

Trends in influenza vaccination in Canada, 1996/1997 to 2005

Jeff C. Kwong, Laura C. Rosella and Helen Johansen

Abstract

Objectives

This article reports recent trends in influenza vaccination rates in Canada, provides data on predictors of vaccination in Canada for 2005, and examines longer-term effects of Ontario's universal influenza immunization program on vaccine uptake.

Data sources

Data are from the 1996/1997 National Population Health Survey (NPHS) and the 2000/2001, 2003, and 2005 Canadian Community Health Survey (CCHS).

Analytical techniques

NPHS and CCHS data were used to estimate influenza vaccination rates of the population aged 12 or older. The Z test was used to assess differences between surveys, and the chi-squared test for trend was used to examine trends over time. Logistic regression was used to identify predictors of vaccination and to compare the odds of being vaccinated in Ontario versus other provinces.

Main results

Nationally, influenza vaccination rates rose from 15% in 1996/1997 to 27% in 2000/2001, stabilized between 2000/2001 and 2003, and increased further to 34% by 2005. Vaccination rates for most high-risk groups still fall short of national targets. Ontarians continue to be more likely to be vaccinated than are residents of any other province, while residents of two of the territories—Nunavut and the Northwest Territories—are even more likely to be vaccinated than are Ontarians.

Keywords

preventive health services, community health services, population-based health planning

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Annual influenza epidemics continue to place a significant burden on society in terms of morbidity, mortality and lost productivity.¹⁻⁵ For healthy adults and older children, most influenza infections are not severe, but for vulnerable populations such as the elderly, young children, and those with chronic medical conditions, influenza can lead to serious complications and even death.^{6,7}

The segments of the population for whom influenza vaccination is recommended have been broadened over time. The National Advisory Committee on Immunization (NACI) currently recommends that those at increased risk of serious complications of influenza infection and those capable of transmitting influenza to these vulnerable groups should receive influenza vaccines annually.⁸ The Committee also states that individuals who wish to reduce their chances of suffering from influenza should receive the vaccine.

In 1993, a national consensus conference on influenza set target vaccination coverage rates of 70% for adults aged 65 or older and for all adults with chronic medical conditions.⁹ These targets were raised to 80% at another

consensus conference in 2005.¹⁰ Most provinces and territories had already established publicly funded programs to offer free influenza vaccinations to vulnerable populations and to those who have contact with vulnerable populations, including health care workers.¹¹

In 2000, Ontario introduced a universal influenza immunization program (UIIP) to provide free vaccines to the entire population aged 6 months or older.¹² A previous study found that between that time and 2003, vaccination rates rose more in Ontario than in the other provinces.¹³

The remaining provinces continue with targeted immunization programs, although the groups that are covered vary.¹⁴ Among the territories, Yukon has provided free influenza vaccines to all residents aged 18 or older since 1999¹⁵; Northwest Territories has offered free influenza vaccines since 2003¹⁶; and Nunavut introduced universal vaccination in the fall of 2005.¹⁷

Earlier work reported on influenza vaccination rates for 1996/1997, 2000/2001,¹⁸ and 2003.¹⁹ The objectives of this study are to report on the latest trends in vaccination rates in Canada for the entire period from 1996/1997 to 2005, to provide more in-depth data on rates and predictors of vaccination in Canada for 2005, and to examine longer-term effects of Ontario's UIIP on vaccine uptake.

Methods

Data sources

This analysis used the master files for the 1996/1997 cycle of the National Population Health Survey (NPHS) and the first three cycles of the Canadian Community Health Survey (CCHS), conducted in 2000/2001 (cycle 1.1), 2003 (cycle 2.1), and 2005 (cycle 3.1). These national population-based health surveys cover the household population. They exclude residents of Indian reserves, institutions (for example, nursing homes and prisons), and some remote areas; full-time members of the Canadian Forces; and residents (civilian and military) of Canadian Forces bases. This study pertains to the population aged 12 or older in the 10 provinces and three territories.

National Population Health Survey

The biennial National Population Health Survey (NPHS), which began in 1994/1995, has both cross-sectional and longitudinal components, with data collected mainly through telephone interviews. Details of the design and sampling techniques have been previously described.¹⁷

Respondents to the cross-sectional component of NPHS 1996/1997 were surveyed from June 1996 to August 1997, with an overall response rate of approximately 83%. The sample for this study comprised 73,402 respondents aged 12 or older, weighted to represent an approximate population of 24.6 million.

