If Older Canadians Want a COVID-19 Vaccine, Why Is Canada Struggling to Get Them Vaccinated?

April 2021

NIA NATIONAL INSTITUTE ON AGEING

National Institute on Ageing

Suggested Citation:
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.

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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.

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Executive Summary

Over the past year, Canada has recorded over 1 million cases of COVID-19 and 23,000 deaths. More than 95% of these fatalities have occurred among Canadians aged 60 and older.[1] Canadians have been confronted daily with stories and images of the mounting death toll in long-term care settings, most notably when the Canadian military was called upon in spring 2020 to staff LTC homes in Ontario and Quebec. Canada is now in the midst of its COVID-19 vaccine rollout, with provinces and territories racing to achieve population-level herd immunity. In the face of logistical constraints, such as limited and staggered arrivals of vaccine supply, provincial and territorial governments have had to make decisions about which groups in their populations should be prioritized for vaccination.

After completing their first rounds of vaccinations – prioritizing residents and staff of long-term care, and front-line health care workers – provinces and territories are beginning to expand vaccination eligibility.[2] In this report, we demonstrate that prioritizing older Canadians is the most efficient and effective way to increase COVID-19 vaccination coverage across the country while simultaneously protecting the nation's most vulnerable population.

Throughout the pandemic, older Canadians have consistently been more willing to get a COVID-19 vaccine than younger Canadians. This is not surprising; older Canadians have continued to account for the overwhelming majority of new deaths from the virus.

In the summer of 2020, more than 90% of Canadians aged 75 and older were already willing to get a COVID-19 vaccine when it became available.[3,4]

Moreover, more recent figures reveal that the overwhelming majority of older Canadians continue to express that they intend to receive the COVID-19 vaccine. However, there have been increasing reports of low uptake of COVID-19 vaccines among older Canadians.

As of April 3, 2021, less than 75% of Canadians aged 75 and older had received at least one dose of a COVID-19 vaccine.[5] The results of this analysis clearly demonstrate that this gap – between older Canadians who want a vaccine and those who have been vaccinated – is not attributable to a lack of demand or low supply. It is an issue of access.

Older Canadians are facing substantial accessibility barriers, which limit their ability to get vaccinated quickly. These barriers are leading to an increasingly deadly gap in vaccination coverage among older Canadians.

In order to close this gap, the NIA recommends continuing to prioritize vaccination for older adults and taking immediate steps to improve their access to vaccines. The NIA has developed the following five policy recommendations that could enable jurisdictions to deliver vaccines more efficiently and equitably to older Canadians and save the most lives:

1. **Create more culturally targeted information campaigns that speak to older adults from a diversity of backgrounds**
2. **Provide a variety of methods to book vaccination appointments, beyond online options**
3. **Expand vaccine administration to primary care providers, pharmacies and community clinics**
4. **Develop comprehensive mobile outreach strategies, especially targeting homebound older adults and areas where there is a concentration of older Canadians living in close proximity**
5. **Shorten the interval between first and second doses for older Canadians to expedite becoming fully immunized**

Adopting these measures would enable provinces and territories to vaccinate older populations more quickly and effectively, while also supporting communities across Canada to reach 'herd immunity' faster.

Useful Terms

Canadian Perspectives Survey Series (CPSS): The Canadian Perspectives Survey Series (CPSS) is a new project by Statistics Canada involving a series of short online surveys conducted over a one-year period to collect important information on the knowledge and behaviors of residents in the 10 Canadian provinces. The third survey of the series focused on the gradual reopening of economic and social activities during COVID-19.[6]

COVID-19: COVID-19 is a disease caused by a new strain of coronavirus. 'CO' stands for corona, 'VI' for virus, and 'D' for disease. Formerly, this disease was referred to as '2019 novel coronavirus' or '2019-nCoV.[7]

Herd Immunity: Herd immunity works to control the spread of disease within a population when a specific amount of that population (threshold) becomes immune to the disease through vaccination or infection and recovery (JAMA, 2020).[8]

mRNA Vaccines: Messenger RNA Vaccines (mRNA) is a novel vaccine technology used for the first time in the Pfizer-BioNTech and Moderna COVID-19 vaccines. The mRNA vaccines differ from attenuated or live virus vaccines, as they "take advantage of the process that cells use to make proteins in order to trigger an immune response and build immunity to SARS-CoV-2, the virus that causes COVID-19. In contrast, most vaccines use weakened or inactivated versions or components of the disease-causing pathogen to stimulate the body's immune response to create antibodies" (CDC, 2020).[9]

Older Adults: People aged 65 and older. In specific cases where disaggregated data was unavailable, it may refer to people aged 55 and older, but this would be explicitly stated in the text.

Vaccine Efficacy: The percentage reduction in disease incidence in a vaccinated group compared to an unvaccinated group under optimal conditions.[10]

Vaccine Effectiveness: The ability of vaccines to prevent outcomes of interest in the real world, such as infection or severe illness. Also referred to as 'real-world efficacy'.[11]

Vaccine Hesitancy: The delay in acceptance or refusal of vaccines despite availability of vaccination services.[12]

Vaccine Uptake: The action of receiving a vaccine. This is also known as 'vaccine acceptance'. Vaccine uptake is influenced by vaccine willingness (see below) and barriers to access.

Vaccine Willingness: The state of being prepared to receive a vaccine. Also known as 'vaccine readiness' or 'vaccine intention' or 'vaccine demand'. Willingness to receive a vaccine does not guarantee vaccine acceptance, as willingness evolves over time.[13]

Younger Adults: People aged 64 and younger. This may be broken down by specific age categories throughout this report, which will be explicitly stated in the text.

Wave 1: The first wave of the COVID-19 pandemic in Canada. The NIA defines Wave 1 as beginning March 1, 2020 and ending August 31, 2020.

Wave 2: The second wave of the COVID-19 pandemic in Canada. The NIA defines Wave 2 as beginning September 1st, 2020 and ending February 28, 2021.

Wave 3: The third wave of the COVID-19 pandemic in Canada. The NIA defines Wave 3 as beginning March 1, 2021 to present.

Why Older Canadians Must be Prioritized for Vaccination Against COVID-19

The COVID-19 pandemic has had devastating impacts on the health and well-being of many older Canadians.

Since the beginning of the pandemic, about 69% of Canada's total hospitalizations, 65% of its intensive care admissions, and 96% of its deaths due to COVID-19 have occurred among Canadians aged 60 and older.[14,15]

More than a year after the pandemic was declared, in March 2020, it has become increasingly clear that widespread immunization is the most promising measure to help curb the spread of COVID-19. Countries around the world are now mobilizing efforts to vaccinate their populations. Canada approved two vaccines for immediate use in late December 2020. As of April 2021, the Canadian government had approved a total of four COVID-19 vaccines for use. All but one of those vaccines will require the administration of two doses for maximum protection. By the end of April 2021, Canada will have received enough vaccine doses to administer a first dose to every Canadian 60 years of age and older.

As of April 3, 2021, 15.22% of the Canadian population has received at least one dose of a COVID-19 vaccine. In total, 80.83% of Canadians aged 80 and older have received at least one dose of a COVID-19 vaccine.

There is also significant variation across five-year age intervals for people aged 70 and older. So far, less than half of Canadians aged 70-74 and around 60% of Canadians aged 75-79 have been vaccinated with at least one dose as of April 3, 2021 (**Figure 1**). For both age groups, less than 5% of this population have been vaccinated with two doses **(Figure 2).**[16]

Vaccination coverage among older adults varies across the provinces and territories (**Table 1**). For example, Alberta, Saskatchewan, and Quebec have vaccinated more than 80% of their population aged 80 and older, over 70% of their population aged 75-79, and over 65% of their population aged 70-74.

The three Canadian territories have also done an excellent job of vaccinating their older populations. For example, Nunavut and Yukon have both vaccinated around 90% of their population aged 80 and older. The Northwest Territories have vaccinated nearly 100% of the population aged 80 and older. All three territories have also vaccinated between nearly 80% and 95% of their population aged 70 to 79 (**Table 1**).

Figure 1: Cumulative Percent of Older Canadians Who Have Received at Least 1 Dose of a COVID-19 Vaccine (Health Infobase, Data as of April 3, 2021)

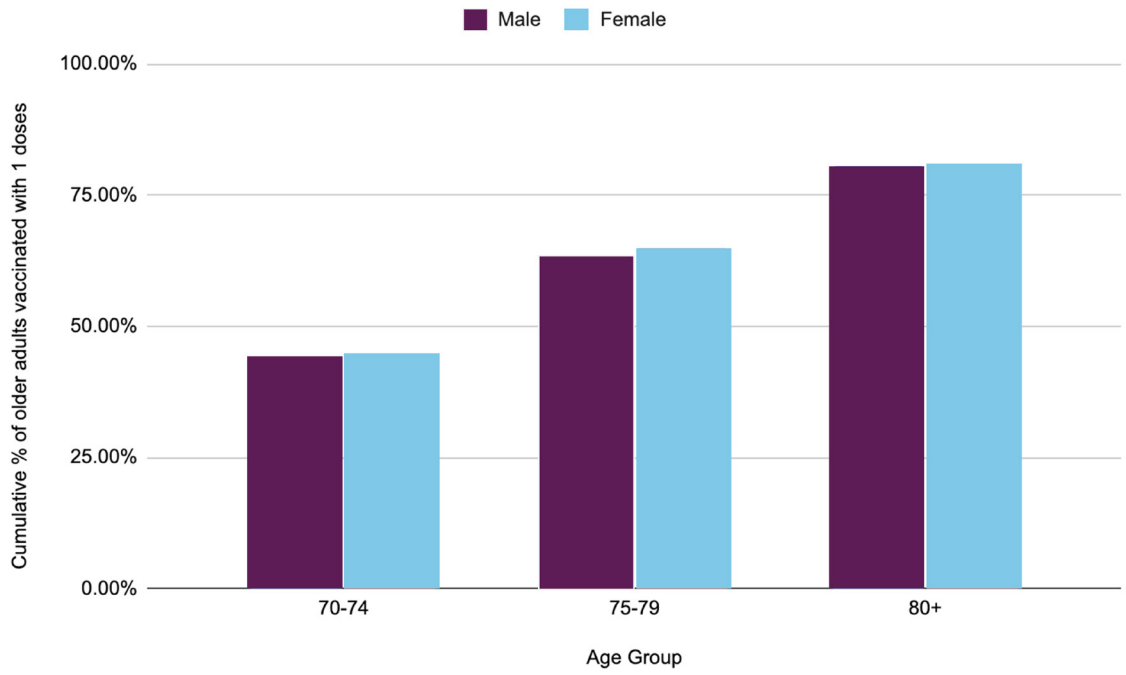


Figure 2: Cumulative Percent of Older Canadians Who Have Received 2 Doses of a COVID-19 Vaccine (Health Infobase, Data as of April 3, 2021)

