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**COMMENTARY**

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# Not Just for Kids: How to Improve Adult Vaccination Uptake in Canada

*Adult vaccination rates urgently need a booster shot in Canada. Better and more regular uptake of vaccines during adulthood and retirement could improve the well-being of older Canadians and offset some of the challenges associated with an aging society.*

**Colin Busby**

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A handwritten signature in black ink that reads 'Daniel Schwanen'.

*Daniel Schwanen*

*Vice President, Research*

## THE STUDY IN BRIEF

Vaccinations and booster shots aren't just for kids. Adult vaccination rates urgently need a booster shot in Canada. Better and more regular uptake of vaccines during adulthood and retirement could improve the well-being of older Canadians and offset some of the challenges associated with an aging society.

Despite clinical evidence showing the value of immunization against infectious diseases in the adult population, insufficient attention to lifetime immunization policies persists. This *Commentary* suggests creating formal approaches, based on applied behavioural design concepts, for improved adult immunization uptake. Influenza should be a pivot point. Even though the seasonal influenza vaccine suffers from relatively lower clinical efficacy than other vaccines, the related lack of confidence in its usefulness is exacerbated by doubts among healthcare workers. Still, the routine nature of the seasonal influenza shot does make it a pivotal part of adult immunization schedules. It should be used to prompt healthcare providers to review a patient's overall immunization status, helping to develop databases to monitor and encourage other adult vaccines.

This *Commentary* utilizes behavioural economic policy design issues and suggests major changes to the way Canadian provinces and territories monitor and ensure uptake of vaccines among adults. Alongside a digital strategy to create databases to monitor coverage of all adult vaccines, policies should build upon many patients' preference to get their annual influenza shot at their local pharmacy by expanding pharmacists access to immunization databases, building greater links to primary care, and expanding pharmacists' ability to set up immunization reminders for patients upon pharmacy visits, plus encouraging the use of digital apps.

Going forward, the focus should shift to overcoming complacency with more use of automatic scheduling and reminders. Pharmacies, often a very convenient location for most urban-dwelling Canadians, could act as important parts of multidisciplinary primary care efforts to gather data on publicly funded adult vaccines – likely through digital platforms – and create reminders and prompts to overcome complacency as well.

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## Despite the economic and social consequences that stem from vaccine-preventable diseases, adult immunizations, relative to childhood ones, are not well integrated as a routine intervention in provincial and territorial healthcare systems.

Limited monitoring and poorly designed interventions lead to missed opportunities for adult immunization and missed national targets for uptake.

Despite clinical evidence showing the value of immunization against infectious diseases in the adult population, insufficient attention to lifetime immunization policies persists (Gemmill 2015). Society undervalues prevention in adults. Limited access to vaccines, waning vaccine effectiveness, complacency against risks and new strains of disease, coupled with less apparent reminders of the consequences of these diseases, have decreased the attention paid to adult immunization. As a result of poorly monitored vaccine uptake among adults and lack of effective adult immunization policies, in some high-income countries the main burden of some infectious diseases, like pertussis, has shifted onto adults (De Graffe 2008).

Although a life-course approach to vaccines should focus mainly on youth, given the potential for increasing complacency in adulthood and vulnerabilities at older ages, this *Commentary* suggests creating formal approaches, based on applied behavioural design concepts, for improved adult immunization uptake. Influenza should be a pivot point. Even though the seasonal influenza vaccine suffers from relatively lower clinical efficacy

than other vaccines, the related lack of confidence in its usefulness is exacerbated by doubts among healthcare workers (Mytton et al. 2013). Still, the routine nature of the seasonal influenza shot does make it a pivotal part of adult immunization schedules. It should be used to prompt healthcare providers to review a patient's overall immunization status, helping to develop databases to monitor and encourage other adult vaccines.

This *Commentary* suggests major changes to the way Canadian provinces and territories monitor and ensure uptake of vaccines among adults. It encourages implementing a digital strategy to create databases to monitor coverage and building upon many patients' preference to get their annual influenza shot at their local pharmacy by expanding pharmacists access to immunization databases, building greater links to primary care, and expanding pharmacists' ability to set up immunization reminders for patients upon pharmacy visits, plus encouraging the use of digital apps.

### **Healthy Aging: The Economic Costs of Insufficient Adult Vaccination**

A rapidly aging population like Canada's heightens the need to prioritize efforts to improve the health

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of the adult population. Although the negative economic impact of Canada's aging society is large (Ragan 2010), the ability to offset these costs by remaining healthy in later years is also outsized: good health can increase the capability of older adults to make expanded contributions to economic and social activity, either with participation in the workforce past traditional retirement ages or as volunteers (Robson, Busby and Jacobs 2017; Day and Devlin 1998). Yet, as people age, so too does their susceptibility to infectious diseases as their immune system weakens, especially in the presence of underlying chronic illnesses.<sup>1</sup>

Outbreaks of infectious diseases – such as seasonal influenza (the “flu”), pertussis, and others – impose large societal and economic costs. Each year, the flu and other infectious diseases cause workplace absences, additional costs to the healthcare system as well as disability and death (Ozawa et al. 2016; PHAC 2014). Further, outbreaks among adults are generally much harder for public health officials to contain as effective responses are much harder to coordinate through localized mechanisms than, say, school-based outbreaks among children.

## THE STATE OF ADULT IMMUNIZATION IN CANADA

The National Advisory Committee on Immunization (NACI) reviews evidence on safety and efficacy, providing vaccine recommendations to each province and territory for public coverage and uptake.<sup>2</sup> Provinces consider this advice but make independent decisions regarding adult vaccine schedules – which, for the most common vaccines across Canada, are reasonably similar. Given the wide range of vaccines available to adults,

including those missed in childhood or at school, this paper focuses on some of the more common adult vaccines in Table 1 to sharpen the analysis, noting that much of what is discussed could apply to the full range of vaccines available to adults (see Appendix Table A1 for the all vaccines available in adulthood, which includes human papillomavirus, hepatitis A and B, etc).

The annual influenza vaccine is universally funded almost everywhere in Canada, and although targeted to high-risk adults in Quebec, British Columbia and New Brunswick, the broad classification of high-risk groups in these provinces makes it a near-universal program.

Because of the links between aging, chronic conditions and vulnerability to pneumococcal disease, nearly all provinces fund a pneumococcal vaccine (Pneu-P-23) at age 65 and up as well as for younger, high-risk individuals – Newfoundland and Labrador and Nunavut differ somewhat, offering the vaccine to all aged 60+ and 50+, respectively. In addition, most provinces publicly fund a pneumococcal conjugate vaccine (PCV13) for high-risk/immunocompromised conditions (in addition to Pneu-P-23 vaccine) in adults 50 years of age and older (see Appendix Table A1 for more details).

A shingles vaccine (Zostavax), which is intended to defend against a non-communicable disease (the dormant varicella-zoster (chicken pox) virus that can activate later in life) – hence it offers no “herd” benefits – is only funded for one dose in Ontario for those aged 65 to 70. Most provinces recommend the vaccine for those aged 60 and up but individuals, or their private insurers, would need to cover the costs. Further, an improved shingles vaccine (Shingrix) – with greater efficacy and longer duration of immunity – has recently been approved for use in Canada (CDC 2018a).

1 The effective response to vaccines decreases at older ages as well.

2 Soon it will provide cost-effectiveness evaluations of vaccines to those who make recommendations on the use of new ones (Gemmill 2016).