Canadian Community Health Survey

The Canadian Community Health Survey (CCHS), which began in 2000/2001, is a cross-sectional survey conducted through telephone and in-person interviews over a two-year repeating cycle. Data for cycle 1.1 were collected over 12 months starting in September 2000, but questions on influenza vaccination were asked only in the fourth quarter (June to August 2001). By contrast, these questions were asked in all four quarters for cycles 2.1 and 3.1 (January to December of both 2003 and 2005). Details of the CCHS design and sampling techniques have been previously described.¹⁸

The response rates for the CCHS 1.1, 2.1, and 3.1 were approximately 85%, 81%, and 79%. The samples used in this study were 35,187, 133,026, and 132,947 respondents, weighted to represent populations of approximately 25.9 million, 26.5 million, and 27.1 million, respectively. Selected characteristics of the 2005 sample are presented in the appendix (Table A).

Definitions and outcome measures

Survey respondents were asked: "Have you ever had a flu shot?" Those who responded affirmatively were asked when they had last been vaccinated. Those who reported having had a flu shot within the last 12 months were considered to be actively immunized.

To determine chronic condition status, respondents were asked if they had any “long-term conditions that had lasted or were expected to last 6 months or more and that had been diagnosed by a health professional,” and a list of conditions was read to them. Those who reported having heart disease, diabetes, cancer, effects of stroke, asthma, or emphysema/chronic bronchitis were considered to have a chronic condition for which influenza immunization is recommended.

Two sets of age groups were considered in this analysis: 1) 12 to 19, 20 to 49, 50 to 64, 65 to 74, 75 to 84, 85 or older; and 2) 12 to 49, 50 to 64, 65 or older.

Risk groups were defined as high or low. Those deemed high risk were 65 or older, or aged 12 to 64 with at least one chronic condition. Individuals aged 12 to 64 with no chronic conditions were considered low risk.

The definitions of education, household income, smoking status, self-reported health, and having a regular doctor have been previously described.¹³

Statistical analysis

Cross-tabulations were used to estimate the proportion of people who reported having had an influenza vaccination in the previous year for the overall population aged 12 or older, for various subgroups of the population defined by socio-demographic characteristics, and by risk group for influenza immunization. Cross-sectional vaccine coverage rates between consecutive surveys were compared using Z tests for proportions. A chi-squared test for trend was performed to examine trends over time.

Multivariate analyses to identify independent predictors of vaccination included age group, sex, presence of a chronic condition, household income, smoking status, having a regular doctor, self-perceived health status, and province of residence as covariates in a logistic regression model. The model excluded education because many people younger than 20 have not completed their education. Logistic regression models were also used to examine the odds of being vaccinated in Ontario compared with other provinces. These models were

stratified by age group (12 to 49, 50 to 64, and 65 or older) and by chronic condition status, and adjusted for age as a continuous variable, sex, household income, smoking status, having a regular doctor, and self-perceived health status.

All estimates were calculated using bootstrap survey weights to accurately reflect the demographics of the Canadian population and to account for the survey sampling design of the NPHS and CCHS. Variance estimates were calculated using bootstrap survey weights.²² All tests were two-sided, and a significance level of $p < 0.05$ was used. As a result of the large sample sizes, small changes were statistically significant. Consequently, only changes in vaccination rates greater than 5 percentage points were considered meaningful. All statistics were computed using SAS statistical software (version 9.1, SAS Institute Inc., Cary, NC).

Results

Trends in influenza vaccination rates

At the national level, influenza vaccination rates approximately doubled between 1996/1997 and 2000/2001; were essentially unchanged between 2000/2001 and 2003; and increased further between 2003 and 2005 (Table 1). This pattern was consistent between sexes and across age groups except 50- to 64-year-olds, among whom vaccination rates rose during all three intervals. For people reporting chronic conditions, only those suffering the effects of stroke did not have an increase in vaccine uptake between 2003 and 2005. Vaccination rates increased over time in all provinces and territories, with most mirroring the national trend. Ontario had the highest rates at each of the four survey dates (rising from 18% to 42%), while Newfoundland and Labrador generally had the lowest (a rise from 11% to 22%).

Vaccination rates rose among both high- and low-risk groups nationally and in all provinces and territories, except for seniors in Newfoundland and Labrador, Prince Edward Island, Yukon and Nunavut, and younger people with chronic conditions in the territories (Table 2).