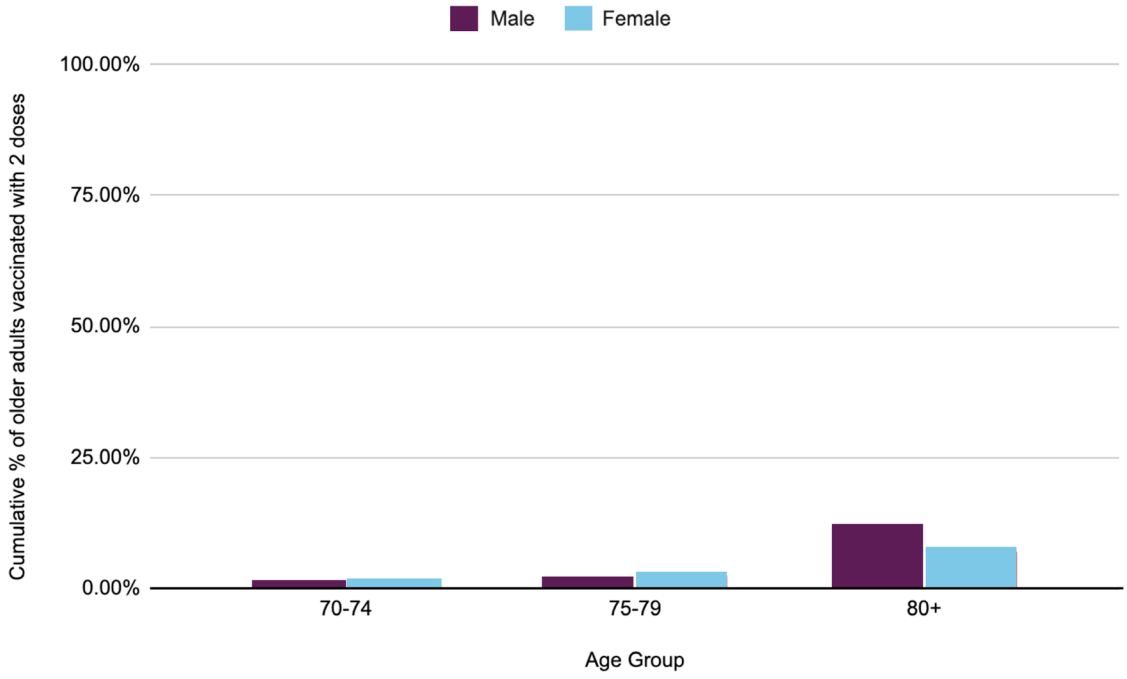


Table 1: Percent of Older Canadians Vaccinated Against COVID-19 By Jurisdiction as of April 3, 2021.

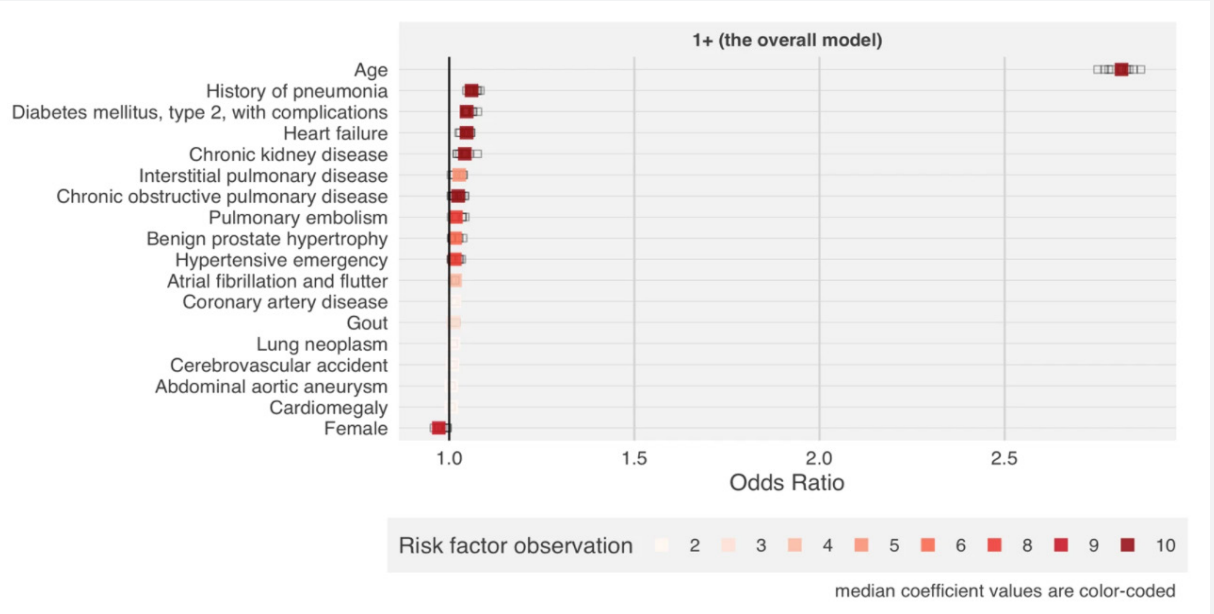
Canadian Jurisdiction	Total Population 70+			Aged 70-74			Aged 75-79			Aged 80+		
	% At least 1 dose	% 1 dose only	% 2 doses	% At least 1 dose	% 1 dose only	% 2 doses	% At least 1 dose	% 1 dose only	% 2 doses	% At least 1 dose	% 1 dose only	% 2 doses
Alberta	74.86	66.06	8.80	66.16	63.70	2.46	79.06	73.57	5.49	81.56	63.19	18.36
British Columbia	56.13	52.48	3.65	28.03	26.84	1.19	62.85	61.03	1.82	82.34	74.62	7.72
Manitoba	42.04	29.94	12.10	16.66	12.08	4.58	32.29	26.00	6.29	74.93	51.07	23.86
New Brunswick	38.40	36.73	1.68	13.16	12.55	0.61	29.26	28.52	0.74	76.58	72.84	3.73
Newfoundland and Labrador	53.03	50.57	2.47	37.04	36.26	0.78	46.41	44.47	1.94	82.16	76.78	5.38
Northwest Territories	96.24	7.51	88.73	93.70	6.87	86.83	96.02	8.46	87.56	99.81	7.56	92.25
Nova Scotia	25.16	20.47	4.69	2.79	1.35	1.43	17.27	15.43	1.84	58.82	47.87	10.95
Nunavut	86.60	-	86.60	89.76	-	89.76	79.15	-	79.15	88.27	-	88.27
Ontario	60.84	54.19	6.65	40.75	38.87	1.88	63.02	60.02	2.99	79.93	65.83	14.11
Prince Edward Island	40.91	24.04	16.87	13.65	10.37	3.28	26.48	20.11	6.37	86.93	44.54	42.39
Quebec	75.70	75.70	-	68.27	68.27	-	74.71	74.71	-	84.46	84.46	-
Saskatchewan	74.06	61.60	12.45	65.91	60.62	5.28	72.97	65.33	7.62	82.25	60.14	22.11
Yukon	93.52	6.66	86.86	94.26	7.83	86.42	93.97	6.15	87.82	91.71	5.05	86.66
Canada	**63.00**	**58.02**	**4.98**	**45.73**	**44.11**	**1.62**	**63.99**	**61.48**	**2.51**	**80.83**	**70.43**	**10.40**

Source: Government of Canada, Health Infobase, COVID-19 Vaccination in Canada, Data as of April 3, 2021.

While other provinces such as British Columbia, Ontario, and Manitoba have comparable rates of vaccination coverage among people aged 80 and older, they have vaccinated a significantly smaller proportion of their population aged 79 and younger. For example, Manitoba has vaccinated less than 35% of its population aged 75-79, and less than 20% of its population aged 70-74.[17]

Older adults have remained the most vulnerable and at highest risk of experiencing severe illness, hospitalization and death from COVID-19. This is due to their weakened immune systems, likelihood of living with pre-existing health conditions, and where they live. Congregate living settings such as long-term care and retirement homes, for example, had become the epicenter of COVID-19 pandemic in Canada during its first two waves. Despite the start of Canada's vaccination rollout, since entering its third wave of this pandemic in March 2021, Canadians aged 60 and older, living in their own homes in the community, have now come to account for the majority of Canada's COVID-19 hospitalizations, ICU admissions and deaths.[18]

Figure 3: Odds Ratios for the Covariates Identified as Predictors of Mortality in COVID-19 Patients (Estiri et al, 2021)



An odds ratio (OR) is a measure of association between an exposure and outcomes. The OR represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure.[19]

If an OR is greater than 1, this means greater odds of association with the exposure than outcome

OR = 1 means there is no association between exposure and outcome.
OR < 1 means there is a lower odds of association between the exposure

Recent studies confirm the significance of age as the number one risk factor for COVID-19 mortality. For example, a recent US study – which looked at how age and 46 clinical conditions predicted death after a COVID-19 infection – found that age was by far the most important predictor of mortality in COVID-19 patients **(Figure 3)**. In fact, the study found that the likelihood of death associated with increased age (OR 2.82) was nearly twice as high as the next most important predictor, which was pneumonia (OR 1.06).[20]

A 2020 NIA-led study comparing COVID-19 deaths across 12 high-income countries found that LTC residents and community-dwelling older adults accounted for 47% and 44% of COVID-19 fatalities, while younger persons accounted for only 8% of deaths. In Canada, the study found that the risk of dying for residents of LTC and retirement homes was more than 1000 times higher compared to community-dwelling younger Canadians (people aged 64 and younger). For community-dwelling older adults, the risk was still 14 times higher compared to community-dwelling younger Canadians. LTC home residents in Sweden, the UK, and the USA had a 469, 385, and 215 times higher risk of dying compared to

Figure 4: Death per 100,000 among LTC Residents, Older Adults, and People Aged 64 Years and Younger Across 12 OECD Countries (Sepulveda, Stall, & Sinha, 2020)