**Table 1: Adult Immunizations in Canada, by Province, by Select Vaccine and Public Funding**

Vaccine:	Influenza	Pneu-P-23	Shingles	Td (Tetanus Diphtheria)	Tdap (Tetanus-Diphtheria-Pertussis)
Frequency	one dose annually	one dose	one dose	one dose every 10 years	one booster dose per adult lifetime
Province	Publicly Funded for:				
Ontario	all adults	all adults 65+ and high risk individuals	all adults age 65-70	all adults	all adults
British Columbia	all adults age 65+ and high risk individuals; recommended for adults who want protection	all adults 65+ and high risk individuals; recommended for smokers	recommended but not publicly funded for adults age 60+	all adults	
Alberta	all adults	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
Saskatchewan	all adults	all adults 65+ and high risk individuals	recommended but not publicly funded	all adults	all adults
Manitoba	all adults	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
Quebec	all adults 60+ and high risk individuals	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
New Brunswick	all adults 65+ and high risk individuals	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
Nova Scotia	all adults	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
Prince Edward Island	all adults	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
Newfoundland & Labrador	all adults	all adults 60+ and high risk individuals	recommended but not publicly funded for adults age 60+	NA	all adults; one dose every 10 year
Yukon	all adults	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
Northwest Territories	all adults	all adults 65+ and high risk individuals	recommended but not publicly funded for adults age 50+	NA	all adults; one dose every 10 year
Nunavut	all adults	all adults 50+ and high risk individuals	recommended but not publicly funded for adults age 60+	all adults	all adults
Included in the provincial routine Immunization Schedules?	yes	yes	no except ON	yes except NL and NT	yes except BC
NACI recommendation	every year for age 18 and over	1 dose for age 65 and over	1 dose for age 60 and over	1 dose every 10 years for age 18 and over	1 dose for age 18 and over

Sources: Canadian Immunization Guide and various provinces' Routine Immunization Schedules.

There is the once-per-decade recommendation for a tetanus-diphtheria (Td) booster that is publicly funded for all adults everywhere except Newfoundland and Labrador and the Northwest Territories, which instead recommend the tetanus-diphtheria-pertussis (Tdap) booster every 10 years instead of once per adult lifetime like in most other provinces. British Columbia is the one province that does not fund the Tdap booster because of concerns around the rate of decline of clinical efficacy for the pertussis component (Schwartz et al. 2016). Overall, vaccine schedules are reasonably similar for adults across provinces and territories, but greater differences emerge with unique processes to encourage immunization uptake.

The National Immunization Strategy, involving federal, provincial and territorial (FPT) partners, has recently established the following coverage targets for adults by 2025:

- Achieve 80 percent vaccination coverage (one dose per season) of an influenza vaccine among adults aged 65 years and older, 18-64 years with high-risk conditions, and healthcare professionals.
- Achieve 80 percent vaccination coverage (one dose) of a pneumococcal vaccine among adults 65 years of age and older.
- Achieve 90 percent coverage (one dose) of hepatitis B vaccine among healthcare professionals.

### How are Adult Vaccines Administered?

The annual influenza vaccine is the centerpiece of the adult immunization schedule: it takes substantial efforts from public health and providers, plus the flu's annual, seasonal recurrence makes this vaccine a regular health intervention for most Canadians. The administration of other adult

vaccines is much less routine and more dependent on the actions and interventions of one's primary care provider as well as motivated individuals. Although there is more to discuss regarding the delivery of non-influenza adult vaccines, it is best to start with influenza because of data availability and because specific policy platforms are more widely available and understood.

Until recent years, family doctors and public health nurses – plus a handful of other providers, such as nurses and occupational health providers – were solely responsible for administering publicly funded flu shots. Some places, like Quebec, Alberta and the territories utilized public health nurses more exclusively to administer flu shots, whereas most other jurisdictions relied on a mix of physicians and nurses. Due to worries about the ability for patients to easily access their physician or other providers, in 2009, British Columbia and Alberta permitted pharmacists to administer publicly funded influenza vaccines. Other provinces, with the exception of Quebec and the territories, soon followed suit. The result of this has been a rapid expansion of pharmacists in administering flu shots, especially in urban areas.

Recently, many public health officials report that, in provinces where pharmacists can give government-paid flu shots, close to one-third of flu vaccines are administered by pharmacists or other providers (Table 2)<sup>3</sup> – and the number may continue to increase over time. Many patients have clearly indicated a preference to receive their shots in community pharmacies. Although much, if not all, of this increase is a result of switching away from other providers, marginal increases were observed in overall uptake (Kwong et al. 2016). That said, there is important within-province variation regarding providers who administer the vaccine,

3 The author was unable to obtain an estimate for Ontario. In Quebec, where pharmacists are not enabled to administer the vaccine, the only question was what small share of overall flu shots were administered by doctors, and an estimate was not available.

**Table 2: Who Administers the Flu Vaccine? Approximate Percent by Provider Group**

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YK	NT	NU
Physician	33	5	7	30	63	N/A*	33	40	33	N/A	0	0	0
Public Health Nurse	33	45	60	40	6	N/A*	33	30	33	60	100	100	100
Pharmacist/ Other	33	50	33	30	31	0	33	30	33	N/A	0	0	0

Note: Figures are rough estimates based on interviews with provincial officials in 2017. Ontario's results are for 2013/2014, found in the Auditor General's report.

\* In Quebec, where pharmacists are not enabled to administer the flu vaccine, the only question was what small share of overall flu shots were administered by doctors, and an estimate was not available.

and most rural regions with fewer community pharmacies still tend to rely predominantly on public health nurses or family doctors to administer flu shots.

Many flu vaccines delivered by public health are through mass immunization clinics – for adults and children – and with targeted outreach to high-risk populations, such as residents in long-term care homes. Other outreach locations include workplace clinics or mobile stations in acute care settings. Physicians administering flu vaccines in their offices are also quite common across the country. Most provinces currently see a roughly even split of nurses, pharmacists and physicians administering vaccines (Table 2).

Beyond the influenza vaccine, physicians, public health nurses and other professionals administer most other publicly funded vaccines on adult schedules. Although the scope of practice for pharmacists enables most pharmacists to administer almost all adult vaccines on provincial schedules

(see Table 3), provincial governments, with some exceptions,<sup>4</sup> limit reimbursement to flu vaccines, otherwise requiring individuals to pay out of pocket or with private insurance at a pharmacy.

**How is Uptake Monitored? What are the Results?**

Publicly available data for province- and territory-wide influenza uptake and coverage information normally rely on national surveys for estimates of the general population and among those aged 65 and up, with a few exceptions of provinces that also gather some administrative data. The overall results are disappointing. Despite targets of around 80 percent or higher for high-risk groups, among all adults with more than one chronic condition around one-third received their flu shot, ranging from a low of 25 percent in Saskatchewan to 43 percent in Atlantic Canada (Gionet 2015). About two-thirds of adults aged 65 and up receive

4 Manitoba and British Columbia pharmacists are able to administer many publicly funded vaccines. Some other provinces have this same provision.