Table 1
Percentage vaccinated for influenza, by selected characteristics, household population aged 12 or older, Canada, 1996/1997, 2000/2001, 2003 and 2005

	1996/ 1997	2000/ 2001	2003	2005
Overall (excluding territories)	15	27*	28	34*
Sex				
Males	13	24*	25*	31*
Females	16	30*	30	36*
Age group				
12 to 49	7	18*	17	23*
12 to 19	9	17*	17	23*
20 to 49	7	18*	17*	23*
50 to 64	17	30*	35*	42*
65 or older	51	67*	67	71*
65 to 74	47	63*	63	66*
75 to 84	60	74*	73	77*
85 or older	51	72*	73	78*
Chronic conditions†				
One or more	31	45*	47*	53*
Heart disease	50	59*	62	68*
Effects of stroke	46	67*	63	61
Diabetes	38	58*	59	64*
Cancer	45	51	57*	64*
Asthma	22	36*	38	43*
Emphysema or chronic bronchitis	33	51*	50	57*
No conditions	12	23*	23	29*
Province or territory				
Newfoundland and Labrador	11	11	16*	22*
Prince Edward Island	16	21*	23	31*
Nova Scotia	19	23*	31*	39*
New Brunswick	15	19*	22*	28*
Quebec	8	18*	20*	25*
Ontario	18	36*	35	42*
Manitoba	14	22*	20	28*
Saskatchewan	13	19*	24*	28*
Alberta	15	23*	23	28*
British Columbia	17	26*	27	33*
Yukon	..	26	21	32*
Northwest Territories	..	25	24	37*
Nunavut	..	24	25	41*

* significantly different from estimate from previous survey ($p < 0.05$)

.. not available

Note: All chi-squared tests for trend were significant ($p < 0.05$).

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Progress toward targets

In 2005, vaccination rates among the elderly compared favourably with the 70% target set for seniors and people with chronic conditions in 1993. However, the new 80% target set in 2005 was reached only by those 75 or older with chronic conditions (Chart 1). Vaccination rates among people younger than 65 with chronic conditions fell far short of both targets.

Predictors of vaccination

In 2005, characteristics that were associated with an increased likelihood of getting a flu shot included female sex, advancing age, presence of a chronic condition, increasing household income, having a regular doctor, and self-reported poor/fair health; being a current smoker was associated with decreased odds of vaccination (Table 3). Residing in any province other than Ontario was associated with lower odds of being vaccinated, compared with Ontario; people in Newfoundland and Labrador were the least likely to report vaccination. Residents of Nunavut had over twice the odds of Ontarians of having received a flu shot, and the odds for those from the Northwest Territories were also significantly higher. Although everyone aged 18 or older in Yukon was covered by an influenza vaccination program, residents of this territory were less likely to be vaccinated than were people in Ontario.

Reasons for not getting vaccinated

Among seniors (65 or older) who reported not having had a flu shot in the previous year, the proportion who felt that it was not necessary has decreased over time, and the percentage citing “other” reasons for not getting vaccinated has risen (Table 4). The percentage reporting not being vaccinated because of a previous bad reaction has grown slightly since the mid-1990s, as might be expected with the increasing numbers getting vaccinated. Yet despite consistently higher vaccination rates in Ontario throughout the period, the proportion of Ontarians reporting a previous bad reaction did not differ from that in the other provinces (data not shown).

Effect of universal vaccination in Ontario

Among all age groups, with and without chronic conditions, vaccination rates in Ontario were higher than in other provinces at all four survey dates (Chart 2). For those aged 12 to 49, the gap between Ontario and other provinces that appeared in 2000/2001 was reduced slightly among those with chronic conditions, but not among those without. A similar pattern was evident for 50- to 64-year-olds. For

Table 2

Percentage vaccinated for influenza, by age, presence of chronic conditions and province or territory, household population aged 12 or older, Canada, 1996/1997, 2000/2001, 2003 and 2005

	Low-risk group					High-risk groups									
	Aged 18 to 64 with no chronic conditions [†]					Aged 12 to 64 with at least one chronic condition [†]					Aged 65 or older				
	1996/ 1997	2000/ 2001	2003	2005	p-value [†]	1996/ 1997	2000/ 2001	2003	2005	p-value [†]	1996/ 1997	2000/ 2001	2003	2005	p-value [†]
Canada (excluding territories)	7	18*	19	25*	<0.001	20	33*	36*	42*	<0.001	51	67*	67	71*	<0.001
Province or territory															
Newfoundland and Labrador	5	4 ^E	8*	14*	<0.001	20 ^E	14 ^E	26*	28	0.001	47	49	50	58*	0.06
Prince Edward Island	7 ^E	10	15*	21*	<0.001	22 ^E	31	25	38*	<0.001	56	65	63	70	0.09
Nova Scotia	8	13*	19*	27*	<0.001	34 ^E	29	43*	52*	<0.001	60	71*	74	77	<0.001
New Brunswick	8	9 ^E	14*	18*	<0.001	23 ^E	29	28	38*	0.002	48	62*	57	64*	<0.001
Quebec	3 ^E	10*	11	16*	<0.001	10 ^E	20*	29*	32*	<0.001	34	59*	59	62*	<0.001
Ontario	10	27*	26	34*	<0.001	24	46*	44	50*	<0.001	60	72*	74	77*	<0.001
Manitoba	6	12*	10	17*	<0.001	18	29 ^E	26	38*	<0.001	52	62*	60	71*	<0.001
Saskatchewan	4 ^E	9*	13*	19*	<0.001	13 ^E	20 ^E	29*	31	<0.001	53	63*	63	66	<0.001
Alberta	9	16*	17	20*	<0.001	21	26	27	37*	<0.001	59	69*	64	69*	<0.001
British Columbia	9	16*	18	23*	<0.001	23	31	35	41*	<0.001	52	68*	69	72*	<0.001
Yukon	..	21 ^E	18	27*	0.006	..	35 ^E	25	34	0.80	..	66 ^E	50	73*	0.15
Northwest Territories	..	20	19	33*	<0.001	..	38 ^E	36	47	0.14	..	56 ^E	64	78	0.03
Nunavut	..	21	22	39*	<0.001	..	46	34 ^E	46 ^E	0.17	..	53	74*	89	0.11