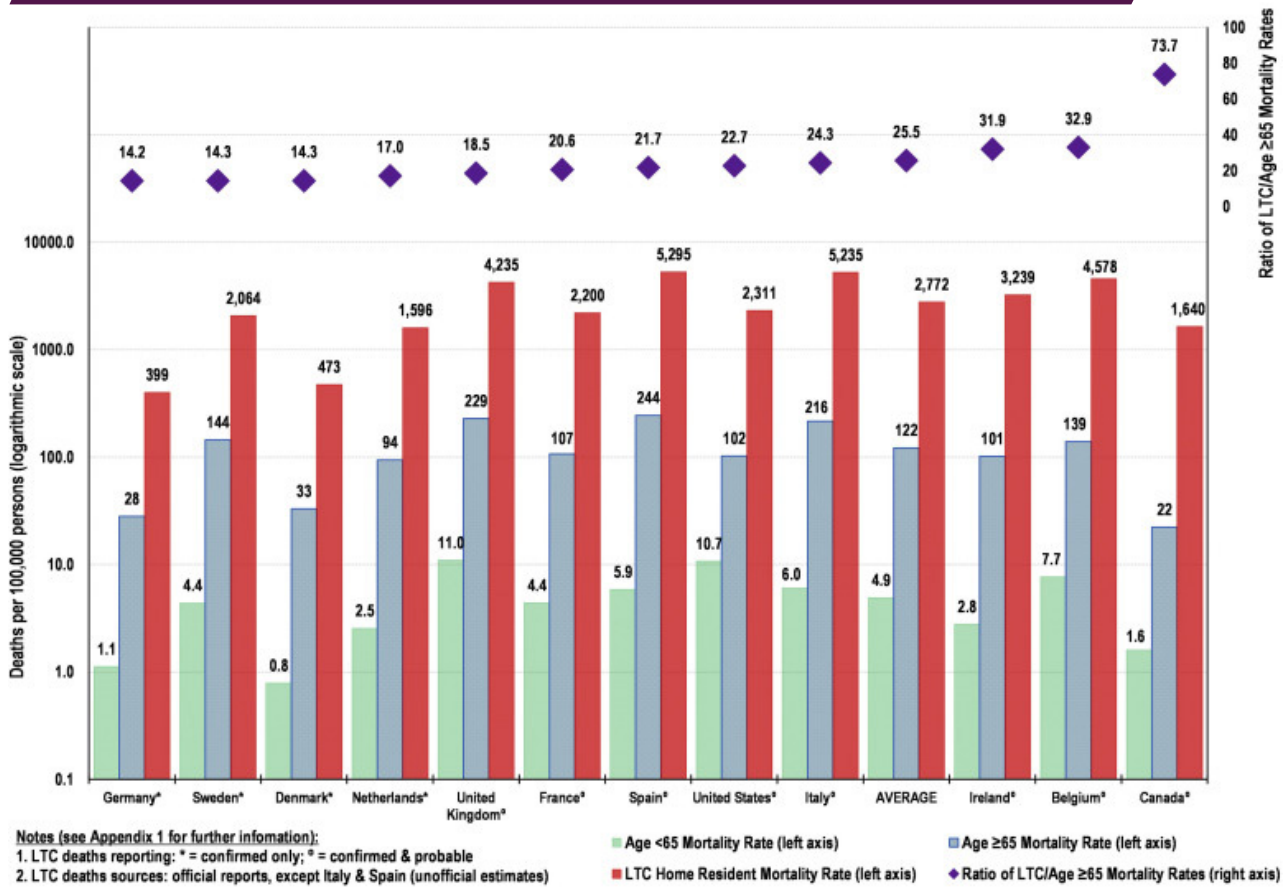
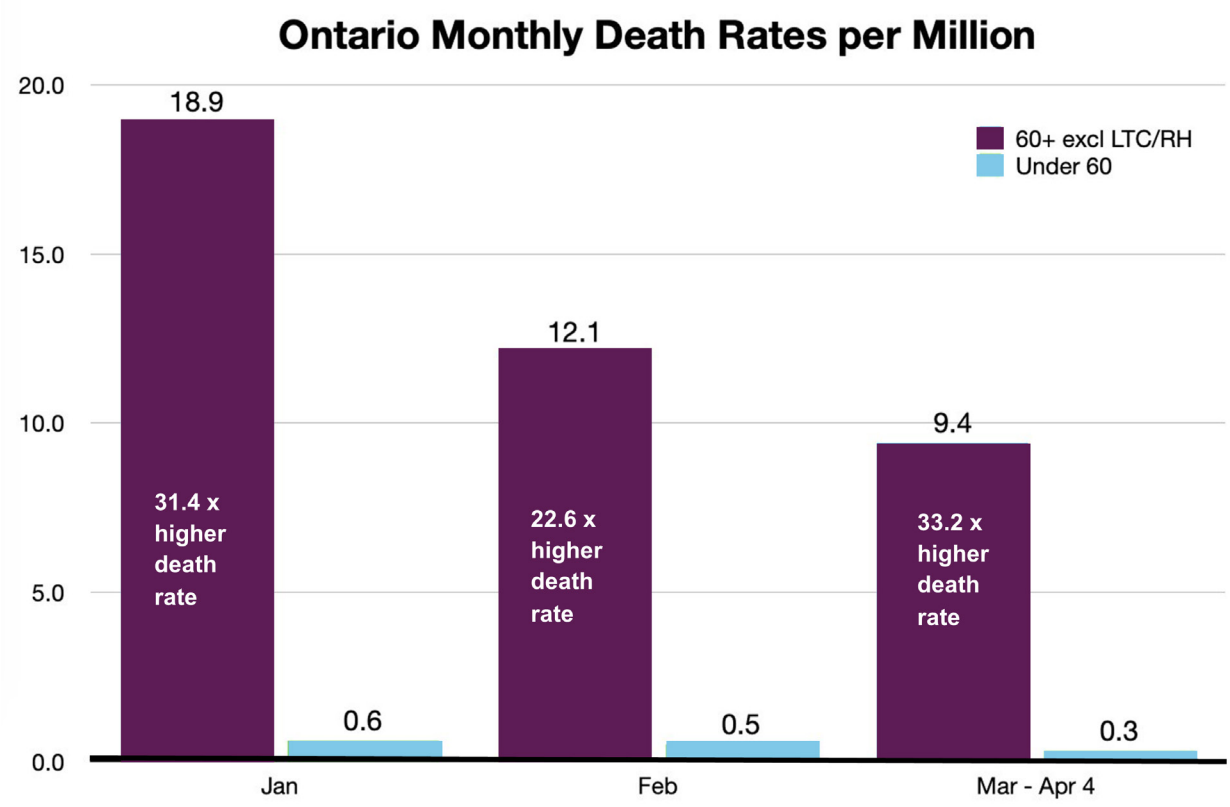


Figure 5: Death Rate Among Non-LTC Residing Older Adults Aged 60 and Over in Ontario (Comeau, Bill. Raw Ontario Public Health Data, 2021)



Bill Comeau @Billius27 April 5. Deaths rates are adjusted to a 30 day average for each period. Sources: PHO, RHRA

adults aged 64 years and younger, while community-dwelling older adults aged 65 and older had a 32.7, 20.8, 9.57 times higher risk of dying than those aged 64 and younger across the same three countries **(Figure 4)**.[21]

Results from early LTC home vaccination efforts in British Columbia and Quebec have led to significant reductions of COVID-19 outbreaks in LTC settings. Specifically, as of February 11, 2021, Quebec LTC homes were averaging six new cases a day, a 10-fold decrease from the beginning of January 2021.[22] In British Columbia, there has been an 80% reduction in COVID-19 cases observed in its LTC homes over the same time period.[23]

Nonetheless, recent evidence from Ontario illustrates the significant continued risk facing community-dwelling older adults from the height of the pandemic's second wave and now into its third wave. In January 2021, community-dwelling adults aged 60 and older had a 31 times higher risk of death compared to adults aged 59 and younger. The higher risk of death has persisted as vaccinations began for community-dwelling older persons. In February and March 2021, the risk of death for adults aged 60 and older was found to be 23 times and 33 times greater compared to adults aged 59 and younger **(Figure 5)**.[24]

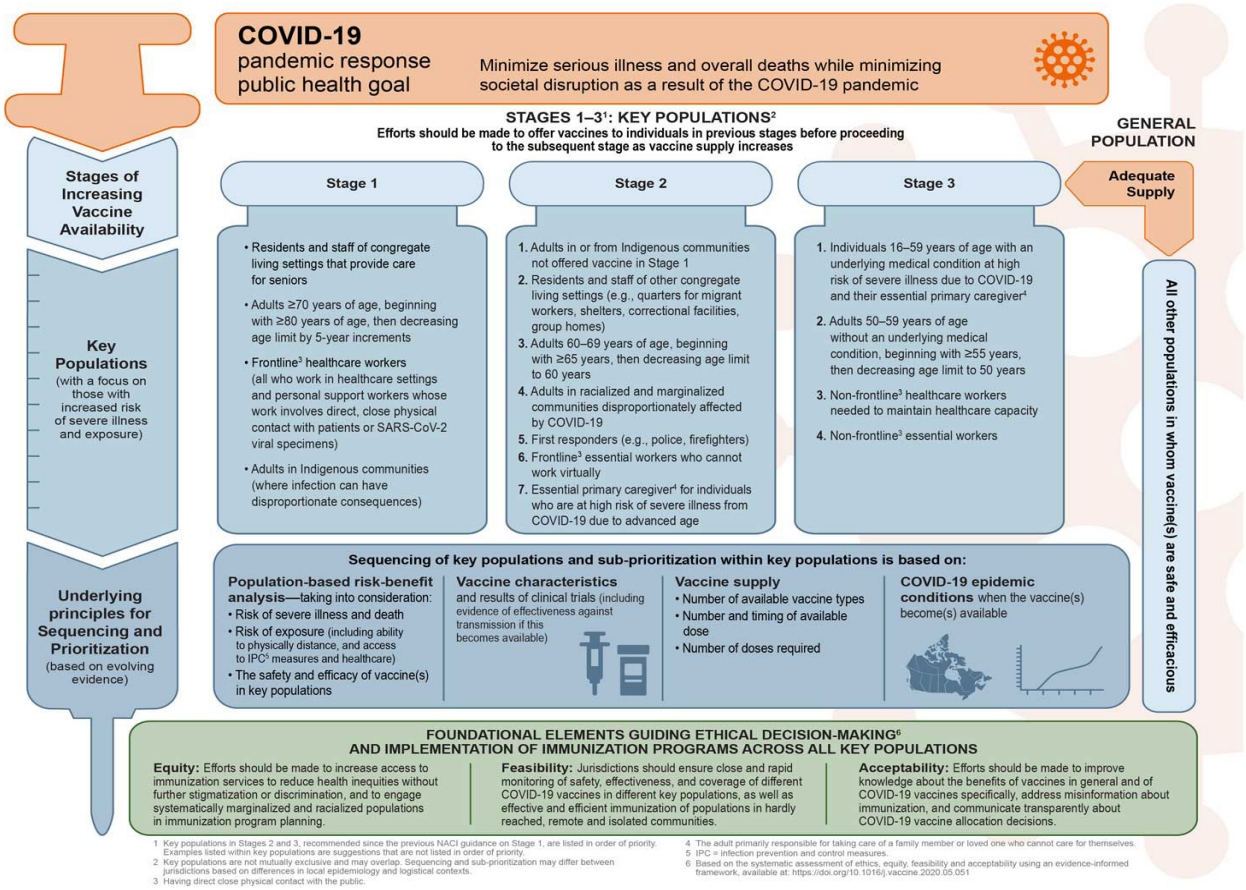
Putting Evidence into Practice

International results from Israel and the United Kingdom have clearly demonstrated the impact of implementing a vaccination strategy prioritizing both age and speed. For example, both Israel and the United Kingdom relied on a simple prioritization process targeting individuals based solely on age, in addition to healthcare workers and first responders.[25] In Israel, over 90% of the population aged 50 and older had received two doses of the Pfizer-BioNtech vaccine by late February.[26] While the UK administered over 4 million doses of COVID-19 vaccines to adults aged 70 and older from December 2020 until the end of January 2021.[27]

Preliminary results from Israel's Ministry of Health showed a 41% drop in infections in people aged 60 and older, and a 31% drop in hospitalizations due to COVID-19 from mid-January to early-February 2021.[28] Similarly, a recent analysis published by Public Health England estimated that this effort resulted in 6,100 averted deaths among people aged 70 and older between December 2020 and February 2021.[29] Furthermore, the BBC, using official government data, has reported positive results from England's initial vaccine rollout, as deaths among people aged 65 and older fell by 63% from February 19 to March 5, 2021 compared to 53% for the rest of the population.[30]

In preparation for a national vaccine rollout in Canada, the National Advisory Committee on Immunization (NACI) released its guidance on priority populations for vaccination in November 2020. NACI reaffirmed the priorities in its subsequent COVID-19 vaccination prioritization guidelines. These were initially released in December 2020 and updated in February 2021 **(Figure 6)**. All three iterations of the guidance affirmed that the first doses of vaccines should be provided to residents and staff of congregate living settings like long-term care homes, which provide care to older persons (defined as adults aged 70 and older). Following this, community-dwelling adults aged 80 and older would be prioritized, followed by cohorts in decreasing five-year age increments, along with high-risk frontline healthcare workers, and adults in Indigenous communities.[31]

Figure 6: Summary of Priority NACI Population Guidance (February 2021)



In Canada, the *Canada Health Act* gives provinces and territories control over governance of their healthcare systems. This means that NACI recommendations for priority populations serve as guidance. This means that since Canada's national vaccination rollout began, on December 14, 2020, each province and territory has been responsible for interpreting the NACI guidelines and developing their own vaccination rollout strategy based on their individual priorities.

In line with NACI's recommendations, many jurisdictions across Canada have clearly followed the evidence and prioritized older adults for COVID-19 vaccines and diligently followed age-based vaccine rollouts to target its population most at risk. However, others have struggled to effectively execute their age-based vaccinations plans. In some regions, this has resulted in doses going to lower-risk groups earlier than planned. In many parts of the country, eligibility has also been expanded to include younger age groups more quickly due to lower than expected vaccine uptake amongst their older adults.