Table 3: Pharmacist Scope of Practice, By Province

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Allowed to administer	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Vaccines</i>										
Influenza	x\$	x\$	x\$	x\$	x\$		x\$*	x\$	x\$	x\$
TD (tetanus and diphtheria)	x\$	x		x\$					x	
Tdap (Tetanus, Diphtheria and Pertussis)	x**	x		x\$				x	x	
HPV	x**	x	x	x\$	x		x	x	x	
Pneumococcal vaccines	x\$	x	x	x\$	x			x	x	
Measles Mumps Rubella (MMR)	x\$	x						x		
Hepatitis A	x\$	x	x – travel vaccine	x	x – travel vaccine		x – travel vaccine	x	x	x
Hepatitis B	x\$	x	x – travel vaccine	x	x – travel vaccine		x – travel vaccine	x	x	x
Varicella (Chickenpox)	x**	x			x			x		x
Meningococcal vaccine	x**	x			x			x		
IPV (Polio)		x								
Herpes zoster (Shingles)	x	x	x	x	x		x	x	x	x
Bacille Calmette-Guérin (BCG)		x			x					x
Haemophilus Influenza Type B (Hib)		x			x			x		
Travel vaccines	x	x	x	x	x		x	x	x	x
Patient age requirement	5 years old or over	Injection: 5 years old or over; publicly funded influenza program: 9 years old or over	9 years old or over	7 years old or over	5 years old or over		5 years or over	5 years old or over	vaccine: 18 years old or over; influenza vaccine: 5 years old or over	5 years old or over

\$ Pharmacists are allowed to immunize eligible residents under the publicly funded immunization program and the administration will be reimbursed by the provincial governments.

\* New Brunswick does not have universal flu vaccine coverage. Adults  $\geq 65$  years old, people with compromised immune systems and children aged 5 to 18 are eligible.

\*\* Pharmacists can administer vaccine to supplement school based programs.

Note: Pharmacists are currently not allowed to administer adult vaccines in the territories, although the Northwest Territories is considering changing legislation to allow it.

**Table 4: Provincial and Territorial Influenza Coverage: Monitoring and Most Recent Results**

How is coverage monitored?	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YK	NT	NU
General Population		National survey	National survey	National survey	National survey	National survey	National survey	National survey	National survey	National survey	National survey	National survey	National survey
Other		Seasonal influenza reports				Seasonal influenza reports				By geographic zone			
<i>Healthcare Workers</i>													
Acute-Care Setting	Yes – data available by health authority region	Yes – by hospital and care centre and by geographic zone	N/A	N/A	Yes – across province (median)	Yes – available for doctors, nurses, other health prof. and support staff	N/A	Yes – by geographic zone	N/A	N/A	N/A	N/A	N/A
Nursing Home Staff	Yes – data available by health authority region	N/A	Yes – data available at select health region	N/A	Yes – across province (median)	N/A	N/A	Yes – by geographic zone	N/A	N/A	N/A	N/A	N/A
Nursing Home Residents	Yes – data available by health authority region	N/A	Yes – data available at select health region	N/A	Yes – across province (median)	N/A	N/A	Yes – by geographic zone	N/A	Yes – by geographic zone	N/A	N/A	N/A
Homecare workers or patients	N/A	N/A	N/A	N/A	Yes – for patients only, available across province and by health region	N/A	N/A	Yes – by position (direct care/support staff)	N/A	N/A	N/A	N/A	N/A

Table 4: Continued

Influenza Coverage	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YK	NT	NU
	Percent												
General Population	32	33	25	30	34	27	37	45	33	26	37		
Other statistic, if available		27				adults ≥ 60 years old: 52				21			
Healthcare Workers	-	-	54	-	-	45	-	-	-	44 (range: 44-54)	-	-	-
Acute-Care Setting	75	63	-	-	53	60*	-	44	-	-	-	-	-
Nursing Home Staff	74	-	48**	-	72	-	-	48	-	-	-	-	-
Nursing Home Residents	87	-	82**	-	94	-	-	92	-	85	-	-	-
Homecare workers or patients	-	-	-	-	28	-	-	50	-	-	-	-	-

\*\*Figures are for Saskatoon Health Region only, obtained from its 2016/2017 influenza report.

Notes: N/A means that the data are not available publicly, even if they are recorded. \* Quebec's figure for acute-care settings is roughly the average figure between nurses and doctors.

Most recent data used. These comparisons should be considered rough ones, as most recent data from different time periods and the data are not always recorded in a consistent manner across provinces.

the annual flu vaccine, with a low of around 50 percent in Newfoundland and Labrador and a high of 75 percent in Nova Scotia (Gionet 2015).

More detailed influenza coverage estimates can be found in many provinces for healthcare workers or among patients in particular healthcare settings, such as in acute care settings, among staff and residents in nursing homes, and among homecare staff or patients (Table 4). British Columbia, Nova Scotia and Ontario keep statistics for nearly all of these high-risk locations; Saskatchewan does as well, with the exception of acute care settings; Alberta monitors coverage among workers in acute facilities and clinics and Newfoundland and Labrador monitors coverage among nursing home residents. Quebec monitors influenza coverage for each annual campaign, reporting results for all adults, including the chronically ill before age 60 (24 percent uptake), those above age 60 (52 percent uptake), and healthcare workers, such as doctors (66 percent), nurses (54 percent), other health professionals (46 percent) and administrative staff (42 percent).

Based on the most recent available data, British Columbia – which has a province-wide immunize-or-mask policy that ensures health professionals who have not received the flu vaccine wear a mask at work – has the highest provincial coverage among acute care workers at around 75 percent, on average. Nova Scotia has the lowest average coverage in acute care at 44 percent. Nursing home staff uptake is also highest in BC at an average of 74 percent, closely followed by Ontario at 72 percent. In contrast, Saskatchewan and Nova Scotia see much lower average uptake rates at just below 50 percent (Table 4). Lower rates among healthcare workers are concerning because of their close proximity to frail or immunocompromised patients: trials have found that high uptake of flu shots in nursing homes can reduce mortality by 20 to 40 percent (Bryce et al. 2012; Carman et al. 2000). Average influenza uptake among nursing home residents, however, is quite high in all regions that record the data, though this

often masks substantial local variation between individual homes.

### **Other Non-Influenza Adult Vaccines**

Outside of the annual influenza vaccine, little monitoring takes place for the administration of most adult vaccines. The National Immunization Coverage Survey provides some nationwide estimates of vaccine coverage for tetanus, pertussis and pneumococcal (as well as hep B, varicella and HPV), and the coverage levels are disappointing (Table 5). The national target for pneumococcal among those aged 65 and up is 80 percent, so coverage of 37 percent in the survey is well below target. Although there are no national targets for tetanus and pertussis, their coverage levels of roughly 50 and 9 percent, respectively, are much lower than the recommended one dose per 10 years or one dose per adult lifetime.

A number of provinces – Manitoba, PEI, Newfoundland and Labrador, and Saskatchewan – have had childhood immunization registries in place for around 20 years or more, which should provide a rich picture of coverage among young adults. Few studies have been conducted on what vaccine coverage looks like at these ages. However, Manitoba keeps adult data on immunizations, beginning in 2000, in its registry, and Quebec keeps some data as well.

Manitoba's adult coverage data give a snapshot of uptake for the once-every-10-years booster for tetanus, diphtheria and pertussis, as well as pneumococcal-23 uptake among those aged 65 and up, and the providers who are most active in administering each vaccine (Manitoba 2016). Among Manitobans aged 18 and up, 38 percent received a tetanus and diphtheria booster in the last 10 years. Around 17 percent of the adult population received a pertussis booster past age 7 – a figure much lower than the tetanus and diphtheria figures mainly because of the different vaccine preferred by health professionals (Td vs. Tdap).