[†] chi-squared test for trend

[‡] heart disease, effects of stroke, diabetes, cancer, asthma, emphysema/chronic bronchitis

* significantly different from estimate from previous survey ($p < 0.05$)

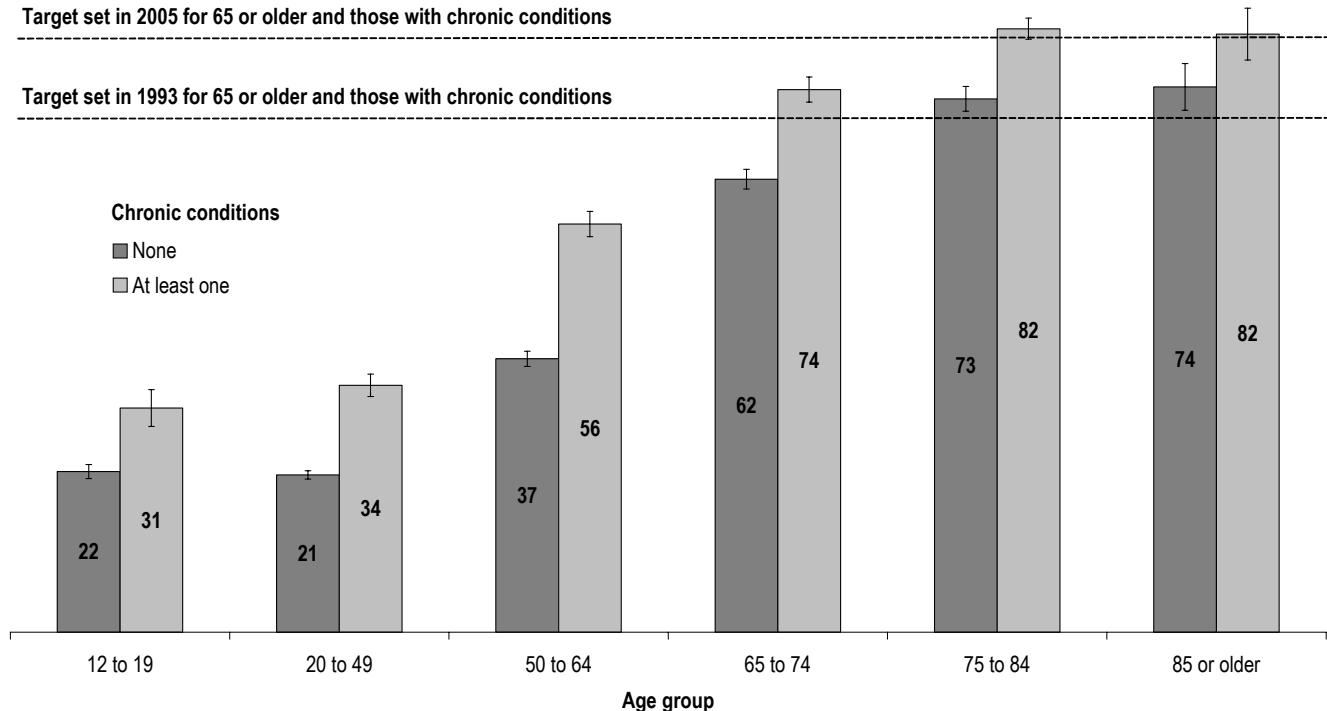
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^E use with caution (coefficient of variation 16.6% to 33.3%)

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Chart 1

Percentage vaccinated for influenza, by age group and presence of chronic conditions, household population aged 12 or older, Canada, 2005



┆ = 95% confidence interval

Source: 2005 Canadian Community Health Survey, cycle 3.1.