Older Canadians Have Remained Far More Willing to get a COVID-19 Vaccine than Younger Canadians Throughout the Pandemic

Several Canadian public opinion surveys have enabled a comparison of COVID-19 vaccination intentions between older and younger Canadians throughout the pandemic. The data sources and methods used in this report can be viewed in the **Appendix I.**

The results show that older adults have consistently remained far more willing to receive a vaccine against COVID-19 than younger Canadians. This holds true both before COVID-19 vaccines were even available, and throughout Canada's vaccine rollout.

If older Canadians are the most willing to get vaccinated, and the population for whom it would have the most benefit, then making vaccines accessible and efficiently vaccinating this group will help Canada reach herd immunity sooner.

Given that existing evidence also shows that this group should be prioritized for vaccines, more attention has begun to focus on why some Canadian jurisdictions appear to be struggling to vaccinate their older Canadians.

A better understanding of the emerging barriers to vaccinating older Canadians could allow jurisdictions to address them more effectively. This would ensure that all older Canadians who want a COVID-19 vaccine can get vaccinated as soon as possible. It would also help prevent these same barriers from affecting younger Canadian populations as vaccine eligibility expands.

Public Opinion Surveys Have Shown A Consistent Willingness for Vaccination Among Older Canadians[32]

JUNE 2020 - Canada's Post Wave 1 and Early Vaccine Development Period:

Older Canadians were more willing to get a COVID-19 vaccine than younger Canadians before any vaccine had been fully developed, tested, and approved

Moderna and Pfizer-BioNTech – the two vaccine developers that established themselves as early front runners in COVID-19 vaccine development efforts – began testing their experimental vaccines in small groups of human volunteers in May 2020. Both companies began late-stage human trials to comprehensively test the side effects and safety of their vaccines in late-July.[33]

Long before the safety and efficacy of any vaccine had been fully tested and approved, older Canadians were more willing to get a COVID-19 vaccine than younger Canadians. Specifically, Statistics Canada's CPSS Survey results show that in June 2020,[34] months before either the Pfizer-BioNTech or Moderna vaccines had completed clinical trials, let alone been approved by Health Canada, 86.1% of Canadians aged 65 and older reported that they would likely get a COVID-19 vaccine once one became available. This is compared to 73.9% of Canadians aged 15 to 64 years (**Table 1**).

Moreover, Canada's oldest population was also found to be the most willing to get a vaccine in the summer of 2020, with 90.7% of Canadians aged 75 older reporting that they would likely get a COVID-19 vaccine when available.

The increased willingness of older adults to get vaccinated, early in the course of vaccine developments, suggests that they were acutely aware of the risks they faced and the disproportionate impact that COVID-19 was having on the health and wellbeing on Canada's older populations.

Older Canadians were also less hesitant than their younger counterparts to get a COVID-19 vaccine prior to its approval. Nearly one in six (14.1%) Canadians aged 15 and older said they were unlikely to get a COVID-19 vaccine when one became available. On the other hand, only 7.3% of Canadians aged 65 and older held the same view. The most frequent rationale provided by Canadians of all ages was a lack of confidence in the safety of the COVID-19 vaccine (54.2%), followed by concerns about the risks and side effects (51.7%). In addition, 34.8% indicated they would wait until it seemed safe to get the vaccine **(Table 1)**.

Table 2: Canadians' Willingness to Get a COVID-19 Vaccine When it Becomes Available and Reasons Not to Get a Vaccine

	Total (15 and older)	Younger Canadians (aged 15 to 64)	Older Canadians (aged 65 and older)
Willingness to get a COVID-19 vaccine when it becomes available			
N=	4,201	3,056	1,145
Likely	76.5	73.9	86.1
Unlikely	14.1	15.9	7.3
Don't Know	9.4	10.2	6.6
Top 3 reasons for not getting the COVID-19 Vaccine			
N=	524	450	74
Not confident in safety of vaccine	54.2	54.1	55.3
Concern about risks and side effects	51.7	51.2	55.0
Will wait until it seems safe to get the vaccine	34.8	34.4	38.2

Notes:
Respondents' willingness to get a COVID-19 vaccine was measured on a five-point scale, ranging from "very likely" to "don't know". In this table, "likely" includes respondents who indicated they were "very likely" and "somewhat likely", while "not likely" includes respondents who indicated that they were "somewhat unlikely" or "very unlikely".

Categories for reasons not to get a COVID-19 vaccine do not sum to 100% because respondents could select more than one response.

Source: Statistics Canada, Canadian Perspective Survey Series 3 (June 2020).

Statistics Canada's CPSS Survey results also demonstrated that, across socio-demographic factors, older Canadians were more willing to get a COVID-19 vaccine than younger Canadians early in the course of vaccine developments.

The increased willingness of older Canadians to get vaccinated held true across other factors such as sex, relationship status, education level, immigration status, geography, and living alone **(Table 2)**. In particular, immigration status, geography, and living alone seemed to show large differences between older and younger Canadians in their willingness to get a COVID-19 vaccine **(Table 2)**.

For example, older immigrants (83.1%) reported more often than younger immigrants (66.6%) that they would likely get a COVID-19 vaccine. Additionally, the share of older Canadians living in rural regions (87.8%) who reported that they would likely get a COVID-19 vaccine was almost 20 per cent higher than the share among their younger counterparts living in rural regions (68.0%). Among those who lived alone, the difference between older (87.5%) and younger (63.3%) Canadians exceeded 20 per cent. Yet despite differences across socio-demographic factors, the fact that older Canadians were still more willing to get a COVID-19 vaccine means that these characteristics did not explain away the difference between older and younger Canadians. This only strengthens the argument that older Canadians ought to be prioritized and better supported to receive a COVID-19 vaccine.

Table 3: Canadians' Willingness to Get a COVID-19 Vaccine When it Becomes Available by Sociodemographic Characteristics

Willingness to get a COVID-19 vaccine	Total (15 and older)			Younger Canadians (aged 15 to 64)			Older Canadians (aged 65 and older)		
	Likely	Unlikely	Don't know	Likely	Unlikely	Don't know	Likely	Unlikely	Don't know
Sex:									
Men	77.5	13.8	8.7	75.0	15.3	9.7	87.8	7.4	4.8
Women	75.5	14.5	10.1	72.8	16.6	10.6	84.7	7.2	8.2
Relationship Status:									
Single	76.5	13.0	10.5	73.9	14.9	11.2	89.7	3.2	7.1
Coupled	76.4	14.9	8.7	73.9	16.6	9.5	84.5	9.1	6.4
Highest Education:									
Less than High School	71.8	12.6	15.6	69.5	13.4	17.2	79.6	10.1	10.3
High School	80.5	11.2	8.4	77.3	13.0	9.7	88.9	6.4	4.7
College	69.9	19.9	10.2	67.0	21.9	11.1	83.6	10.7	5.7
University	81.7	11.5	6.8	80.2	13.3	6.5	88.5	3.8	7.7
Rural or Urban:									
Rural	73.4	17.0	9.6	68.0	21.5	10.6	87.8	5.2	7.0
Urban	77.1	13.6	9.4	74.9	15.0	10.1	85.6	7.9	6.5
Lives Alone:									
Yes	70.5	16.2	13.3	63.3	21.2	15.5	87.5	4.3	8.2
No	77.6	13.8	8.7	75.6	15.1	9.3	85.7	8.2	6.1
Immigrant Status:									
Born in Canada	78.6	13.0	8.5	76.3	14.8	8.9	87.2	5.8	7.0
Not Born in Canada	70.2	17.6	12.2	66.6	19.3	14.1	83.1	11.5	5.4

Notes: Respondents' willingness to get a COVID-19 vaccine was measured on a five-point scale, ranging from "very likely" to "don't know". In this table, "likely" includes respondents who indicated they were "very likely" and "somewhat likely", while "not likely" includes respondents who indicated that they were "somewhat unlikely" or "very unlikely".

Source: Statistics Canada, Canadian Perspective Survey Series 3 (June 2020).

SEPTMEBER 2020 - FEB 2021 - Canada's Wave 2 and Early Vaccine Rollout Period:

Older Canadians remained the most willing to get a COVID-19 vaccine once Canada began preparing for its national vaccine rollout, approved COVID-19 vaccines, and launched its vaccination rollout

In preparation for a national vaccine rollout, the National Advisory Committee on Immunization (NACI) released its guidance on priority populations for vaccination in November 2020. Health Canada approved the first COVID-19 vaccine, Pfizer-BioNTech, on December 9, 2020. NACI responded by reaffirming their priority population guidance, and provinces began to plan their vaccination rollout strategies, with the first doses administered on December 14, 2020. The Moderna vaccine was approved shortly after on December 23, 2020.

According to Statistics Canada's Fall 2020 Canadian Community Health Survey,[35] older Canadians remained the age group most willing to get the COVID-19 vaccine when Canada was preparing its vaccine roll-out. Between September and December 2020, 82.5% of Canadians aged 65 and older expressed that they were willing to get the COVID-19 vaccine compared to only 75.5% of Canadians aged 12 to 64.

There were also large differences in the willingness to get a COVID-19 vaccine by age across certain groups that faced greater risks of exposure during the pandemic. For example, Black Canadians aged 65 and older (78.1%) were much more willing to receive the COVID-19 vaccine than their younger counterparts (54.9%). Older immigrants (81.1%) were also more willing than younger immigrants (73.2%) to report they would get the COVID-19 vaccine. However, members of other groups that had been disproportionately affected by COVID-19 expressed less willingness to be vaccinated during the roll out, including Indigenous people and visible minorities. This is important to consider because age intersects across these groups, meaning that older adults within these groups may also be potentially less willing than the broader older adult population to get a COVID-19 vaccine. These findings highlight the need to ensure that targeted and tailored information is developed to increase uptake within these groups.

Notably, the survey did not demonstrate a difference in vaccine uptake willingness for LGBTQ2+ Canadians by age. Members of this group were more willing, overall, than non-LGBTQ2+ to get the COVID-19 vaccine, with 83.3% expressing that they were willing to get the vaccine compared to 76.8% of non-LGBTQ2+ Canadians. This may be because LGBTQ2+ Canadians have faced greater risks during the pandemic, with recent data showing this group is two times more likely to know someone who has been admitted to the hospital or died due to COVID-19.[36]

Despite the differences revealed by this data, the results continue to support prioritizing older adults as the most efficient means of achieving maximal vaccination coverage across all demographic factors.