**Table 5: National Vaccine Coverage for Influenza, Tetanus, Pertussis and Pneumococcal Antigens, 2014**

	Vaccine Coverage (percent)			
	Influenza	Tetanus (one dose in last 10 years)	Pertussis (one dose since age 18)	Pneumococcal
Adults (≥ 18 years)	40.3	49.5	9.3	-
18-64 years of age with a chronic medical condition	43.8	51.4	8.4	17.3
≥ 65 years of age	67.1	38	8.9	36.5
Healthcare personnel	69.2	68.3	23	-
Close contact with patient or resident (within one meter)	75.6	70.1	23.7	-

Source: Table Reproduced from Statistics Canada (2016); National Immunization Coverage Survey

Finally, around 70 percent of Manitobans aged 65 and up have received one dose of pneumococcal-23 in their lifetime (Manitoba 2016). Physicians were the most common care professional to administer each major adult vaccine, representing roughly 60 percent of all Pneu-23 and Td doses; public health nurses administered most of the remaining Pneu-23 doses although other providers – such as nurses in publicly funded facilities and occupational health workers – together provided about one-quarter of all Td boosters. Quebec keeps some limited information about adult vaccines, such as tetanus coverage among adults aged 50 and older, which shows a coverage rate of around 33 percent for a booster in the last 10 years.

Although the lack of a lifetime registry limits knowledge about adult immunization coverage,

one province – PEI – is piloting a plan to build a more comprehensive adult immunization database. Funded by the Public Health Agency of Canada's Immunization Partnership Fund, public health clinics are aiming to build a central repository for a comprehensive adult database by collecting individuals' immunization histories – and determining which shots are missed – when they come in to get their flu shots. A survey is administered while patients wait to receive a shot; or afterwards while they wait to ensure no adverse reaction. The province plans to link the data to the childhood immunization database that goes back to 1997, which will be helpful for capturing additional data among young adults who did not migrate outside the province over this time.

## BARRIERS TO UPTAKE: WHY ARE ADULTS UNDERVACCINATED?<sup>5</sup>

Adult decisions and beliefs drive society-wide vaccine hesitancy. Some adults may not see why getting vaccinated is important to their personal health or their family's – the perceived risk of illness is low. Limited information, distrust, difficulty in accessing services and the beliefs of health providers in a vaccine's value also impact the likelihood of uptake (Favin et al. 2012). In addition to this, it is likely that the reasons for poor immunization uptake among adults vary across Canada, by geographic regions and by individual characteristics.

International studies highlight the following varied reasons for limited uptake of vaccines among adults (USDHHS 2016; SAATI 2013):

- Lack of coordination across many healthcare providers for adults.
- Vaccines not being integrated into adult medical care.
- Skepticism of vaccine safety and efficacy.
- Poor or underuse of monitoring and recordkeeping.
- Lack of knowledge regarding adult immunization schedules and the risks for adults from vaccine-preventable diseases.
- Weak recommendations, or lack of leadership from healthcare providers.
- Limited use of reminder systems.
- Limited public funding.
- Inconsistent recommendations across jurisdictions within Canada and internationally.

Perhaps a bigger reason for such low rates of uptake for seasonal flu shots is simply that the vaccine is not always very effective. With an average efficacy of around 50 percent – but sometimes select vaccine components, such as H3N2, result in efficacy falling to as low as 10 percent in some years – many people do not see the value in getting the flu shot (CDC 2018b). This lack of confidence in flu vaccine effectiveness persists among healthcare professionals (Mytton et al 2013). Given what an important driver vaccine uptake and confidence among providers is to uptake in the general population – normally provider confidence is a top reason for getting vaccinated (Favin et al. 2012) – this undermines the ability for improved uptake in the general population. Further, the requirement to get the flu shot every year, and the inconvenience that may result, is another reason for low uptake.

For all other adult vaccines, in addition to the reasons above, policy processes may struggle to boost low uptake because of: limited knowledge of individuals' immunization history; limited public funding (shingles); and the lack of a formal, routine process for uptake like the flu, among many other reasons. Across the provinces, there is no clearly defined and common approach to adult immunization, although some provinces, notably Saskatchewan, Newfoundland and Labrador, or even some hospitals and other health regions, utilize "cocooning" strategies for pregnant women and family members with new children to prevent against pertussis.

Cocooning, which is a strategy introduced by the US Centers for Disease Control and

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5 The various challenges in ensuring that children are fully immunized, either on schedule or before adulthood, are widely documented (Busby, Jacobs and Muthukumaran 2017). The reasons for incomplete and undervaccinated children are many and include demographic factors, such as the number of siblings in a family, marital and socioeconomic status (Zhang et al. 2008; Carpiano and Bettinger 2016), as well as delays in getting vaccines on schedule (Quebec 2015). Incomplete childhood and school-based immunization compounds lifetime immunization challenges, because the emphasis in adulthood must be both on catching up as well as on administering an adult schedule in a timely fashion.

Prevention, aims to protect vulnerable children from pertussis by immunizing those who will be in direct contact with the baby: pregnant women, parents, grandparents, and other adults. Pregnancy, therefore, functions as a prompt: a moment in time in an adult's life (usually around common childbearing years, ages 20-45) during which healthcare providers can get information about an immunization history, with the result that the pertussis booster becomes more routine.

Although some researchers have rightly criticized the cost-effectiveness of cocooning strategies (Skowronski et al. 2012), this more formal type of approach to adult vaccines utilizes many of the concepts that are common in childhood vaccines by creating signposts to obtain and exchange information, as well as encourage uptake. These concepts are increasingly being recognized as within the scope of behavioural economics, which has helped shape many other policies ranging from improved organ donations to pension savings (Thaler and Sunstein 2008).

### **Behavioural Economics and the “Three Cs” of Vaccine Hesitancy**

As policymakers grapple to overcome barriers that prevent desirable vaccine uptake, understanding how behavioural sciences and policy design intersect with public health is an increasingly important part of policy analysis (Roberto and Kawachi 2015, Volpp 2017). Behavioural economics investigates and describes applied social psychological behaviour in different settings, and has been applied to improve policies regarding education decisions and employment programs, among other examples (French and Oreopoulos 2016). In fact, much of the thinking on behavioural sciences is already recognized – although not in a formal sense – in how policymakers think about “vaccine hesitancy” and in understanding reasons why many people do not get fully immunized despite scientifically proven advantages from doing so.

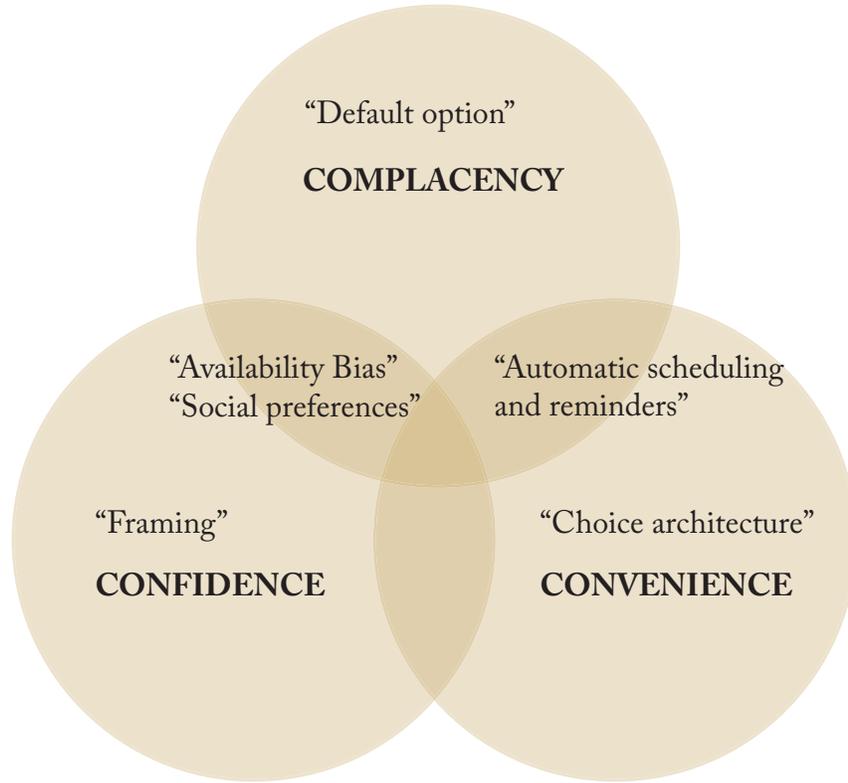
Three general reasons, known as the “Three Cs,” have been articulated to describe the many, complex reasons for un- and under-vaccinated among us: confidence, complacency and convenience. Convenience speaks to the challenges – in time, energy, indirect or direct costs – involved in accessing immunization services; complacency refers to an individual's low perceived risks of contracting an infectious disease; confidence is about one's trust in vaccine effectiveness and safety (MacDonald 2015).