Table 3
Rates of and adjusted odds ratios for influenza vaccination, by selected characteristics, household population aged 12 or older, Canada, 2005

	Vaccination rate	Adjusted odds ratio	95% confidence interval
Total	34
Sex			
Males [†]	31	1.00	...
Females	36*	1.22*	1.17 to 1.28
Age group			
12 to 19 [†]	23	1.00	...
20 to 49	23	1.10*	1.03 to 1.19
50 to 64	42*	2.40*	2.21 to 2.60
65 to 74	66*	6.55*	5.98 to 7.18
75 to 84	77*	10.57*	9.55 to 11.69
85 or older	78*	10.27*	8.57 to 12.31
At least one chronic condition[‡]			
No [†]	29	1.00	...
Yes	53*	1.89*	1.79 to 1.99
Household income			
Lowest [†]	34	1.00	...
Lower-middle	37*	1.05	0.96 to 1.14
Upper-middle	33	1.13*	1.04 to 1.23
Highest	33	1.28*	1.18 to 1.39
Smoking status			
Never [†]	33	1.00	...
Former	39*	1.03	0.98 to 1.09
Daily or occasional	25*	0.74*	0.70 to 0.79
Has regular doctor			
No [†]	15	1.00	...
Yes	37*	2.01*	1.86 to 2.16
Self-reported health			
Good or very good or excellent	32	1.00	...
Poor or fair	50*	1.23*	1.14 to 1.32
Province or territory			
Ontario [†]	42	1.00	...
Newfoundland and Labrador	22*	0.33*	0.29 to 0.37
Prince Edward Island	31*	0.54*	0.46 to 0.63
Nova Scotia	39*	0.77*	0.70 to 0.86
New Brunswick	28*	0.45*	0.40 to 0.49
Quebec	25*	0.42*	0.40 to 0.45
Manitoba	28*	0.47*	0.43 to 0.52
Saskatchewan	28*	0.46*	0.42 to 0.50
Alberta	28*	0.52*	0.48 to 0.57
British Columbia	33*	0.61*	0.57 to 0.65
Yukon	32*	0.72*	0.57 to 0.90
Northwest Territories	37*	1.36*	1.09 to 1.70
Nunavut	41	2.20*	1.65 to 2.93

[†] reference category

[‡] heart disease, effects of stroke, diabetes, cancer, asthma, emphysema or chronic bronchitis

* significantly different from reference category (p < 0.05)

... not applicable

Source: 2005 Canadian Community Health Survey, cycle 3.1.

Table 4
Reasons for not having influenza vaccination, household population aged 65 or older, Canada excluding territories, 1996/1997, 2000/2001, 2003 and 2005

	1996/1997	2000/2001	2003	2005	p-value [†]
Seniors not vaccinated ('000)	1,567	1,146	1,150	1,071	...
Reason (%)					
Unnecessary	71	63*	66	61*	<0.001
Previous bad reaction	9	9	12*	13	0.01
Did not get around to it	12	13	11	9*	<0.001
Fear	3	3 ^E	6*	5	0.49
Doctor said unnecessary	6	5	6	3*	<0.001
Not available	2 ^E	F	1	1	<0.001
Other	1 ^E	7*	1*	16*	<0.001

[†] chi-squared test for trend

* significantly different from estimate from previous survey (p < 0.05)

^E use with caution (coefficient of variation 16.6% to 33.3%)

^F too unreliable to be published (coefficient of variation greater than 33.3%)

... not applicable

Note: Because more than one answer was accepted, totals add to more than 100%.