Older Canadians were also more willing to get the COVID-19 vaccine after the start of Canada's vaccine rollout, as the second wave progressed. According to Leger's North American Public Opinion Tracker, during the initial months of Canada's rollout, older Canadians were the least concerned about the unprecedented speed of vaccine development. They were also more likely to report that they planned on getting vaccinated than younger Canadians. In mid-December 2020, 80% of Canadians aged 55 and older reported they intend to get a COVID-19 vaccine, compared to 57% of those aged 35-54 and 59% of those aged 18-34.[37] By mid-January 2021, 78% of Canadians aged 55 and older reported they intend to get a COVID-19 vaccine, compared to 67% of those aged 35-54 and 65% of those aged 18-34.[38]

MARCH 2021 - Canada's Wave 3 and Mid Vaccine Rollout Period:

Older Canadians are still the most willing to get a COVID-19 vaccine, months into Canada's vaccination rollout

As Canada entered its third wave of the COVID-19 pandemic, on March 1, 2021, jurisdictions across the country were expanding their eligibility criteria for vaccine appointments to community-dwelling older Canadians. As of April 10, 2021, all provinces have extended eligibility to include older adults, although the exact timing has varied across provincial jurisdictions. For example, Saskatchewan and Quebec announced that all adults aged 62 and older are eligible for vaccination as of April 10, 2021.[39,40]

While Newfoundland and New Brunswick are currently still vaccinating people aged 80 and older.[41]

According to Leger's North American Public Opinion Tracker, as vaccine rollouts have transitioned to targeting priority populations beyond residents and staff in LTC settings - as 96% of Canadians living in LTC and congregate settings have been now been vaccinated[42] - older Canadians have remained the most willing age group to get a COVID-19 vaccine. Moreover, the proportion of older Canadians who intend to get vaccinated has only continued to increase throughout the rollout. In mid-February 2021, 82% of Canadians aged 55 and older reported that they intended to get a COVID-19 vaccine, compared to 69% of those aged 35-54 and 67% of those aged 18-34.[43] By mid-March 2021, 86% of Canadians aged 55 and older reported that they intended to get a COVID-19 vaccine compared to 68% of those aged 35-54 and 74% of those aged 18-34.[44] The most recent figures show that as of April 12, 2021, 89% of Canadians aged 55 and older report that they intend to get vaccinated, compared to 74% of Canadians aged 35-54 and 73% of those aged 18-34.[45]

Not only are older Canadians more willing to get vaccinated, they also appear to be less concerned about novel mRNA technology and expedited timelines of development, the varying levels of published efficacy across different COVID-19 vaccines Health Canada has approved, and recent concerns surrounding the safety of the AstraZeneca vaccine.

According to Leger's North American Public Opinion Tracker, as of March 15, 2021, older Canadians were more willing than their younger counterparts to get vaccinated regardless of which vaccine they are offered: 62% of Canadians aged 55 and older reported that they would get vaccinated the first chance they get regardless of which vaccine they are offered, compared to 44% of those aged 54 and younger. While 21% of Canadians aged 55 and older reported that they will wait for a particular vaccine that they want to receive, the share among Canadians aged 54 and younger ranged between 24-30%. Moreover, among Canadians who reported that they will wait for the vaccine of their choice, the disproportionate majority (83%) were willing to wait a month or more to get the vaccine they want.[46]

If younger Canadians intend to postpone their vaccinations depending on the supply of available vaccines, then this provides yet another reason to comprehensively target and prioritize older populations for vaccination. Delaying vaccination puts both individuals and the public at risk. Recent concerns surrounding the safety of the AstraZeneca vaccine have potentially led many younger Canadians to reconsider whether they would get vaccinated as soon as they become eligible, regardless of the vaccine offered. If younger segments of the population refuse or delay getting vaccinated, this will exacerbate vaccination coverage gaps, further hindering efforts to protect the health and well-being of Canada's most vulnerable groups. This again supports the need to comprehensively vaccinate its older population.

Older Adults Should Remain a Top Priority for COVID-19 Vaccine Coverage

Early evidence from Canada's COVID-19 vaccine rollout revealed that many provinces have struggled to implement their vaccine rollout strategies and to efficiently vaccinate their oldest residents. This was due to a number of factors, including limited and staggered arrivals of vaccine supply and a lack of coordinated decision-making between provincial and federal governments. However, even in jurisdictions that have more successfully executed vaccination strategies with speed, and quickly expanded access to the COVID-19 vaccines to younger age groups, this has not necessarily translated to high vaccination coverage among older adults.

Jurisdictions are increasingly beginning to vaccinate younger age groups despite limited vaccination coverage among the oldest and most vulnerable Canadians. For example, as of March 27, 2021, a quarter or more of Canadians aged 75 and older had not received a dose of a COVID-19 vaccine in Ontario, Quebec, and Manitoba.[47] However, these same jurisdictions have either already extended eligibility to people aged 70 and younger or had plans to expand eligibility soon.[48]

In addition, data from the rollouts in many provinces revealed concerningly low uptake of vaccines among those aged 80 and older weeks after they became eligible.[49,50] In fact, in Ontario, vaccinations were opened to younger age groups earlier than planned because vaccination bookings had stalled among older age groups.[51] Yet, the results outlined in this report show the overwhelming majority of older Canadians expressing that they intend to receive the COVID-19 vaccine. This suggests that the lower than expected uptake among the older Canadians is not due to their unwillingness to get vaccinated, nor lack of demand for a vaccine. Instead, older Canadians seem to be experiencing significant barriers that are limiting their ability to get vaccinated in a timely manner. While these barriers to vaccine uptake should have been better anticipated and planned for, it is now imperative that they be rapidly addressed. There are at least three important reasons that justify increasing efforts to reduce access barriers and adapt vaccination strategies for the older population.

Firstly, older Canadians remain among the most at risk of severe outcomes if they contract COVID-19. Since the rollout of COVID-19 vaccines in Canadian LTC settings, community-dwelling older Canadians have become the primary victims of COVID-19. As a result, now that many provinces are in the midst of a third

wave, older Canadians continue to account for the overwhelming majority of COVID-19 deaths. For example, in Ontario, older adults have accounted for 89% of deaths and 61% of hospitalizations between March 26 and April 8, 2021.[52] In addition, since March 1, 2021, community-dwelling Ontarians aged 60 and older have had a monthly death rate of 9.4 per million, more than 33 times higher than the death rate for Ontarians who are younger than 60 years of age.[53] Thus, older adults who remain unvaccinated cannot be left behind as they continue to account for the disproportionate majority of deaths and hospitalizations from COVID-19 infections.

Secondly, if older Canadians are both most at risk of serious infection and the most willing to get a COVID-19 vaccine, then comprehensively targeting this population (after LTC residents and staff are fully vaccinated) is the most effective strategy for reducing COVID-19-related hospitalizations and deaths, and also the most efficient pathway to increase vaccination coverage and reach herd immunity sooner. In a pandemic where speed plays a critical role in efforts to contain the spread of the virus, particularly in the wake of more transmissible variants, taking advantage of existing demand to supply resources to those already most in need is simply good strategy. We don't yet know what level of immunity in the population will be sufficient to achieve herd immunity, and prevent the continued transmission of COVID-19.[54] The Ontario government estimates that 84% of the population would need to be vaccinated if a more transmissible variant becomes predominant.[55]

Given that the most recent figures suggest older Canadians are currently the only age group where the proportion who intend to get vaccinated surpasses this herd immunity threshold, targeting this group will help achieve widespread vaccination coverage faster.

Finally, addressing the barriers older adults are facing to get vaccinated, will lead to higher vaccine coverage in general and to increased coverage across all marginalized populations. Among immigrant, Black and LGBTQ2+ Canadians, older adults are more or equally willing to get a COVID-19 vaccine as their younger counterparts. Therefore, prioritizing older adults provides an inclusive strategy for addressing inequities in COVID-19-related cases, hospitalizations, and deaths.

Additionally, developing strategies to address these barriers now will help to improve vaccine coverage among marginalized groups as eligibility continues to expand into the general population. The challenges older adults are currently facing will also limit access for certain segments of the population when other age groups become eligible. The fact that younger Canadians already appear less inclined to get a COVID-19 vaccine will only compound the problem, resulting in vaccination coverage gaps across Canada that threaten efforts to overcome COVID-19. Therefore, addressing these barriers now will ensure vaccine rollouts can proceed more equitably for all Canadians moving forward.

Case Study - Examining the Early Results of Differing Provincial COVID-19 Vaccine Rollouts Amongst Canada's Two Largest Provinces of Ontario and Quebec

Comparing the rollout of two provinces – Ontario and Quebec – reveals distinct differences in the execution of vaccination rollout strategies. Consequently, this resulted in varying vaccination coverage of older age groups in each of the two provinces.

As of mid-March 2021, only about 40% of vaccine doses administered in Ontario had gone to those aged 65 and older. This is the result of Ontario not clearly prioritizing older adults at the beginning of its rollout and shifting its focus to non-essential workers such as naturopaths. On the other hand, Quebec explicitly prioritized vaccinating older adults, beginning with adults aged 80 and older, and expanding the inclusion age as coverage and supplies increased.[56] Thus, by mid-March 2021, Quebec had administered almost 70% of its doses to those aged 60 and older.[57] In fact, 58% of Quebec's overall vaccine supply has gone to people aged 70 and older.

The approach taken in Ontario directly translated into lower vaccination coverage among older adults. As of March 13, only 35% of adults aged 80 and older had received one dose of a COVID-19 vaccine in Ontario, and only about 11% had received both of their required doses.[58] Comparatively in Quebec, 50% of men and almost 60% of women aged 80 and older had received at least one dose by March 13, 2021.[59] While 77.2% of adults aged 80 and older had received one dose of a COVID-19 vaccine in Ontario as of April 9, 2021,[60] Quebec had given doses to 76% of those aged 80 and older as of March 28, 2021.[61]

The difference between Ontario and Quebec's rollout strategies is also made evident when comparing the success of rollouts in each of the provinces' largest metropolitan areas, which have been major hotspots during the pandemic. By the start of April 2021, only 55% of people aged 80 and older in Toronto have been vaccinated.[62] On the other hand, Montreal had reported that nearly 77% of people aged 65 and older had been vaccinated as early as March 13, 2021.[63]

These differences between two of Canada's largest provinces and cities arise from different approaches to planning for the distribution of COVID-19 vaccines.[64] Specifically, while Quebec's high vaccination coverage rates among older adults can also be attributed to policies designed to reduce barriers to access. Quebec expanded its booking system as of March 15 to add some 350 pharmacies to the list of places where people in Montreal can get

vaccinated. Those eligible in Montreal will be able to book vaccination appointments at their local pharmacy, with a total of 365 pharmacies on the island that will be offering vaccinations. Ontario also implemented similar policies in late-March, but they were designated as a 'pilot project' and initially limited to operating across 4 Public Health Units. Ontario has since expanded the program to 350 pharmacies across the province beginning the first week of April and hopes to reach 1,500 pharmacies by the end of the month.[65] However, with over 1 million doses reported to be freezers and the speed of vaccination rollouts is the difference between lives lost and saved. Waiting weeks to make vaccines more accessible in community-based settings seems like time unnecessarily wasted.[66]

In comparing these two provinces, Quebec has clearly gained from explicitly prioritizing older adults and expanding access to the COVID-19 vaccines. While Ontario's vaccination coverage of Older adults has increased significantly, it took weeks to reach the same coverage levels as Quebec. This could not be illustrated more clearly when comparing two of Canada's largest metropolitan areas; Montreal and Toronto. Specifically, Montreal made significant efforts to maximize vaccine community level accessibility.

Public attention in recent weeks has increasingly shifted towards concerns about the rising number of COVID-19 cases and ICU admissions among younger Canadians, in the wake of fast-spreading variants that are putting essential workers at greater risk. Waning focus on the impacts of COVID-19 on Canada's older adults may be a result of cognitive biases in decision making. The most probable explanation for this lies in understanding the 'identifiable victim effect', which states that humans respond to threats that they can easily imagine being their own or belonging to people they care about.[67]

However, public health officials cannot lose sight of the disproportionate impact the COVID-19 pandemic continues to have on older Canadians.

There is no doubt that the increasing share of infections and ICU admissions among younger essential workers and their family members cannot be ignored. Where possible, governments should position this population in a higher priority group for receiving the COVID-19 vaccines. However, shifting vaccine priorities should not be done at the expense of adequately addressing vaccine gaps amongst Canada's most vulnerable population - older Canadians.

Five Actionable Policies Jurisdictions Can Implement to Improve the COVID-19 Vaccine Coverage for Older Canadians

Jurisdictions across Canada have adopted various strategies to successfully target older adults, anticipate their needs and facilitate vaccine access. The NIA has identified five actionable policies to enable jurisdictions improve COVID-19 vaccine coverage among older Canadians and save the most lives.