In this part of the essay, I describe how the application of behavioural economics theories and concepts – such as availability bias, myopic decisions, bounded rationality, and the default option in policy design – intersect with the “Three Cs” and reasons for incomplete immunization in important ways. Figure 1 illustrates the overlap of the three Cs of immunization hesitancy with the concepts used by behavioural economists.

**Complacency:** Consider the notion of the “default option” – which is, in immunization policies, the immunization result if an adult chooses to do nothing. In most settings in Canada, getting a vaccine as an adult – a flu shot, a tetanus-diphtheria booster, a shingles immunization – is essentially a voluntary “opt-in” process. These shots are recommended and available – either with public funding or, as is the case of shingles, mainly without – but an adult must actively seek out and give consent to receive these vaccines. Contrast this with childhood immunization where in many provinces parents have follow-up visits with public health nurses after birth and, at school entry, and often have to actively fill out forms to explain incomplete immunization uptake, making these policy frameworks more like a voluntary “opt-out” model of consent. Careful thought and attention to default options of immunization policy speak to the issue of complacency, and the tendency for people to put off getting vaccinated.

Other design aspects of the immunization frameworks also touch upon complacency

**Figure 1: Illustrating Overlapping Concepts: Vaccine Hesitancy, Behavioural Economic Theory and Policy Design**



Source: Author’s adaptations from MacDonald (2015).

issues. For instance, automatically scheduling appointments can improve uptake (Chapman et al. 2010), as can establishing dates in advance and patient reminder systems. Reminder systems can take many forms – either reminders sent by physical mail or electronic reminders that appear in physician electronic medical record systems – and have been shown to be effective (Milkman et al. 2011, CDC 2017; Hilderman 2011). Complacency also touches on the behavioural concept of “bounded rationality,” where individuals may make decisions counter to their best interests.

Availability bias, also expressed as “availability heuristic” in behavioural economic literature, is when people judge the likelihood of an event

happening by common examples that come to mind rather than intuition about actual probabilities. With infectious diseases, especially ones that are often treatable and non-life threatening like mumps, chicken pox and the flu, individuals may often think that the likelihood of getting infected is low and even if they do get an infectious disease they will be fine. Many people do not see vaccine-preventable diseases as threatening and undervalue their benefits. This speaks to issues of both complacency and confidence, where misinformation must be overcome and issues like vaccine effectiveness and herd immunity – the need for high community-level uptake to prevent disease spread – contribute to the confusion. Also related

are prevailing norms and social preferences that can result in peer behaviour influencing decisions (French and Oreopoulos 2016) – one’s peer group could make one more sceptical of vaccine benefits, for instance.

**Confidence:** The issue of confidence in vaccine utility is a central point of study for how to best “frame” immunization benefits and risks. Pamphlets’ wording, form organization, and survey design have all been shown to affect decisions (French and Oreopolous 2016). For vaccines, much experimentation is currently taking place with how providers best inform patients of vaccine benefits and risks, phrasing the benefits as losses or gains – framing the potential outcomes or the positive reassurances affects uptake decisions (Chen and Stevens 2016).

**Convenience:** Finally, there is convenience, which most individuals will interpret as how easy or hard it is to get vaccinated. Choice architecture can be used to create environments where desirable choices are more obvious and easier to make. Examples for vaccine uptake include the time saved for individuals to be vaccinated at the workplace – something which is commonly available for healthcare workers – as well as the availability of vaccines to be administered in pharmacies. Both of these interventions have shown some potential to boost uptake, although they do not always address the many causes of poor uptake.

Many healthcare workplaces have experimented with different ways to encourage greater uptake among hospital staff by making it as convenient as possible to get a flu vaccine. Interventions such as creating competitions between wards, offering rewards like candy bars, wearing buttons, creating nursing champions, etc. have demonstrated only a limited effect on uptake (Quan et al. 2012).

Providing publicly funded flu shots in pharmacies is another example where improvements to convenience were not sufficient to move the dial on uptake in a major way (Kwong et al. 2016). Although there are many advantages and benefits from improved convenience – saved time, improved

productivity, and expanded educational efforts from pharmacies – more challenging aspects of the underlying issues, such as complacency and confidence, need to be tackled with revised policies that consider well-known aspects of behavioural economics in policy design.

## DISCUSSION AND RECOMMENDATIONS: BUILDING ON IMPROVED CONVENIENCE

### Improving “Confidence” for Flu Shot Uptake: Start with Healthcare Workers

A major reason why citizens get vaccinated is because their healthcare provider strongly supports a vaccine and encourages them to get one. Therefore, given the low rates at which healthcare workers get their annual flu shot, any additional efforts to boost flu shots with the general population will be held back by a lack of consistent support from within the health profession. Further, healthcare workers that remain unimmunized choose to place vulnerable patients at greater risk, and so immunization, arguably, should be a central responsibility of employment.

Some studies suggest that many healthcare workers do not get immunized because vaccines are not easily available or because they forget (Christini, Shutt, and Byers 2007; Hauri et al. 2006), and so an essential step would be to ensure that the immunization process is simple and available in the workplace, making it hard to forget and eliminating commute and planning costs. However, as discussed above, many behavioural interventions have been made in acute-care settings to make things more convenient, and the disappointing overall results suggest limitations to how far simple, voluntary behavioural interventions can go.

If the goal is to meet herd immunity targets for influenza, then more “opt-out” style policies, such as “vaccinate-or-mask” legislation, are required. In 2012, British Columbia introduced a policy requiring healthcare workers to choose between receiving

an influenza vaccine or wearing a mask during flu season. Prior to this policy, influenza immunization coverage in BC's acute care facilities ranged around 40 percent, on average. After the vaccinate-or-mask policy was introduced, influenza immunization coverage rose to around 75 percent, on average.

Vaccinate-or-mask or other more compulsory forms of immunization for healthcare workers is, however, fraught with potential political conflict. Nursing unions resist this legislation, highlighting the average 50 percent effectiveness of annual flu vaccines and argue that more forceful, mandatory-like policies risk violating freedom of choice. Although other provinces should consider adopting a similar policy as BC, a recent arbitration ruling in Ontario (The Sault Area Hospital) may cause a pause. The ruling strongly criticized the design of vaccinate-or-mask policies as a "coercive tool." The ruling was based on the limited ability for clinical masks to prevent the spread of the flu, throwing out the hospital-based policy.<sup>6</sup> Vulnerable patients should arguably be able to choose providers based on their immunization status – and vaccinate-or-mask policies enable this choice, regardless of how well masking works to prevent the spread of disease. However, this ruling sharply, and I believe unwisely, criticizes the choice architecture embedded in policies – nudging – and unfortunately brings Canadians closer to the thorny issue of legislated, mandatory vaccine uptake.