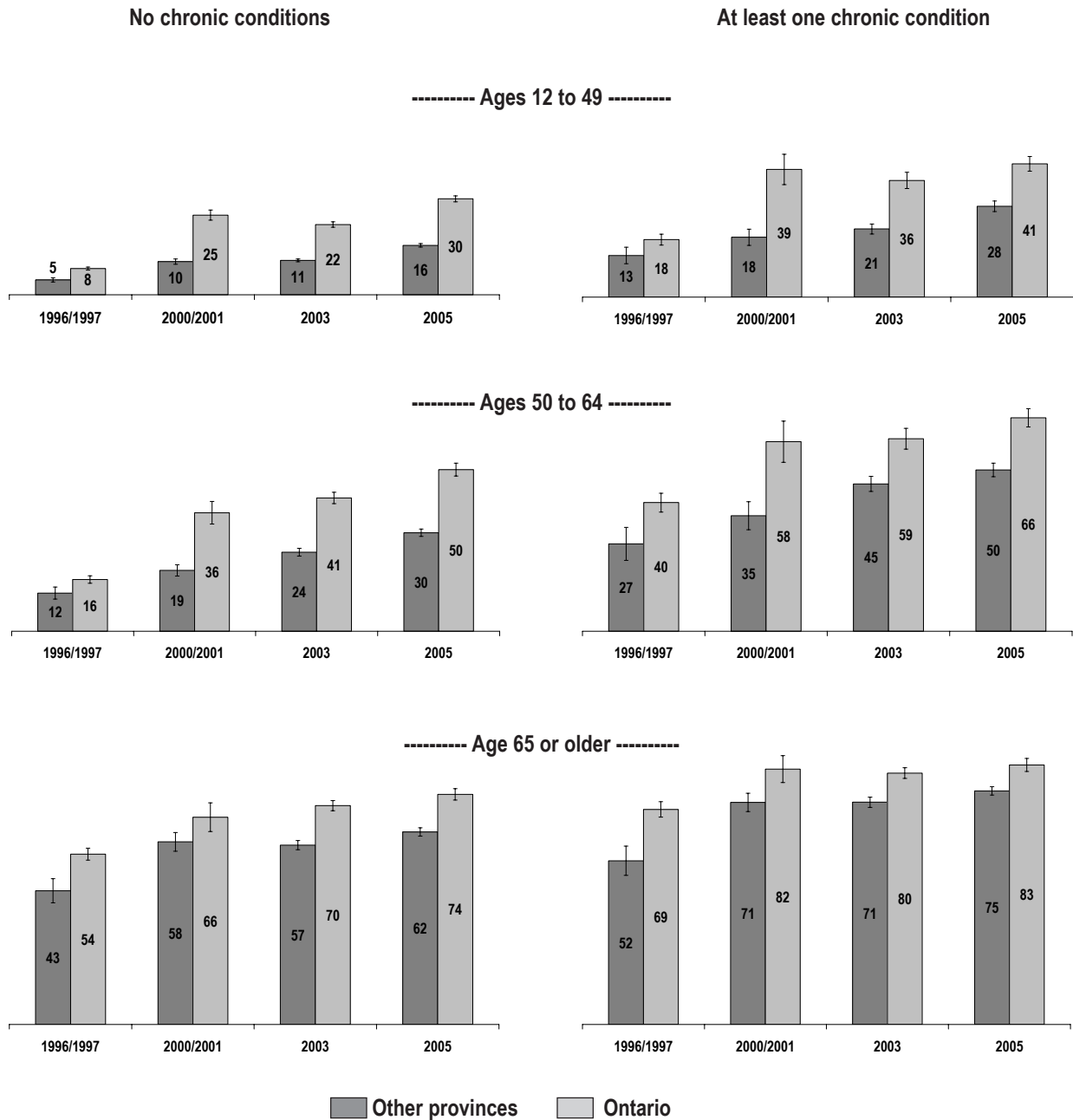
Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

older adults, the difference between Ontario and other provinces has narrowed slightly over time.

In the adjusted analyses, the odds of vaccination were almost always significantly greater for Ontarians, compared with residents of the other provinces (Chart 3). Among people aged 12 to 49 with chronic conditions, the OR increased from 1.21 (95% confidence interval [C.I.] 0.91-1.62) in 1996/1997 to 2.74 (95% C.I. 2.06-3.65) in 2000/2001, but then declined to 1.67 (95% C.I. 1.45-1.91) by 2005, suggesting some “catch-up” by other provinces. A similar pattern was observed for those aged 12 to 49 and 50 to 64 without chronic conditions. The differences between the surveys for 50- to 64-year-olds with chronic conditions were not statistically significant, likely because of the smaller sample size. As expected, relatively few differences over time were noted for those aged 65 or older, since seniors have traditionally been included in most targeted vaccination programs.

Chart 2

Percentage vaccinated for influenza, by age group and presence of chronic conditions, household population aged 12 or older, Ontario versus other provinces combined, 1996/1997, 2000/2001, 2003 and 2005