1. Create more culturally targeted information campaigns that speak to older adults from a diversity of backgrounds

Sharing clear, evidence-based information – about the safety, efficacy, and benefits of vaccination – is critical for building individual and community support, confidence and willingness to get vaccinated. This is particularly important in the context of COVID-19 vaccines given that the initial vaccines approved for use in Canada are the first publicly available ones in history to utilize mRNA technology. In addition, the unprecedented speed of the vaccine development process and the persistence of misinformation are also fueling vaccine hesitancy.

Information campaigns targeting older adults, and addressing their unique questions and concerns, are also needed to increase confidence among segments of the population who remain hesitant about COVID-19 vaccines. For example, older adults may have concerns about the wavering guidance from NACI on the use of the AstraZeneca vaccine among those aged 65 and older. They may also have questions about how COVID-19 vaccines will interact with their prescribed medications.[68] In response, the NIA has now published two editions of its COVID-19 Vaccines and Older Canadians guidance document, which is also being released in 12 languages to help improve vaccine confidence amongst older Canadians.[69]

Cultural competency must be embedded into all aspects of Canada's vaccine rollout, as it continues to progress, to ensure that older adults receive the information they need to access vaccines as soon as possible. Older Canadians are the most, or equally willing, to get vaccinated among groups that have been disproportionately impacted by this pandemic. Like older Canadians, other affected groups will also face barriers to vaccine access, including the Black population, immigrants and LGBTQ2+ persons. Thus, it is critical that vaccines are not only geographically accessible to high-risk groups, but that vaccine information is widely distributed in multiple languages and in various formats are important considerations for ensuring maximum vaccine uptake.[70]

Recognizing the information barriers for non-English speaking populations, the City of Toronto and other jurisdictions have been developing multilingual fact sheets and information campaigns to better improve vaccine confidence amongst its entire populations. Moreover, several grassroots organizations in Canada and the United States have been targeting vaccine hesitancy among ethnic and racialized groups. For example, doctors have been facilitating zoom calls with community level organizations to communicate with African immigrants and answer any questions about the COVID-19 vaccine in their native languages.[71]

2. Provide a variety of methods to book vaccination appointments, beyond online options

Many provinces have set up online booking systems and/or telephone booking systems to schedule vaccination appointments. However, language and digital literacy barriers can make it difficult for older adults to navigate these platforms. Older Canadians may also have limited access to the internet.[72] Estimates in Canada suggest that only about half of the population aged 80 and older uses the internet. Moreover, technological barriers to booking a vaccination appointment are especially an issue for older adults who live alone and do not have a caregiver, family member or friend to schedule appointments for them. For example, 1 in 4 older Ontarians report that they are not socially connected with others,[73] meaning that they may have no family members or friends who can provide assistance in securing an appointment. The result of relying on technology-oriented solutions and online booking systems to inform residents of eligibility and schedule vaccine appointments is that those who are the most vulnerable, and in need of being reached, may get further left behind.

Efforts must be made by governments and local jurisdictions to ensure that no older person is left behind. One way the barriers that older adults face to scheduling a vaccine appointment could be addressed is through efforts by administrators to contact them directly. For example, in New Brunswick, in early March, older adults could go online or in person to fill out a consent form at many of their local pharmacies before being directly contacted to book a vaccine appointment once they became eligible.[74] Similarly, to address barriers to scheduling vaccine appointments, British Columbia and Ontario have ensured that translators are available for all appointments booked over the phone, although some older Canadians in these jurisdictions may be unaware of this.[75]

Ontario is targeting transportation issues, recently announcing a $3.7M investment in its latest budget to help with the costs of transportation services that can enable older adults to get to and from COVID-19 vaccination clinics, in some cases at no cost.[76]

Strategies to remove vaccine uptake barriers should be adopted. Relying solely on online booking systems and phone lines, which are offered only in English and/or French, can limit the ability of older adults to schedule their vaccine appointments. In response to the difficulties to fill vaccine appointments for older adults, the cities of Toronto and Ottawa both launched multilingual educational campaigns at the beginning of April, covering more than 15 languages each, to encourage people to get vaccinated as soon as they can.[77] In March, Quebec implemented a similar education campaign across the province, covering 21 languages.[78] British Columbia and Ontario have ensured that call centers have translators, who speak multiple languages, available at all times when booking by phone.[79]

3. Expand vaccine administration to primary care providers, pharmacies and community-based clinics

There is a reluctance on the part of many older adults to go to mass-vaccination sites for a number of reasons, such as transportation, mobility issues and the fear of coming in close contact with others and contracting the virus. Despite months to prepare, there have been many reports of older adults being forced to wait for hours outside in large crowds and in freezing temperatures for their vaccination appointments due to administrative delays in both Quebec, Ontario and Manitoba.[80] Yet even during the warmer spring months, transportation and mobility issues, along with fears of possibly becoming infected at mass-vaccinations sites, may continue to impede access and the willingness for older populations to get vaccinated. Thus, provincial and territorial investments will be needed to expand vaccine access points and ensure that primary care providers and pharmacies have the resources to administer COVID-19 vaccinations, as they usually do for other vaccinations like Influenza on an annual basis.

A number of provinces have utilized community-level health centers to expand access to vaccines. Quebec, New Brunswick, and Alberta pioneered a vaccination delivery system through their pharmacies and primary care clinics. New Brunswick was the first province to open pharmacy-led vaccinations for older adults, with all pharmacies in the province offering vaccine doses.[81] Nova Scotia announced in mid-March that it expects over 70% of its vaccine supply to be administered through primary care clinics and pharmacies.[82] Also, Quebec was one of the first jurisdictions to expand their vaccine distribution system to include over 350 pharmacies in Montreal, with plans to expand to 1550 pharmacies across the province over the coming months. Quebec has announced that its pharmacies are expected to administer over 2 million total doses throughout its entire rollout.[83] Two weeks after beginning this program, Montreal reported to have vaccinated 77% of its residents aged 60 and older.[84] On the contrary, Ontario did not allow pharmacies to deliver vaccines to people aged 60 and older until March 25, 2021 and only in 4 of its 34 public health units.[85] However,

the province announced on April 11, 2021 that it will be expanding vaccine delivery to over 1500 pharmacies by the end of the month.[86] Across the province, the use of primary care clinics to support vaccination has been limited overall although this is now beginning to change.

4. Develop comprehensive mobile outreach strategies, especially targeting homebound older adults and areas where there is a concentration of older Canadians living in close proximity

Homebound older adults have also been widely left out of provincial/territorial vaccination strategies. Many older Canadians are limited in their ability to access mass vaccination sites, doctor's offices, and pharmacies due to mobility limitations and chronic health conditions. This means they require in-home COVID-19 vaccination. Homebound adults are also at increased risk of contracting COVID-19 from visitors and home care workers.[87] The NIA believes the best solution to addressing the vaccination of homebound adults is the development of a mixed delivery system consisting of primary care providers, homecare nurses, and community paramedics that can administer in-home vaccinations for individuals for whom this would be a necessity and not a convenience.[88]

A recent study conducted by the Institute for Clinical Evaluation Sciences found that less than half of Ontario's community-dwelling older adults aged 80 and older had been vaccinated in neighborhoods with the highest COVID-19 infection rates.[89] These geographic areas are typically defined by higher poverty rates, language barriers and multi-generational households. Ontario's COVID-19 Science Advisory Table also modelled the differences in prevented hospital admissions, intensive care unit (ICU) admissions and deaths, comparing a vaccination strategy based on age and one based on age and neighborhood. The estimated impact of targeting older adults in high-risk neighborhoods (lower socioeconomic status) was projected to prevent hospital admissions by 17.8%, ICU admissions by 19.4%, and reduce deaths by 10%.[90]

Outreach strategies are not limited to homebound adults, but can be extended to neighborhoods with high concentrations of adults. The Ontario Science Advisory Table for example proposed implementing mobile on-site COVID-19 vaccinations in naturally occurring retirement communities (NORCs) by neighborhood risk in Toronto. The study identified 489 NORCs in Toronto, of which 52% are located in neighborhoods with the highest COVID-19 incidence rates. Targeting NORCs has the potential to reduce multiple equity-related barriers, including transportation, mobility limitations, along with cultural challenges such as language, ensuring that all older adults are vaccinated in a timely manner.[91] Moreover, targeting high-risk neighborhoods ensures that all minority populations are included in vaccination rollouts, thus producing a more inclusive rollout overall.

Other outreach strategies to increase vaccination coverage among older Canadians includes mobile on-site vaccination programs and vaccination clinics, such as pop-up and drive-thru clinics. Establishing these opportunities in prioritized neighborhoods, and buildings where many older Canadians reside and congregate, would also increase vaccination uptake.

To provide a few examples of these kind of strategies, Windsor, Ontario targeted pop-up outreach clinics were dispatched in apartment buildings with a large number of older adults who were eligible for vaccines early in March 2021. In Toronto, paramedics and primary care providers have started to vaccinate over 5,000 homebound residents through Canada's most comprehensive vaccination strategy for homebound persons.[92] The program targets older adults who may be lower income, or those for whom English is not their first language.[93] Manitoba has focused on setting up rural vaccination clinics across the province to target adults in hard-to-reach areas.[94] Quebec has also developed a comprehensive mobile clinics/pop-up clinics strategy. It will bring vaccination teams to different locations, for a single day, in order to reach targeted clientele based on various criteria like the vaccination rate in the area, presence of variants and the socio-economic vulnerability of the neighbourhood.[95]

5. Shorten the interval between first and second doses for older Canadians to expedite becoming fully immunized

NACI's March 3, 2021 recommendation to extend the dose interval to four months, and the decision by provincial governments to follow this guidance, was initially made based on existing, available, real-world evidence supporting their recommendation. As of March 25, 2021, every province has delayed the second vaccine doses to 16 weeks or longer, other than New Brunswick, where doses are being delayed up to 14 weeks.

Emerging evidence from the United Kingdom and Canada now demonstrates that antibody development from one vaccine dose is weaker among older adults. A study of more than 150,000 people from the United Kingdom found that individuals aged 70-79 and 80 years or older had only a 48.7% and 34.7% prevalence of COVID-19 antibodies 21 days after receiving the first dose of the Pfizer-BioNTech vaccine.[96] Antibody prevalence was found to increase to 97.5% among individuals aged 70-79 and 90.3% among those aged 80 and older after the second dose of vaccine was administered. Moreover, a recent Canadian-specific study by the COVID-19 Immunity Task Force found that antibody levels in older LTC residents were four times lower following a single dose of the Pfizer-BioNTech vaccine than among younger healthcare workers.[97]

Overall, these two studies illustrate the unnecessary risk towards older adults as a result of the extended second dose interval.

The NIA recommends that people aged 70 and older receive their second dose within the time frame recommended by the vaccine manufacturer. Adjusting to an age-based dose delay strategy would ensure the greatest level of protection for older adults, ultimately leading to significant reductions in COVID-19 related hospitalization and death.

