%20about%20vaccine%20availability>

<sup>199</sup> Medically attended herpes zoster is defined as “an outpatient physician visit for herpes zoster with a prescription for a herpes zoster antiviral (ie, acyclovir, famciclovir, valacyclovir) dispensed in the 5 days preceding or following the date of the physician encounter or an emergency department visit or hospital admission where the most responsible diagnosis was herpes zoster”

<sup>200</sup> Martins, D., McCormack, D., Tadrous, M., Gomes, T., Kwong, J. C., Mamdani, M. M., ... & Antoniou, T. (2021). Impact of a Publicly Funded Herpes Zoster Immunization Program on the Burden of Disease in Ontario, Canada: A Population-based Study. *Clinical Infectious Diseases*, 72(2), 279-284.

<sup>201</sup> Martins, D., McCormack, D., Tadrous, M., Gomes, T., Kwong, J. C., Mamdani, M. M., ... & Antoniou, T. (2021). Impact of a Publicly Funded Herpes Zoster Immunization Program on the Burden of Disease in Ontario, Canada: A Population-based Study. *Clinical Infectious Diseases*, 72(2), 279-284.

<sup>202</sup> Government of Canada. (2020). Public Funding for Influenza Vaccination by Province/Territory. Retrieved from: <https://www.canada.ca/en/public-health/services/provincial-territorial-immunization-information/public-funding-influenza-vaccination-province-territory.html>

<sup>203</sup> Alberta Health Services. (2021). Fluzone High-Dose Influenza Vaccine Biological Page. Retrieved from: <https://www.albertahealthservices.ca/assets/info/hp/cdc/if-hp-cdc-highdose-inf-vac-bio-pg-07-266.pdf>

<sup>204</sup> Government of New Brunswick. Influenza Immunization. Retrieved from: [https://www2.gnb.ca/content/gnb/en/services/services\\_renderer.10775.Influenza\\_Immunization.html](https://www2.gnb.ca/content/gnb/en/services/services_renderer.10775.Influenza_Immunization.html)

<sup>205</sup> Public Health Ontario. (2021). Influenza Vaccines for the 2021-2022 Influenza Season. Retrieved from: <https://www.publichealthontario.ca/-/media/documents/f/2020/fact-sheet-influenza-vaccine-2020-2021.pdf?la=en>

<sup>206</sup> Prince Edward Island. (2021). Universal Influenza Program Frequently Asked Questions From Immunizers. Retrieved from: <https://www.princeedwardisland.ca/en/information/health-and-wellness/universal-influenza-program-frequently-asked-questions-from>

<sup>207</sup> British Columbia Centre for Disease Control. (2021). High-Dose Quadrivalent Influenza Vaccine Question and Answer Document. Retrieved from: [http://www.bccdc.ca/resourcegallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Immunization/Vaccine%20Info/FluzoneHD\\_QandA.pdf](http://www.bccdc.ca/resourcegallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Immunization/Vaccine%20Info/FluzoneHD_QandA.pdf)

<sup>208</sup> Government of Manitoba. High Dose Seasonal Influenza Vaccine for Eligible Seniors Aged 65 Years and Older. Retrieved from: [https://www.gov.mb.ca/health/publichealth/factsheets/flu\\_highdose\\_qanda.pdf](https://www.gov.mb.ca/health/publichealth/factsheets/flu_highdose_qanda.pdf)

<sup>209</sup> Matsui, D., Shigeta, M., Ozasa, K., Kuriyama, N., Watanabe, I., & Watanabe, Y. (2011). Factors associated with influenza vaccination status of residents of a rural community in Japan. *BMC Public Health*, 11(1), 1-9

<sup>210</sup> Takayama, M., Wetmore, C. M., & Mokdad, A. H. (2012). Characteristics associated with the uptake of influenza vaccination among adults in the United States. *Preventive medicine*, 54(5), 358-362

<sup>211</sup> Sato, A. P. S., Antunes, J. L. F., Moura, R. F., de Andrade, F. B., Duarte, Y. A. O., & Lebrão, M. L. (2015). Factors associated to vaccination against influenza among elderly in a large Brazilian metropolis. *PloS one*, 10(4), e0123840

<sup>212</sup> International Federation on Ageing. Pneumonia Vaccination: in at-risk groups: A Canadian Perspective. October 2020:

Retrieved: <https://www.vaccines4life.com/wp-content/uploads/2020/12/Pneumonia-vaccination-in-at-risk-groups-CS.pdf>

<sup>213</sup> Canadian Pharmacists Association. (2020). Scope of Practice Immunization. Retrieved from: [http://www.pharmacists.ca/cpha-ca/assets/File/cpha-on-the-issues/Scope\\_of\\_Practice\\_Immunization\\_Dec2020.pdf](http://www.pharmacists.ca/cpha-ca/assets/File/cpha-on-the-issues/Scope_of_Practice_Immunization_Dec2020.pdf)