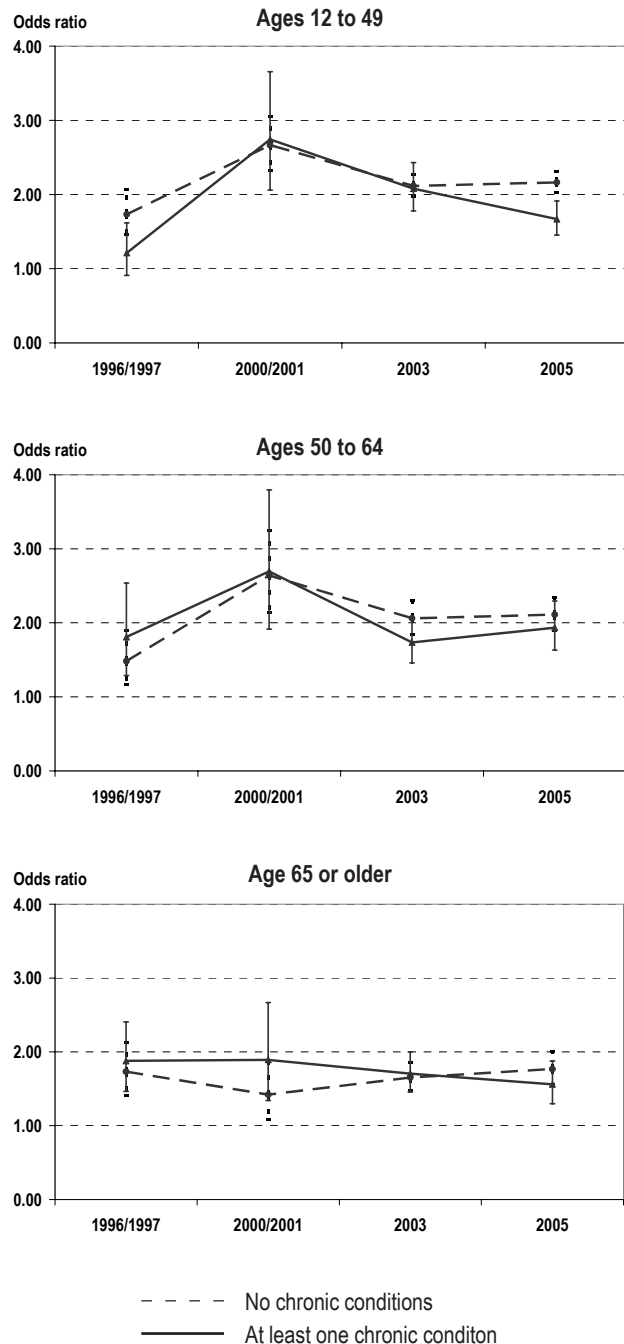


I = 95% confidence interval

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Chart 3

Adjusted odds ratios for influenza vaccination, by age group and presence of chronic conditions, household population aged 12 or older, Ontario versus other provinces combined, 1996/1997, 2000/2001, 2003 and 2005



□ = 95% confidence interval

Note: Adjusted for sex, age group, presence of chronic conditions, household income, smoking status, having regular doctor, self-reported health, and province or territory.

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Discussion

As of 2005, influenza vaccination rates were increasing across Canada after an apparent levelling off in 2003. Even so, many who are considered to be at high risk for serious complications from influenza infection, specifically younger people with chronic conditions and healthy seniors, are not being vaccinated. Consequently, the vaccination rates for these high-risk groups fall short of national targets. Ontarians are still more likely to be vaccinated than are residents of any other province, likely reflecting Ontario's universal vaccination program. Nunavut achieved the highest vaccination rates among the elderly, as well as among young, healthy individuals, even before introduction of their universal vaccination program.

The explanation for the "rise-plateau-rise" pattern is a matter of speculation, since the surveys did not ask respondents why they got vaccinated. The past decade, however, has seen a number of outbreaks of novel viral respiratory diseases around the world. First detected in Hong Kong in 1997, H5N1 avian influenza has caused several outbreaks and is associated with high mortality rates among poultry, humans and other species.²³ Other avian influenza viruses such as H7N7 (the Netherlands, February 2003)²⁴ and H7N3 (British Columbia, February 2004)²⁵ have also caused disease in humans. Because almost forty years have elapsed since the last influenza pandemic in 1968, leading to consensus among experts that the world is overdue for a pandemic, and given the global increase in avian influenza activity, public health officials have stepped up pandemic planning, an important component of which is educating the public about the importance of potentially mitigating activities such as annual vaccination against seasonal human influenza.²⁶ In addition to these growing concerns about pandemic influenza, the spring 2003 epidemic of Severe Acute Respiratory Syndrome (SARS) coronavirus, which was associated with 438 cases and 44 deaths in Canada,²⁷ heightened media attention on infectious diseases. Collectively, these outbreaks may have influenced flu vaccination rates between 2003 and 2005.

The impact of Ontario's UIIP has apparently been sustained over time, with the province persistently having higher vaccination rates. Immediately after introduction of the program, the adjusted relative effect on vaccination of being in Ontario rather than the other provinces spiked for younger age groups. A subsequent slight drop-off reflected rising rates in other provinces rather than declines in vaccine uptake among Ontarians. By contrast, the trend was flat among the elderly, who were previously covered in most provinces. This further bolsters the arguments that the increases observed among younger people may be attributed to the UIIP, and that universal or age-based recommendations may be more effective than selective targeting of people with chronic conditions if the goal is to maximize vaccination rates in the entire population.