Currently, no provinces or territories have adjusted their interval timings to reflect the emerging evidence on immunity and age. However, on March 26, Ontario did change the second dose interval for immunocompromised people, including transplant recipients and certain cancer patients. This decision was based on recently published evidence showing that a single dose provided antibodies in only 39% of cancer patients and 13% of hematological cancers.[98] An additional study examining adults with organ transplants found antibody prevalence in only 17% of patients after one dose of vaccine.[99] The general cancer antibody prevalence was similar to the 48.7% and 34.7% antibody prevalence found in individuals aged 70-79 and 80 years and older.[100] However, the Ontario Ministry of Health Vaccine Clinical Advisory Group stated that while shortening the extended second dose interval for people over the age of 80 was considered, current limitations in supply and supporting evidence affirm that its current extended dose interval strategy is appropriate.[101] Additionally, On April 6, 2021, NACI, stood by its current recommendation of a 16 weeks dose interval, citing the need to maximize the number of individuals benefiting from the first dose in the context of limited vaccine supply and ongoing pandemic.[102]

While it is clear that one dose of vaccine offers far less protection towards cancer and organ transplant patients, it is well documented that age does too, while also posing the greatest risk to death and hospitalization due to COVID-19. Moreover, while initial decisions to extend were made in the context of vaccine supply forecasts. With the recent arrival of increased shipments, and significant doses going unused, Ontario and all Canadian jurisdictions would benefit from reevaluating their current stances supporting an extended dose interval strategy. Thus, to protect the greatest number of high-risk Canadians from dying, the NIA recommends that provincial and territorial governments should shorten their currently extended second dose intervals for community-dwelling older adults. This is especially critical in light of the fact that they continue to represent over 90% of Canada's ongoing COVID-19 related deaths.

Conclusion

The NIA's analysis of surveys conducted throughout the pandemic clearly demonstrate that older adults are the most willing age groups to get the COVID-19 vaccine. This was evident across all stages of Canada's vaccine rollout: during the early development of vaccines, the approval and initial rollout of vaccines, and months into Canada's distribution of vaccines. Older Canadians were consistently more willing to get a COVID-19 vaccine across a range of socio-demographic factors, meaning that these characteristics did not explain away the difference in willingness to get vaccinated observed between older and younger Canadians.

Despite being the age group that is most willing to get vaccinated, and most at risk, there have been increasing reports of lower than expected uptake of COVID-19 vaccines among older Canadians. Yet the results of this survey analysis clearly demonstrate that low uptake of COVID-19 vaccines among older adults is not attributable to their unwillingness to get vaccinated, nor due to a lack of demand on their part. Instead, the results suggest that older Canadians are facing significant barriers to receiving COVID-19 vaccines – barriers that should have been better anticipated and planned for.

The NIA strongly recommends that jurisdictions prioritize removing the barriers to vaccination identified in this report and adapting their vaccine strategies to increase vaccination coverage for older adults. In support of this, the NIA has developed five actionable policy recommendations designed to enable jurisdictions to deliver vaccines sooner and more efficiently to older Canadians.

Jurisdictions should collectively integrate these measures into their vaccine rollout strategies to enhance protection against COVID-19 to Canada's most vulnerable population.

Addressing access barriers that older adults are now facing will also ensure vaccine rollouts can proceed more equitably for all Canadians, both in the context of COVID-19 and beyond.

If governments further focus their efforts on vaccinating as many older adults as possible, this approach will not only save the most lives, but also support a clearer path to increase vaccination coverage and achieve 'herd immunity' amongst the general population as soon as possible.

Appendix I

The NIA analyzed several surveys and polls to examine Canadians' COVID-19 vaccination intentions throughout COVID-10 vaccine research, approval and availability. The primary source of data used was the Canadian Perspective Survey Series (CPSS), a new Statistics Canada initiative aimed at rapidly collecting data about Canadians using short online surveys. The NIA analyzed data from the third edition of the CPSS: *Resuming Economic and Social Activities during COVID-19,* collected between June 15 and June 21, 2020. Results from the CPSS analysis were supplemented with data from other surveys to examine Canadians' perceptions surrounding the COVID-19 vaccine throughout the first and second waves of the COVID-19 pandemic. Three types of additional surveys were examined: Canadian Community Health Survey (Conducted September 1-December 12, 2020), Maru/Blue National Public Opinion Poll (Conducted November 27-December 1, 2020), and Leger's North American Tracker (Conducted biweekly from December 2020 to April 2021).

The NIA re-analyzed the data provided in the CPSS survey. This involved re-coding multiple variables and performing a separate statistical analysis. A full description of the analytical methods relied on are below in **Appendix II,** and results are listed in Tables 1 and 2 included in the review of surveys section of the paper. The results from the additional surveys - the Canadian Community Health Survey, Maru Blue, and the Leger North American Tracker were all interpreted directly from their publications. **Appendix III, Table 1** contains a detailed description of each survey's methodology as provided in their original publications. The results from the CPSS and other surveys were compared to track the evolution of Canadians' perceptions about the COVID-19 vaccine with a specific focus on older adults.

Appendix II

Canadian Perspective Survey Series (CPSS)

The CPSS is a set of short online surveys conducted by Statistics Canada over the period of about one year beginning in March 2020. Thus far, there have been six surveys in the series, each focused on a different topic related to the impacts of the COVID-19 pandemic on Canadians. The CPSS is a cross-sectional survey and uses a probability-based sampling design, allowing the results to be generalized to the Canadian population. The CPSS is representative of the Canadian population aged 15 and older living in the ten provinces.

This analysis uses data from the wave of Statistics Canada's CPSS, conducted between June 15 and June 21, 2020. The third wave of the CPSS includes a sample of 4,209 respondents. Respondents with missing data for intention to get a COVID-19 vaccine (N=8) are excluded to prevent biased estimates in the analysis as this is the primary measure of interest. The final analytic sample therefore includes 4,201 respondents. Analyses were performed on data from the Public-Use Microdata File.

The two main measures in this analysis was the survey question intention *to get a COVID-19 vaccine* and the demographic variable *age*. Canadians' intention to get a COVID-19 vaccine was measured with the survey question "When a COVID-19 vaccine becomes available, how likely is it that you will choose to get it?" Respondents could choose from five possible responses, ranging from "very likely" to "don't know". For this analysis, intention to get a COVID-19 vaccine was coded into a three-category measure. The response categories "very likely" and "somewhat likely" were combined to create a single category for respondents who are "likely" to choose to get a COVID-19 vaccine, and "somewhat unlikely" and "very unlikely" were combined into a category for those who are "unlikely", while "don't know" was kept as a separate category to account for those who are unsure.

Respondents who indicated that they were somewhat unlikely or very unlikely to get a COVID-19 vaccine were asked to indicate the reasons why. The CPSS survey listed nine different reasons and respondents could select more than one response. The different reasons respondents could selected included the following categories: "Already had or think I have had COVID-19"; "Not considered necessary"; "Not confidence the vaccine is safe"; "Do not believe in vaccination"; "Concern about risks and side effects"; "Have a pre-existing medical

condition"; "waiting until it seems safe"; "Have not decided"; "other reason". Finally, respondents also had the option to select "Don't know".

The public CPSS3 dataset provides a variable for age that groups respondents into seven categories based on 10-year intervals ranging from "15-24 years old" to "75 years and older". For this analysis, age was coded into a binary measure to account for those aged 65 and older and those aged 64 years and younger.

Finally, other demographic characteristics are also considered in the analysis. The characteristics considered are sex, immigrant status, marital status, education, and region of residence. Sex is coded as "male" or "female". Immigration Status is coded as a dichotomous variable. Marital Status is coded into 3 categories: "Married or Common Law", "Widowed, Divorced or Separated" and "Single". Education is measured as respondents' highest completed level of education and includes the categories "less than high school", "high school or equivalent", "College/Trade certificate or diploma" and "University certificate, diploma or degree". Lastly, region of residence is measured with a dichotomous variable that assesses whether respondents live in a rural or urban region, based on whether or not respondents live in a census metropolitan area.

To analyze the data, cross-tabulations comparing the distribution of older and younger Canadians across intentions to get a COVID-19 vaccine were examined.

Then, three-way cross-tabulations were examined to compare how Canadians' intention to get a COVID-19 vaccine differed by age across other demographic characteristics. These results compare percentage distributions between older and younger Canadians, and chi-square tests were used to test the statistical association. To obtain estimates that are representative of the Canadian population and not just the sample, we applied the survey weight provided in the CPSS data to the analysis.

Appendix III

Table 1: Surveys from third-party polling companies tracking views on COVID-19 vaccines included in this report and available information on their respective methodologies

Survey	Date Conducted	N	Methodology	Link to Survey
Canadian Community Health Survey	Sep 1-Dec 12, 2020	More than 20,000	The Canadian Community Health Survey (CCHS) is an annual survey that was adjusted during the pandemic to produce more frequent estimates on COVID-19 topics. This analysis is based on CCHS data collected from September to mid-December 2020. The sample of more than 20,000 is representative of the Canadian population aged 12 years and older living in the provinces. Sampling and collection for the time period used in this analysis does not have adequate coverage to represent the entire population of the territories.	https://www150.statcan.gc.ca/n1/pub/45-28-0001/2021001/article/00011-eng.htm
Maru/Blue Public Opinion Poll	Nov 27-Dec 1, 2020	1,507-1,509	The Maru/Blue Public Opinion Poll was conducted among randomly selected Canadian adults in both English and French who are members of Maru/Blue's Online Maru Voice Canada panel. The results are considered nationally accurate to within +/- 2.9 percentage points using a Bayesian Credibility Interval. The results have been weighted by education, age, gender, and region to match the population according to the most recent Census data so that the sample is representative of the entire adult population of Canada.	https://static1.squarespace.com/static/5a5d2933a8b2b0f49d244724/t/5fc7b4978f07963615841c94/1606923416018/Vaccine+Release+F+Dec+2+2020.pdf

Leger's North American Tracker	Dec 11-13, 2020	1,528	Leger, in collaboration with the Canadian press, conducted this Web survey with a sample representative of those over the age of 18 selected from Leger Opinion's representative panel. Using the 2016 Census reference tables, the Canadian data was then analyzed and weighted according to gender, age, mother tongue, region, education level and the presence of children in households in order to render a presentative sample of the general population. A margin of error cannot be associated with a non-probability sample in a panel survey. For comparison purposes, a probability sample of this size would have a margin of error +/- 2.50%, 19 times out of 20.	https://2g2ckk18vixp3neolz4b6605-wpengine.netdna-ssl.com/wp-content/uploads/2020/12/Legers-North-American-Tracker-December-14th-2020-min.pdf
Leger's North American Tracker	Jan 15-17, 2021	1,516	Leger, in collaboration with the Canadian press, conducted this Web survey with a sample representative of those over the age of 18 selected from Leger Opinion's representative panel. Using the 2016 Census reference tables, the Canadian data was then analyzed and weighted according to gender, age, mother tongue, region, education level and the presence of children in households in order to render a presentative sample of the general population. A margin of error cannot be associated with a non-probability sample in a panel survey. For comparison purposes, a probability sample of this size would have a margin of error +/- 2.53%, 19 times out of 20.	https://2g2ckk18vixp3neolz4b6605-wpengine.netdna-ssl.com/wp-content/uploads/2021/01/Legers-North-American-Tracker-January-18th-2021-min.pdf
Leger's North American Tracker	Feb 12-14, 2021	1,535	Leger, in collaboration with the Canadian press, conducted this Web survey with a sample representative of those over the age of 18 selected from Leger Opinion's representative panel. Using the 2016 Census reference tables, the Canadian data was then analyzed and weighted according to gender, age, mother tongue, region, education level and the presence of children in households in order to render a presentative sample of the general population. A margin of error cannot be associated with a non-probability sample in a panel survey. For comparison purposes, a probability sample of this size would have a margin of error +/- 2.50%, 19 times out of 20.	https://2g2ckk18vixp3neolz4b6605-wpengine.netdna-ssl.com/wp-content/uploads/2021/02/Legers-North-American-Tracker-February-15th-2021-min.pdf

Leger's North American Tracker	March 12-14, 2021	1,512	Leger, in collaboration with the Canadian press, conducted this Web survey with a sample representative of those over the age of 18 selected from Leger Opinion's representative panel. Using the 2016 Census reference tables, the Canadian data was then analyzed and weighted according to gender, age, mother tongue, region, education level and the presence of children in households in order to render a presentative sample of the general population. A margin of error cannot be associated with a non-probability sample in a panel survey. For comparison purposes, a probability sample of this size would have a margin of error +/- 2.52%, 19 times out of 20.	https://2g2ckk18vixp3neolz4b6605-wpengine.netdna-ssl.com/wp-content/uploads/2021/03/Legers-North-American-Tracker-March-15th-2021-min.pdf
Leger's North American Tracker	April 9-11, 2021	1,504	Leger, in collaboration with the Canadian press, conducted this Web survey with a sample representative of those over the age of 18 selected from Leger Opinion's representative panel. Using the 2016 Census reference tables, the Canadian data was then analyzed and weighted according to gender, age, mother tongue, region, education level and the presence of children in households in order to render a presentative sample of the general population. A margin of error cannot be associated with a non-probability sample in a panel survey. For comparison purposes, a probability sample of this size would have a margin of error +/- 2.53%, 19 times out of 20.	https://2g2ckk18vixp3neolz4b6605-wpengine.netdna-ssl.com/wp-content/uploads/2021/04/Legers-North-American-Tracker-April-12th-2021.pdf

References

[1] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[2] Government of Newfoundland, "COVID-19 Vaccine Priority Groups."