Should political obstacles continue to hold back vaccinate-or-mask policies, then policymakers should acknowledge that low confidence of healthcare workers in the flu shot will also limit public confidence, hamstringing broader efforts for flu shot uptake. In this case, the development

of a more clinically effective flu shot would be necessary to improve uptake among healthcare workers and the general population. Confidence in the effectiveness of a vaccine is such a central pillar to overall immunization uptake that, barring a large improvement in the effectiveness of a flu vaccine – or the development of a vaccine that does not need to be taken annually – a major increase in uptake will be hard to achieve.

Targeted efforts with more vulnerable populations, however, could and should still be a major focus of public health efforts, and provinces and territories should compare approaches to see what works best.<sup>7</sup>

### **Building a Better Monitoring Infrastructure: Tackling “Confidence” with Informed Monitoring and Removing “Complacency” with Routine Processes**

Despite poor overall uptake, the annual flu shot is, however, the one “routine” feature of the adult immunization policy framework, so it can be utilized to encourage uptake of other adult vaccines and to fill monitoring gaps. This is precisely what PEI is currently doing by having public health nurses administer surveys to patients during otherwise tedious waits – before or after receiving a flu shot. Building an adult immunization database should be a central part of efforts to bolster vaccine uptake among adults because it informs policy and allows for targeted and cost-effective approaches to undervaccinated citizens. All provinces should be increasing their efforts in this area. Improved monitoring and adult database development efforts are something that could also be undertaken at

6 Saskatchewan once introduced a similar policy, but did so in 2014-15 when the vaccine had lower efficacy, and as a result enthusiasm waned and the policy was dropped. Horizon Health Network in New Brunswick also has a vaccinate-or-mask policy.

7 See the National Institute on Aging (forthcoming) for a range of policy options to better protect against the flu.

community pharmacies, perhaps alongside, or in exchange for, a broadened ability to administer more publicly funded vaccines.

### **An Expanded Role for Pharmacies: Building on “Convenience” by Expanding Digital Monitoring, Signposts and Reminders as Multidisciplinary Primary Care**

Pharmacies could also play a greater role in helping develop an adult database, and perhaps take on an expanded role in the adult immunization framework. A life-course approach to immunization uptake could see more responsibility handed off to pharmacists for publicly funded adult-based immunization, provided close connections exist with local primary health providers. This is a multidisciplinary approach to primary care, using the patient’s preferred convenience of local pharmacies while further establishing links – as a part of the vertical supply chain of patient care – with local family health providers.

Pharmacists could be enabled to administer, as in the PEI public health survey example, a voluntary survey with the annual flu shot. This could include the use of a digital platform or an app, perhaps CANImmunize – an app developed by staff at the Ottawa Hospital Research Institute to help individuals take charge of their immunization plans – and ask adults to fill in a short questionnaire that asks about: age, last tetanus booster, last mumps vaccine or pertussis booster, etc. This would begin to provide individualized immunization history for an adult database but also further efforts to equip individuals with their immunization history.

Building positive relationships between pharmacies, public health and local family primary care professionals has tremendous potential. Already, many acknowledge that the additional benefits from having pharmacists administer publicly funded flu shots include mass advertising and time saved for patients. But there are more

important untapped benefits – namely the ability for pharmacists to establish routine reminders and interventions for other publicly funded adult vaccines and tackle complacency issues.

Routine interventions are required to overcome complacency: recommendations from providers to get vaccines are not enough – policies need to implement a programmed approach with regular follow-ups. Pharmacists could help in this regard were they enabled to provide reminders on behalf, or in place of, local primary care practices.

Consider, for example, a situation where an adult is filling a prescription at her local pharmacy, and is informed by the pharmacist that she is due for a Td booster because she has not got one in 10 years. A pharmacist could know this after collecting one’s immunization history and using the date of birth on a health card, etc. Pharmacists could also establish reminders every 10 years to check immunization history upon filling a drug prescription. Age could work as another signpost and reminder for a Pneumococcal-23 vaccine for those filling a prescription after the age of 65. Further, the existence of other chronic conditions could also help prompt uptake of other adult vaccines, like Hepatitis B.

Another advantage of having pharmacies more involved in adult immunization is that, as many new vaccines and technologies become available over time (Simerska et al. 2009), pharmacists can effectively enable their implementation and use. The potential for innovations, such as new technologies that might allow for orally ingestible vaccines (or those that could utilize advancements in self-injector technology), might have a greater impact on uptake than any other policy intervention.

A broader trend in healthcare is the bundling of health services with traditional bricks-and-mortar (not-online) retail. People are increasingly looking for these opportunities, which is why many larger retailers, like Walmart, are rapidly

expanding primary care services in their stores to match demand for convenience.<sup>8</sup> Although many in public health or primary care might be more keen to highlight the challenges of closer integration with retail-based or community pharmacies, the desires of many Canadians for doing so must be acknowledged.

Of course, there would be challenges were pharmacies to take on a greater role: there might be greater potential for multiple uptake of vaccines or duplication elsewhere in the system if electronic records are not shared or harmonized, and coordinating with primary care providers is not necessarily a straightforward process. There may be reluctance among some physicians, or public health agencies, to permit pharmacists more immunization responsibility, either due to an impact on billing or coordination challenges. Further, pharmacists themselves might be reluctant to take on these new responsibilities if the benefits do not outweigh the additional work required. Balancing individual physician preferences on who administers vaccines to patients under their care, with those of pharmacists, will be a challenging hurdle. Also, the effectiveness of pharmacist recommendations – how benefits and risks are explained and framed to people – would need to be monitored given the range of approaches for doing so and the potential effect on uptake decisions.

Further, some anonymous reviewers on earlier drafts of this paper have highlighted reporting of medical errors, capacity, the proper management of vaccine inventory (cold chain/wastage), and the reporting of adverse events and issues like vaccine distribution as important for consideration when contemplating pharmacists playing a greater role in administering vaccines. I acknowledge these issues, but given the similar issues that pharmacists

already deal with for other prescriptions drugs or antibiotics, I do not see any of these challenges as insurmountable nor do they overcome the revealed preferences of many patients to receive shots in their pharmacy (at the right time, right place).

### **Post-Secondary Entry: Another Possible Checkpoint to Breakdown “Complacency”**

Making adult immunization more of a routine process could be aided by asking for proof of immunization coverage at entry to post-secondary institutions. Nearly 30 years ago, a little more than half of all young adults would attend a post-secondary school – a university, college, polytechnique or trade school – whereas today that number is much closer to 85 percent. Proof of immunization coverage at school entry is such an effective policy in many provinces because it helps overcome complacency and makes parents opt-out of immunization decisions or risk having their child suspended from school (Toronto 2012). It is also effective because almost all children receive a primary education in a school. With most young adults and foreign students participating in post-secondary education, extending this concept has potential. Medical school enrolment already requires immunization proof upon entry, as do a few universities in the United States, so there is a foundation, despite some logistical and privacy issues, to work from in building default options that chip away at complacency.

### **Overcoming “Confidence” Issues: Improving Public and Professional Awareness**

“Framing” the benefits and risks of vaccines and infectious diseases affects vaccine confidence.

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8 See “The rise of doctor’s clinics in supermarkets” as an example: <http://www.canadiangrocer.com/worth-reading/the-rise-of-retail-clinics-66172>.

Yet, waning immunity or new strands of vaccines are not concepts of which most adults are aware. Hence, any complete strategy for improved adult vaccination would need to include careful thought on how providers can best overcome hesitancy among individuals.