Nonetheless, vaccination rates are not solely determined by the type of program employed. Although Yukon has offered free flu shots to everyone aged 18 or older since 1999, its vaccination rates are generally the lowest among the territories. And, even without a universal program, Nova Scotia has matched Ontario's vaccination rates among high-risk groups.

This study has a number of limitations. The NPHS and CCHS exclude some important populations who are at very high risk of complications from influenza infections, notably, children younger than 12 and the institutionalized elderly. Also, these surveys do not ask about all the chronic conditions for which influenza vaccination is recommended, such as immunodeficiency, renal disease, anemia and hemoglobinopathy; therefore, the group identified in this study as having one or more chronic conditions is actually a subset of those with important chronic conditions.²⁵ Another limitation is that it is not possible to confirm the accuracy of survey participants' responses, although previous studies have demonstrated that self-

reported influenza immunization status is reasonably accurate.²⁶⁻²⁸ The NPHS and the CCHS differed slightly in terms of timing of survey administration and data collection, both of which may have affected participant recall. Unfortunately, annual data are not available, so it is not possible to examine changes in risk factors and vaccination rates between surveys. Inferences about trends over time are limited because of the cross-sectional nature of the data. Associations between predictors of vaccination status and respondent characteristics in 2005 are also cross-sectional, thus limiting the ability to make inferences about temporal associations between individual characteristics and vaccination status. Finally, provincial health system variables, such as vaccine delivery methods (for example, school-, workplace-, and community-based clinics) and policy incentives (for example, remuneration of vaccine providers), were not available for this analysis, although they might have helped to explain the strong provincial effect in vaccination rates.

Despite these limitations, it is safe to conclude that influenza vaccination rates across Canada have more than doubled between 1996/1997 and 2005. However, targets for important risk groups, especially those younger than 65 with chronic conditions, are still not being met in any province or territory. Therefore, additional strategies and/or efforts will likely be needed to achieve further increases in vaccine uptake. The many available interventions to increase influenza vaccination coverage rates by targeting clients, providers, and/or systems have been previously and extensively reviewed.³²⁻³⁴ As well, it has been suggested that the development of immunization registries would facilitate monitoring trends in vaccine uptake and informing policymaking for vaccine programs at the population level.^{35,36} ●

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Appendix

Table A
Distribution of selected characteristics, household population aged 12 or older, 2005

	Sample size	Estimated population	
		'000	%
Total	132,947	27,132	100.0
Males	60,910	13,372	49.3
Females	72,037	13,760	50.7
Age group			
12 to 49	74,359	17,397	64.1
12 to 19	16,397	3,354	12.4
20 to 49	57,962	14,043	51.8
50 to 64	30,391	5,807	21.4
65 or older	28,197	3,928	14.5
65 to 74	15,032	2,245	8.3
75 to 84	10,332	1,356	5.0
85 or older	2,833	327	1.2
Education			
Less than secondary graduation	37,391	6,282	23.9
Secondary graduation	19,315	3,998	15.2
At least some postsecondary	72,839	16,054	61.0
Household income			
Lowest	12,812	1,752	7.6
Lower-middle	24,175	4,057	17.7
Upper-middle	39,205	7,748	33.8
Highest	37,356	9,392	40.9
Smoking status			
Never	48,349	10,683	39.6
Former	53,043	10,424	38.6
Daily or occasional	30,957	5,875	21.8
Has regular doctor			
Yes	112,732	23,232	85.7
No	20,042	3,868	14.3
Self-reported health			
Poor or fair	18,344	3,028	11.2
Good or very good or excellent	114,438	24,077	88.8
Chronic conditions[†]			
One or more	29,883	5,174	19.1
Heart disease	8,561	1,288	4.8
Effects of stroke	2,003	299	1.1
Diabetes	8,200	1,325	4.9
Cancer	2,293	371	1.4
Asthma	11,766	2,250	8.3
Emphysema or chronic bronchitis	5,752	908	3.4
No conditions	102,688	21,886	80.9
Province or territory			
Newfoundland and Labrador	4,111	449	1.7
Prince Edward Island	2,031	117	0.4
Nova Scotia	5,066	796	2.9
New Brunswick	5,100	638	2.4
Quebec	29,891	6,473	23.9
Ontario	41,766	10,570	39.0
Manitoba	7,352	935	3.4
Saskatchewan	7,765	788	2.9
Alberta	11,800	2,686	9.9
British Columbia	15,407	3,602	13.3
Yukon	868	27	0.1
Northwest Territories	1,007	35	0.1
Nunavut	783	15	0.1
Had flu shot in past year			
Yes	47,333	8,881	33.8
No	82,126	17,430	64.2

[†] heart disease, effects of stroke, diabetes, cancer, asthma, emphysema or chronic bronchitis

Source: 2005 Canadian Community Health Survey, cycle 3.1.