[3] Government of Canada, "Canadian Perspectives Survey Series (CPSS)."

[4] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[5] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[6] Government of Canada, "Canadian Perspectives Survey Series (CPSS)."

[7] World Health Organization, "Key Messages and Actions for COVID-19 Prevention and Control in Schools," 19.

[8] Desai and Majumder, "What Is Herd Immunity?"

[9] McNeil, "Overview of Vaccine Efficacy and Vaccine Effectiveness."

[10] McNeil.

[11] McNeil.

[12] Jarrett et al., "Strategies for Addressing Vaccine Hesitancy–A Systematic Review."

[13] Lazarus et al., "A Global Survey of Potential Acceptance of a COVID-19 Vaccine."

[14] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[15] Canadian Institute of Health Information, "The Impact of COVID-19 on Long-Term Care in Canada: Focus on the First 6 Months."

[16] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[17] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[18] Government of Canada.

[19] Szumilas, Magdalena. "Explaining odds ratios." *Journal of the Canadian academy of child and adolescent psychiatry* 19, no. 3 (2010): 227.

[20] Estiri et al., "Predicting COVID-19 Mortality with Electronic Medical Records."

[21] Sepulveda, Stall, and Sinha, "A Comparison of COVID-19 Mortality Rates Among Long-Term Care Residents in 12 OECD Countries."

[22] Perreaux, "Quebec's Race to Vaccinate All Long-Term Care Residents First Brings Relief after so Many Coronavirus Deaths - The Globe and Mail."

[23] Kotyk, "Single Vaccine Dose Could Prevent 8 out of Every 10 COVID-19 Cases: BCCDC | CTV News."

[24] Comeau, "Public Health Ontario Data."

[25] Choi, Stall, and Maltsev, *Lessons Learned from Israel's Vaccine Rollout. Science Briefs of the Ontario COVID-19 Science Advisory Table. 2021; 2 (9)*.

[26] Hendrix, Rubin, and Brulliard, "Israel's Ahead-of-the-World Vaccine Rollout Offers Hope for Countries Lagging Behind."

[27] Public Health England, "PHE Monitoring of the Effectiveness of COVID-19 Vaccination."

[28] Mallapaty, "Vaccines Are Curbing COVID: Data from Israel Show Drop in Infections."

[29] Public Health England, "PHE Monitoring of the Effectiveness of COVID-19 Vaccination."

[30] Rigby, "COVID-19."

[31] Government of Canada, "COVID-19 Immunization."

[32] The full list of data sources and analytical methods are available in the Appendix.

[33] Lovelance, "Pfizer and BioNTech Began Late-Stage Human Trial for Coronavirus Vaccine Monday."

[34] Government of Canada, "Canadian Perspectives Survey Series (CPSS)."

[35] Government of Canada, "COVID-19 Vaccine Willingness among Canadian Population Groups."

[36] Egale, "Impact of COVID-19 on the LGBTQI2S Community – Second National Report."

[37] Leger, "Leger's North American Tracker - December 15, 2020."

[38] Leger, "Leger's North American Tracker - January 19, 2021."

[39] Canadian Press, "77 per Cent of Montrealers over 60 Have Received COVID Vaccine or Have an Appointment."

[40] Canadian Press, "Who Have Provinces Pegged to Receive COVID-19 Vaccines in the Coming Weeks?"

[41] Government of New Brunswick, "COVID-19 Vaccines"; Government of Newfoundland, "COVID-19 Vaccine Priority Groups."

[42] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[43] Leger, "Leger's North American Tracker - February 16, 2021 – Leger."

[44] Leger, "Leger's North American Tracker - March 16, 2021 – Leger."

[45] Leger, "Leger's North American Tracker - April 13, 2021."

[46] Leger, "Leger's North American Tracker - March 16, 2021 – Leger."

[47] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[48] Vaccinations expanded for those younger than 75 in Ontario, Quebec and Manitoba on March 25, March 9 and March 18, respectively.

[49] Lam, "'It's Very Troubling'"; Crawley, "Nearly 200,000 Ontarians Age 80+ Have Not Signed up for a COVID-19 Vaccine. Here's Why That's a Problem | CBC News."

[50] Lam, "'It's Very Troubling.'"

[51] Crawley, "Nearly 200,000 Ontarians Age 80+ Have Not Signed up for a COVID-19 Vaccine. Here's Why That's a Problem | CBC News."

[52] Public Health Ontario, "COVID-19 Vaccine Uptake in Ontario: December 14, 2020 to April 13, 2021."

[53] Comeau, "Public Health Ontario Data."

[54] Canada, "What You Need to Know about the COVID-19 Vaccine for Canada."

[55] Public Health Ontario, "COVID-19 Vaccine Uptake in Ontario: December 14, 2020 to April 3, 2021."

[56] Stone and Perreaux, "Quebec Has Used More COVID-19 Vaccine Doses on Seniors than Ontario."

[57] Stone and Perreaux.

[58] Public Health Ontario, "COVID-19 Vaccine Uptake in Ontario: December 14, 2020 to April 3, 2021."

[59] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[60] Public Health Agency of Canada. Canadian COVID-19 vaccination coverage report. Ottawa: Public Health Agency of Canada; April 9, 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/

[61] Casey, "Quebec, Ontario Officials Say Many Vaccine Appointments Unfilled, Ask Seniors to Act."

[62] Bowden, "Toronto Is Struggling to Fill Vaccine Appointments for Seniors. Why Ontario's Rollout Is Missing People in COVID-19 Hot Spots | The Star."

[63] CBC, "COVID-19 : L'objectif de Vaccination Des 65 Ans et plus Est Atteint à Montréal."

[64] Laframboise, "Quebec's Registration for COVID-19 Vaccines Is Now Underway."

[65] Government of Ontario, "Ontario Expands COVID-19 Vaccination Locations to More Pharmacies."

[66] Sims, "Ontario Shouldn't Be Sitting on Vaccine Doses While Outbreaks Rage | London Free Press."

[67] Halpern, Truog, and Miller, "Cognitive Bias and Public Health Policy during the COVID-19 Pandemic."

[68] Crawley, "Nearly 200,000 Ontarians Age 80+ Have Not Signed up for a COVID-19 Vaccine. Here's Why That's a Problem | CBC News."

[69] Sinha, S., Vohra-Miller, S., & Johnstone, J. (2021). COVID-19 Vaccines – What Older Canadians Need to Know. National Institute on Ageing. Toronto, ON

[70] Hanif et al., "Cultural Competence in Covid-19 Vaccine Rollout."

[71] Tesfaye, "African Immigrant Health Groups Battle Trans-Atlantic Tide Of Vaccine Disinformation."

[72] Government of Canada, "The Daily — Study."

[73] Sinha, "Living Longer, Living Well."

[74] Siberman, "N.B. Pharmacies Busy Taking Appointments for COVID-19 Vaccine | CBC News."

[75] Government of British Columbia, "How to Get Vaccinated for COVID-19."

[76] Government of Ontario, "Ontario Helping People Get Their COVID-19 Vaccination."

[77] El Gharib, "Toronto and Ottawa Launch Multilingual Campaigns to Tackle COVID-19 Vaccine Hesitancy."

[78] Nerestant, "Language, Cultural Barriers Could Fuel Vaccine Hesitancy, Quebec Community Organizers Warn."

[79] Little, "Outreach Efforts Look to Overcome Language, Cultural Barriers as B.C. Begins Mass Vaccinations."

[80] Wilson, "80-Year-Old Grandmother Forced to Wait for Hours Outside in Freezing Temperatures for COVID-19 Vaccine."

[81] April, "N.B. Pharmacies to Begin Vaccination next Week; Two New Cases of COVID-19 Reported Thursday."

[82] Renic, "Nova Scotia Reveals Projected Dates by Age Group to Get COVID-19 Vaccine - Halifax | Globalnews.Ca."

[83] Canadian Press, "Quebec Pharmacies to Administer COVID-19 Vaccines on March 15."

[84] Canadian Press, "77 per Cent of Montrealers over 60 Have Received COVID Vaccine or Have an Appointment."

[85] McGrath, "Here's Ontario's Phase 2 Vaccine Update."

[86] McGrath, "Here's Ontario's Phase 2 Vaccine Update."

[87] Huynh, Sava, and Hahn-Goldberg, "Mobile On-Site COVID-19 Vaccination of Naturally Occurring Retirement Communities by Neighbourhood Risk in Toronto."

[88] Canadian Press, "Doctors, Caregivers Push for in-Home COVID-19 Vaccinations for Housebound Seniors."

[89] Crawley, "Nearly 200,000 Ontarians Age 80+ Have Not Signed up for a COVID-19 Vaccine. Here's Why That's a Problem | CBC News."

[90] Brown et al., "A Strategy for the Mass Distribution of COVID-19 Vaccines in Ontario Based on Age and Neighbourhood."

[91] Huynh, Sava, and Hahn-Goldberg, "Mobile On-Site COVID-19 Vaccination of Naturally Occurring Retirement Communities by Neighbourhood Risk in Toronto."

[92] McKenzie-Sutter, "Paramedics, Care Providers Give in-Home Vaccinations to Homebound Ontario Seniors."

[93] Sniekers, "City of Toronto Toronto Public Health Playbook for the COVID-19 Vaccination Program."

[94] Lam, "'It's Very Troubling'"; Lam.

[95] Lafaro, "'We Are in a Third Wave' of COVID-19, Says Quebec Health Minister."

[96] Ward et al., "REACT-2 Round 5: Increasing Prevalence of SARS-CoV-2 Antibodies Demonstrate Impact of the Second Wave and of Vaccine Roll-out in England."

[97] Brockman et al., "Weak Humoral Immune Reactivity among Residents of Long-Term Care Facilities Following One Dose of the BNT162b2 MRNA COVID-19 Vaccine."

[98] Boyarsky et al., "Immunogenicity of a Single Dose of SARS-CoV-2 Messenger RNA Vaccine in Solid Organ Transplant Recipients."

[99] Boyarsky et al.

[100] Monin-Aldama et al., "Interim Results of the Safety and Immune-Efficacy of 1 versus 2 Doses of COVID-19 Vaccine BNT162b2 for Cancer Patients in the Context of the UK Vaccine Priority Guidelines."

[101] Ward et al., "REACT-2 Round 5: Increasing Prevalence of SARS-CoV-2 Antibodies Demonstrate Impact of the Second Wave and of Vaccine Roll-out in England."

[102] Aiello, "Delay between Doses 'expected to Be Less' than 4 Months as Supply Increases."

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