<sup>214</sup> Canadian Pharmacists Association. (2020). Scope of Practice Immunization. Retrieved from: [http://www.pharmacists.ca/cpha-ca/assets/File/cpha-on-the-issues/Scope\\_of\\_Practice\\_Immunization\\_Dec2020.pdf](http://www.pharmacists.ca/cpha-ca/assets/File/cpha-on-the-issues/Scope_of_Practice_Immunization_Dec2020.pdf)

<sup>215</sup> MacDougall, D.W., Halperin, B.A., MacKinnon-Cameron, D., Li, L., McNeil, S.A., Langley, J.M., & Halperin, S.A. (2015). The challenge of vaccinating adults: attitudes and beliefs of the Canadian public and healthcare providers. *British Medical Journal Open*, 5, e009062. Doi: 10.1136/bmjopen-2015-009062

<sup>216</sup> Ipsos. (2016). PneuVUE – Adult Pneumonia Vaccine Understanding in Europe: A New View into Pneumonia Among Older Adults.

<sup>217</sup> Hobbs, J.L., & Buxton, J.A. (2014). Influenza immunization in Canada's low-income population. *BMC Public Health*, 14. 740. <http://www.biomedcentral.com/1471-2458/14/740>

<sup>218</sup> Rochon, P. A., Brown, K. A., & Huynh, T. (2021). Ontario's community-dwelling older adults who remain unvaccinated against COVID-19. *Science Briefs of the Ontario COVID-19 Science Advisory Table*. 2021; 2 (37).

<sup>219</sup> Sinha, S. (2012). Living Longer, Living Well – Report Submitted to the Minister of Health and Long-Term Care and the Minister Responsible for Seniors on recommendations

to Inform a Seniors Strategy for Ontario. Retrieved from: [http://www.health.gov.on.ca/en/common/ministry/publications/reports/seniors\\_strategy/docs/seniors\\_strategy\\_report.pdf](http://www.health.gov.on.ca/en/common/ministry/publications/reports/seniors_strategy/docs/seniors_strategy_report.pdf)

<sup>220</sup> Stall, N., Nowaczynski, M., & Sinha, S. K. (2013). Back to the future: home-based primary care for older homebound Canadians: Part 1: where we are now. *Canadian Family Physician, 59*(3), 237-240.

<sup>221</sup> Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior—a systematic review of influenza vaccine hesitancy, 2005–2016. *PloS one, 12*(1), e0170550.

<sup>222</sup> Betsch, C., Böhm, R., & Chapman, G. B. (2015). Using behavioral insights to increase vaccination policy effectiveness. *Policy Insights from the Behavioral and Brain Sciences, 2*(1), 61-73.

<sup>223</sup> Yukon. (2021). COVID-19 booster doses being provided to long-term care residents. Yukon News release #: 21-371. Retrieved from: <https://yukon.ca/en/news/covid-19-booster-doses-being-provided-long-term-care-residents>

<sup>224</sup> CBC News. (2021). N.S. reveals plans for 3rd COVID-19 doses, mask mandate to continue under Phase 5. Retrieved from: <https://www.cbc.ca/news/canada/nova-scotia/covid-19-update-september-29-2021-1.6193466>

<sup>225</sup> CTV News. (2021). P.E.I. reports one new COVID-10 case Tuesday; first day of Vax Pass. Retrieved from: <https://atlantic.ctvnews.ca/p-e-i-reports-one-new-covid-19-case-tuesday-first-day-of-vax-pass-1.5611583>

<sup>226</sup> Cook, Stephen. (2021). Bookings for COVID-19 boosters jump as seniors in Alberta eligible for 3rd dose. Retrieved from: <https://www.cbc.ca/news/canada/edmonton/alberta-covid-19-vaccine-booster-1.6203829>

<sup>227</sup> Wong, Denise. (2021). COVID-19 vaccine booster doses coming to British Columbians in long-term care. Retrieved: <https://www.citynews1130.com/2021/09/28/bc-covid-19-vaccine-doses/>

<sup>228</sup> Pruys, Sarah. (2021). Third doses for the NWT's immunocompromised starting soon. Retrieved from: <https://cabinradio.ca/73048/news/health/third-doses-for-the-nwts-immunocompromised-starting-soon/>

<sup>229</sup> Saskatchewan. (2021). COVID-19 Vaccination Boosters Starting September 7. Retrieved from: <https://www.saskatchewan.ca/government/news-and-media/2021/august/30/covid-19-vaccination-boosters-starting-september-7>

<sup>230</sup> Government of Ontario. (2021). Expanded Eligibility for Third Doses of the COVID-19 Vaccine. Retrieved from: <https://news.ontario.ca/en/backgrounder/1000805/expanded-eligibility-for-third-doses-of-the-covid-19-vaccine>

<sup>231</sup> Caruso-Moro, Luca. (2021). Quebecers with compromised immune systems can now get a third dose of a COVID-19 vaccine. Retrieved from: <https://montreal.ctvnews.ca/quebecers-with-compromised-immune-systems-can-now-get-a-third-dose-of-a-covid-19-vaccine-1.5566890>

<sup>232</sup> Van Horne, Ryan. (2021). N.B. to offer booster shots to seniors in nursing homes; reports 84 new COVID-19 cases and one.