Clarity on schedules also fits into this, and NACI's revised targets for adult coverage help. NACI could go further and, in line with recent expanded scope to undertake economic evaluations, create a "mock" national vaccine list for adults that would include only cost-effective lists of recommended vaccines for public funding. The base recommendations of a national list can help improve clarity of immunization schedules to Canadians and encourage more harmonization in adult schedules by provinces and territories – an issue that is just starting to grow with the new shingles vaccine and may expand as other vaccines are introduced in the future.<sup>9</sup>

Finally, the ideas presented above all attempt to overcome complacency and confidence, while building on improvements in convenience from changes to scopes of practice and expanded workplace immunization options. This does not mean that policymakers should overlook the role of convenience in uptake decisions despite somewhat disappointing results so far from workplace and pharmacy-based flu shot results. For instance, the process of providing consent – which is usually written and somewhat lengthy – for a flu shot at a pharmacy could perhaps be made easier.

## CONCLUSION

Good health for aging Canadians can increase contributions to economic and social activity and help offset some of the economic challenges associated with aging societies. Better and more

regular uptake of vaccines during adulthood and retirement could, therefore, improve the well-being of many Canadians.

Adult immunization schedules are reasonably similar across Canada and pharmacists have administered a greater share of flu shots in recent years. That said, overall uptake of the influenza vaccine remains poor, and the little that we know about uptake for other adult vaccines is worrisome. By examining the adult immunization policy frameworks in Canada and reasons for incomplete immunization, as they relate to behavioural economic issues, this *Commentary* proposes a number of options to boost uptake.

Although many provinces avoid confrontation from policies towards influenza immunization among healthcare workers, as it often results in heated conflict with powerful public sector unions, the inability to make progress on this score ensures limited success for flu vaccine uptake elsewhere in the population. The uptake of flu shots suffers from limited confidence, which could begin to be corrected with greater uptake among healthcare workers, and also with a better vaccine. Yet, because flu shots are a routine intervention, they might also be a critical part of efforts to improve monitoring of other adult vaccines. This could help establish starting points for providers to make non-influenza vaccines a more regular health intervention.

A behavioural economics lens on immunization policies in Canada shows that policymakers, in recent years, have focussed on improving convenience for adults by providing greater access for seasonal flu shots at work or in pharmacies. Although the results, in terms of overall uptake, are somewhat disappointing, patients' preferences to receive their shot in pharmacies, when they want it, makes this point of contact nonetheless

9 An additional purpose of this recommendation is to avoid the issues that the provinces now face with respect to prescription medicines due to no national guide to cost-effective formulary decisions for both public and private insurers.

a great starting point for future policies to build from: tens of thousands of Canadians have saved time and energy in getting their shots at their local pharmacies. Going forward, the focus should shift to overcoming complacency with more use of automatic scheduling and reminders. Pharmacies, often a very convenient location for most urban-dwelling Canadians, could act as important parts of multidisciplinary primary care efforts to gather data on publicly funded adult vaccines – likely through digital platforms – and create reminders and prompts to overcome complacency as well.

## APPENDIX:

Table A1: Complete List of Adult Vaccines and Public Funding

Province	Influenza	Hep A	Hep B	Menin- gococcal con- jugate ACYW- 135	Menin- gococcal B	Pneu- C-13	Pneu- P-23	HPV	HIB	Shingle	MMR	Td	Tdap
Ontario	pf	pf_s	pf_s	pf_s		pf_s	pf_s	pf_s	pf_s	pf_s	pf_s	pf	pf
British Columbia	pf_s	pf_s	pf_s	pf_s		pf_s	pf_s	pf_s			pf_s	pf	
Alberta	pf	pf_s	pf_s	pf_s			pf_s	pf_s	pf_s		pf_s	pf	pf
Saskatchewan	pf	pf_s	pf_s	pf_s	pf_s		pf_s	pf_s			pf_s	pf	pf
Manitoba	pf	pf_s	pf_s	pf_s		pf_s	pf_s	pf_s	pf_s		pf_s	pf	pf
Quebec	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s				pf	pf
New Brunswick	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s			pf_s	pf	pf
Nova Scotia	pf	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s		pf_s		pf_s	pf	pf
Prince Edward Island	pf	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s	pf_s		pf_s	pf	pf
Newfoundland & Labrador	pf	pf_s	pf_s		pf_s	pf_s	pf_s						pf
Yukon	pf	pf_s	pf_s	pf_s	pf_s		pf_s		pf_s			pf	pf
Northwest Territories	pf						pf_s	pf_s			pf_s		pf
Nunavut	pf		pf_s	pf_s			pf_s				pf_s	pf	pf

## Legend:

pf: publicly funded for all adults.

pf\_s: publicly funded for specific adults (including age group, occupational risk, lifestyle risk and medical conditions).

## REFERENCES

- Bryce, Elizabeth, Joanne Embree, Gerald Evans, Lynn Johnston, Kevin Katz, Allison McGreer, Dorothy Moore, Virginia Roth, Andrew Simor, Kathryn Suh, and Mary Vearncombe. 2012. "AMMI Canada Position Paper: 2012 Mandatory Influenza Immunization of Health Care Workers." *Canadian Journal of Infectious Diseases & Medical Microbiology* 23 (4): 93–5.
- Busby, Colin, Aaron Jacobs, and Ramya Muthukumar. 2017. *In Need of a Booster: How to Improve Childhood Immunization Coverage in Canada*. Commentary 477. Toronto: C.D. Howe Institute.
- Canada. 2014. Public Health Agency of Canada. *Economic Burden of Illness in Canada, 2005–2008*. Ottawa. March. Available online at <http://www.phac-aspc.gc.ca/publicat/ebic-femc/2005-2008/assets/pdf/ebic-femc-2005-2008-eng.pdf>.
- Carman, W.F., A.G. Elder, L.A. Wallace, K. McAulay, A. Walker, G.D. Murray, and D.J. Stott. 2000. "Effects of Influenza Immunization of Health-Care Workers on Mortality of Elderly People in Long-Term Care: A Randomised Controlled Trial." *Lancet* 355 (9198): 93–7.
- Carpiano, Richard M., and Julie A. Bettinger. 2016. "Vaccine Coverage for Kindergarteners: Factors Associated with School and Area Variation in Vancouver, British Columbia." *Vaccine Reports* 6: 50–5.
- Centre for Disease Control and Prevention (CDC). 2017. *Reminder Systems and Strategies for Increasing Childhood Immunization Rates*. Available online at <https://www.cdc.gov/vaccines/hcp/admin/reminder-sys.html>.
- CDC. 2018b. <https://www.cdc.gov/flu/about/qa/vaccineeffect.htm>. online at <https://www.cdc.gov/vaccines/vpd/shingles/public/shingrix/index.html>.
- Chapman, Gretchen B., Meng Li, Helen Colby, and Haewon Yoon. 2010. "Opting In vs Opting Out of Influenza Immunization." *Journal of the American Medical Association* 304 (1): 43–4.
- Chen, Frederick, and Ryan Stevens. 2016. "Applying Lessons from Behavioral Economics to Increase Flu Immunization Rates." *Health Promotion International* 32 (6):1067–73.
- Christini, Amanda Banks, Kathleen A. Shutt, and Karin E. Byers. 2007. "Influenza Immunization Rates and Motivators among Healthcare Worker Groups." *Infection Control and Hospital Epidemiology* 28 (2): 171–7.
- Day, Kathleen M., and Rose A. Devlin. 1998. "The Payoff to Work without Pay: Volunteer Work as an Investment in Human Capital." *The Canadian Journal of Economics* 31 (5): 1179–91.
- De Greeff S.C., Mooi F.R., Schellekens J.F. and H.E. de Melker. 2008. "Impact of acellular pertussis preschool booster immunization on disease burden of pertussis in the Netherlands." *Paediatric Infectious Disease Journal* 27(3) :218–223 doi: 10.1097/INF.0b013e318161a2b9.
- Favin, Michael, Robert Steinglass, Rebecca Fields, Kaushik Banerjee, and Monika Sawhney. 2012. "Why Children Are not Vaccinated: A Review of the Grey Literature." *International Health* 4 (4): 229–38.
- French, Robert, and Philip Oreopoulos. 2016. "Applying Behavioral Economics to Public Policy in Canada." NBER Working Paper 22671. Cambridge, MA: National Bureau of Economic Research.
- Gemmill, Ian. 2015. "Vaccines for Adults: The time has come." 41 (S3). April.
- Gionet, Linda. 2015. "Flu Immunization rates in Canada." Statistic Canada. Available online at <https://www.statcan.gc.ca/pub/82-624-x/2015001/article/14218-eng.htm>.
- Hauri, Anja M., Helmut Uphoff, Volker Gussmann, and Stefan Gawrich. 2006. "Factors that Affect Influenza Vaccine Uptake among Staff of Long-Term Care Facilities." *Infection Control and Hospital Epidemiology* 27 (6): 638–41.

- Hilderman, Tim, Alan Katz, Shelley Derksen, Kari-Lynne McGowan, Dan Chateau, Carol Kurbis, Sandra Allison, Ruth-Ann Soodeen, and Jocelyn Nicole Reimer. 2011. "Manitoba Immunization Study." *Manitoba Centre for Health Policy*. Winnipeg. April.
- Kwong, Jeffrey C., Sarah A. Buchan, Laura C. Rosella, Michael Finkelstein, David Juurlink, Jennifer Isenor, Fawziah Marra, Anik Patel, Margaret L. Russell, Susan Quach, and Nancy Waitle. 2017. "Impact of Pharmacist Administration of Influenza Vaccines on Uptake in Canada." *CMAJ* 189 (4): 146-52.
- Manitoba. 2016. "Manitoba Health, Seniors and Active Living." *Manitoba Annual Immunization Surveillance Report*. January. Available online at <https://www.gov.mb.ca/health/publichealth/surveillance/mims/index.html>.
- MacDonald, Noni E. 2015. "Vaccine Hesitancy: Definition, Scope and Determinants." *Vaccine* 33 (34): 4161-4.
- Milkman, Katherine L., John Beshears, James J. Choi, David Laibson, and Brigitte C. Madrian. 2011. "Using Implementation Intentions Prompts to Enhance Influenza Immunization Rates." *Proceedings of the National Academy of Sciences* 108 (26): 10415-20.
- Mytton, O.T., E.M. O'Moore, T. Sparkes, R. Baxi, and M. Abid. 2013. "Knowledge, Attitudes and Beliefs of Health Care Workers towards Influenza Immunization." *Occupational Medicine (Oxford, England)* 63 (3): 189-95.
- National Institute on Aging. Forthcoming. "The Underappreciated Burden of Influenza Amongst Canada's Older Population."
- Ozawa, Sachiko et al. 2016. Modeling the Economic Burden Of Adult Vaccine-Preventable Diseases in the United States. *Health Affairs* 35, NO. 11.
- Quan K, Tehrani DM, Dickey L, E. Spiritus, D. Hizon, K. Heck, P. Samuelson, E. Kornhauser, R. Zeitany, S. Mancina, L. Thrupp, S.M. Tiso, S.S. Huang. 2012. "Voluntary to mandatory: evolution of strategies and attitudes toward influenza immunization of healthcare personnel." *Infectious Control Hospital Epidemiology*. 33(1) pp:63-70. January.
- Quebec. 2015. "Enquete sur la couverture vaccinale des enfants de 1 an et 2 and au Quebec in 2014." Institute national de sante publique.
- Ragan, Christopher. 2010. "Two Policy Challenges Driven by Population Aging." *Policy Options*: 72-79.
- Roberto, Christina A., and Ichiro Kawachi, eds. 2015. *Behavioral Economics and Public Health*. Oxford: Oxford University Press.
- Robson, William B.P., Colin Busby, and Aaron Jacobs. 2017. "The Fiscal Implications of Canadians' Working Longer." E-Brief 268. Toronto: C.D. Howe Institute.
- Schwartz, Kevin L. MD, Jeffrey C. Kwong, MD, Shelley L. Deeks, MD, Michael A. Campitelli, MPH, Frances B. Jamieson, MD, Alex Marchand-Austin, MSc, Therese A. Stukel, PhD, Laura Rosella, PhD, Nick Daneman, MD, Shelly Bolotin, PhD, Steven J. Drews, PhD, Heather Rilkoff, MPH, and Natasha S. Crowcroft, MD(Cantab). 2016. "Effectiveness of Pertussis Immunization and Duration of Immunity." *CMAJ* 188 (16). November.
- Skowronski, D.M., N.Z. Janjua, E.P. Tsafack, M. Ouakki, L. Hoang, and G. De Serres. 2012. "The Number Needed to Vaccinate to Prevent Infant Pertussis Hospitalization and Death through Parent Cocoon Immunization." *Clinical Infectious Diseases* 54 (3): 318-27.
- Simerska P.1., P.M. Moyle, C. Olive, L. Toth . 2009. "Oral vaccine delivery--new strategies and technologies." *Current Drug Delivery* 6(4):347-58. Epub 2009 Aug 1.
- Statistics Canada. 2016. "Vaccine Uptake in Canadian Adults: Results from the 2014 National Immunization Coverage Survey." Available online at [https://www.canada.ca/en/public-health/services/publications/healthy-living/vaccine-uptake-canadian-adults-results-2014-adult-national-immunization-coverage-survey.html#fnt1\\_1](https://www.canada.ca/en/public-health/services/publications/healthy-living/vaccine-uptake-canadian-adults-results-2014-adult-national-immunization-coverage-survey.html#fnt1_1)
- Supporting Active Ageing Through Immunisation (SAATI). 2013. "Adult Immunization: A Key Component of Healthy Ageing." Available online at <https://www.ifa-fiv.org/wp-content/uploads/2015/09/SAATI-Report-2013.pdf>.



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- Toronto. 2012. Medical Officer of Health. *Inequalities and Immunization Rates in Toronto School Children*. Toronto: Board of Health. January. Available online at <https://www.toronto.ca/legdocs/mmis/2012/hl/bgrd/backgroundfile-44266.pdf>.
- United States of America. 2016. U.S. Department of Health and Human Services National Vaccine Program Office. *National Adult Immunization Plan*. Available online at <https://www.hhs.gov/sites/default/files/nvpo/national-adult-immunization-plan/naip.pdf>.
- Volpp, Kevin G., and David A. Asch. 2017. "Make the Healthy Choice the Easy Choice: Using Behavioral Economics to Advance a Culture of Health." *QJM: An International Journal of Medicine* 110 (5): 271-5.
- Zhang, J., A. Ohinmaa, T.H. Nguyen, L. Mashinter, A. Hanrahan, J. Loewen, W. Vaudry, and P. Jacobs. 2008. "Determinants for Immunization Coverage by Age 2 in a Population Cohort in the Capital Health Region, Edmonton, Alberta." *Canada Communicable Disease Report* 34 (9): 1-11.

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