Retrieved from: <https://atlantic.ctvnews.ca/n-b-to-offer-booster-shots-to-seniors-in-nursing-homes-reports-84-new-covid-19-cases-and-one-death-1.5605398>

<sup>233</sup> CTV News. (2021). COVID-19 third doses being expanded in Manitoba. Retrieved from: <https://winnipeg.ctvnews.ca/covid-19-third-doses-being-expanded-in-manitoba-1.5640750>

<sup>234</sup> Global News. (2021). Nunavut begins offering third COVID-19 shot to those 12 and older. Retrieved from: <https://globalnews.ca/news/8352782/nunavut-covid-booster/>

<sup>234a</sup> Newfoundland and Labrador. Public Advisory: Change in Eligibility for COVID-19 Vaccine Booster Doses. Retrieved from: <https://www.gov.nl.ca/releases/2021/health/1105n07/>

<sup>235</sup> CBC News. (2021). Bookings for COVID-19 boosters jump as seniors in Alberta eligible for 3rd dose. Retrieved from: <https://www.cbc.ca/news/canada/edmonton/alberta-covid-19-vaccine-booster-1.6203829>

<sup>236</sup> Toronto Star. (2021). B.C. to offer COVID-19 vaccine boosters for all in 'precedent-setting' move. Retrieved from: <https://www.thestar.com/news/canada/2021/10/26/bc-to-offer-covid-vaccine-boosters-for-all-in-precedent-setting-move.html>

<sup>237</sup> CBC News. (2021). All adults in N.W.T. now eligible for booster shot, say top docs. Retrieved from: <https://www.cbc.ca/news/canada/north/n-w-t-health-officials-covid-19-questions-trailbreaker-1.6227793>

<sup>238</sup> Nunavut

<sup>239</sup> CBC News. (2021). Ontario to offer COVID-19 boosters to everyone 12 and up, with those 70 and older eligible this week. Retrieved from: <https://www.cbc.ca/news/canada/toronto/covid-19-ontario-november-3-2021-booster-shots-details-1.6235235>

<sup>240</sup> CBC News. (2021). Manitobans 70 and older, Indigenous people 18 and up now eligible for 3rd doses of COVID-19 vaccine. Retrieved from: <https://www.cbc.ca/news/canada/manitoba/vaccine-third-dose-manitoba-70-older-indigenous-people-1.6235634>

<sup>241</sup> Prince Edward Island. Questions about Third Doses. Retrieved from: <https://www.princeedwardisland.ca/en/information/health-and-wellness/questions-about-third-doses>

<sup>242</sup> New Brunswick. COVID-19 vaccines. Retrieved from: <https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/nb-vaccine.html#2>

<sup>243</sup> Yukon. COVID-19 booster doses to be available starting with Yukoners ages 50 and older. Retrieved from: <https://yukon.ca/en/news/covid-19-booster-doses-be-available-starting-yukoners-ages-50-and-older>

<sup>244</sup> Saskatchewan. (2021). Stick it to COVID: Expanding Booster Dose Eligibility. Retrieved from: <https://www.saskatchewan.ca/government/news-and-media/2021/october/19/stick-it-to-covid-expanding-booster-dose-eligibility>

<sup>245</sup> Nova Scotia. (2021). Province Adopts National Recommendations on COVID-19 Vaccine Boosters. Retrieved from: <https://novascotia.ca/news/release/?id=20211105006>

<sup>245a</sup> Newfoundland and Labrador. Public Advisory: Change in Eligibility for COVID-19 Vaccine Booster Doses. Retrieved from: <https://www.gov.nl.ca/releases/2021/health/1105n07/>

<sup>245b</sup> Quebec. Additional dose of COVID-19 vaccine. Retrieved from: <https://www.quebec.ca/en/health/health-issues/a-z/2019-coronavirus/progress-of-the-covid-19-vaccination/additional-dose-covid-19-vaccine>

<sup>246</sup> Quach, S., Pereira, J.A., Heidebrecht, C.L., Kwong, J.C., Guay, M., Crowe, L., Quan, S., Bettinger, J.A., for the Public Health Agency of Canada/Canadian Institutes of Health Research Influenza Research Network (PCIRN) Vaccine Coverage Theme Group. *American Journal of Infection Control*, 41, 685-90. <http://dx.doi.org/10.1016/j.ajic.2012.09.022>

<sup>247</sup> Government of Canada. (2016). Vaccine uptake in Canadian adults: Results from the 2014 adult National Immunization Coverage Survey. Retrieved from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/vaccine-uptakecanadian-adults-results-2014-adult-national-immunization-coverage-survey.html>

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