H1N1 vaccination

by Heather Gilmour and Nancy Hofmann

Abstract
Early results (January to April) from the 2010 Canadian Community Health Survey show that an estimated 41% of Canadians (excluding those in the territories) aged 12 or older had been vaccinated for H1N1 by April 2010. The percentages were higher in the Atlantic provinces, Quebec and Saskatchewan than in Canada overall. Relatively high percentages of females and people aged 45 or older were vaccinated; the percentage of immigrants who had done so was relatively low. Being in a priority group (health-care worker, having children younger than 5 in the household, or having a chronic condition that could increase the risk for complications from H1N1) increased the likelihood of vaccination. A history of seasonal flu vaccination and having a regular doctor were also associated with H1N1 vaccination. Nearly three-quarters of those who had not been vaccinated reported that they did not think it was necessary.

Keywords
Immunization, influenza, pandemic, public health

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The H1N1 flu virus, a new influenza strain to which most people have no natural immunity, emerged in April 2009.[1] In June of that year, the World Health Organization (WHO) announced "the start of the 2009 influenza pandemic"[2] and raised its influenza pandemic alert to phase 6, the highest level. Phase 6 indicates that the same identified virus has caused sustained outbreaks in two or more countries in one WHO region and in at least one other country in another WHO region. A year later, 214 countries had reported H1N1 cases, with more than 18,000 deaths world-wide.[3] In Canada, 428 people died from H1N1, and thousands more were infected.[4] In August 2010, the WHO announced that the world was "now in the post-pandemic period."[5]

An integral part of the public health response to pandemic influenza is prevention through vaccination.[6] The Public Health Agency of Canada advised Canadians that the H1N1 vaccine was the best way to protect themselves and others from infection.[7] The federal government oversaw the purchase and distribution of the vaccine to the provinces, but each province was ultimately responsible for determining how it would be administered in its jurisdiction.[8] Beginning in the fall of 2009, vaccination clinics across the country offered the vaccine to Canadians.

Based on data from the 2010 Canadian Community Health Survey (CCHS), this study examines uptake of the H1N1 vaccine. Socio-demographic, priority group and health service characteristics of those who were vaccinated, along with reasons for not doing so, are analyzed.

Four in ten

By April 2010, an estimated 41% of Canadians aged 12 or older (11.6 million) living in the 10 provinces had had an H1N1 flu shot (Table 1). Data to

The data

Estimates are based on data collected from the 2010 Canadian Community Health Survey (CCHS) between January and April 2010. The CCHS covers the household population aged 12 or older in all provinces. It excludes members of the Canadian Forces; residents of Indian reserves, institutions, and some remote areas; and military and civilian residents of Canadian Forces bases. Data were collected by telephone (63.6%) and personal (36.4%) interview from a sample of 20,855 individuals. The response rate was 73.1%.

Respondents were asked, "Have you had the H1N1 shot?" Those who did not receive the shot were asked, "What are the reasons that you have not had the H1N1 flu shot?" The interviewer read a list of reasons that included: "have not gotten around to it," "you did not think it was necessary," "your doctor did not think it was necessary," "waiting time was too long," "bad reaction to previous shot." Response categories of "not available at time required," "not available at all in the area," and "did not know where to go/uninformed" were grouped as *access problems*. "Personal or family responsibilities," "transportation problems," and being "unable to leave the house because of a health problem" were grouped as *personal barriers*. The numbers indicating that they did not receive the H1N1 vaccination because of a "language problem" or "cost" were too low to be released and were included in the *other* category. Respondents could indicate as many reasons as applied. The H1N1 questions were asked only of respondents who were answering on their own behalf; proxy responses were not accepted.

To account for the complex design of the CCHS, the bootstrap method[9,10] was used to estimate standard errors, coefficients of variation and confidence intervals. The statistical significance level was set at <0.05.

Respondents were categorized into five *age groups*: 12 to 19; 20 to 44; 45 to 64; 65 to 84; and 85 or older.

Province pertains to the province of residence at the time of the interview. (Information about H1N1 vaccination in the three territories will be available when data for the entire year have been processed.)

Among respondents aged 25 or older, *marital status* was categorized as: married/common-law; separated/ divorced/ widowed; and single.

Highest level of household education refers to the highest level of educational attainment of at least one household member: less than secondary graduation, secondary graduation, some postsecondary, and postsecondary graduation.

Immigrant status is based on Canadian citizenship by birth and immigration to Canada. Respondents who were not born Canadian citizens and identified a year of immigration to Canada were classified as immigrants.

Health-care workers were identified based on the North American Industry Classification System (NAICS) 2002: Ambulatory Health Care Services (code 621), Hospitals (622), and Nursing and Residential Care Facilities (623).[11] The classification was applied to respondents aged 15 to 75 who indicated that they had a job in the week before their CCHS interview.

Children aged 5 or younger in household indicates if a child(ren) in this age group was (were) living in the household of respondents aged 15 to 55.

Pregnant women were identified by asking women aged 15 to 49 in non-proxy interviews if they were pregnant. It is not known if pregnant women responding to the CCHS received the adjuvanted or unadjuvanted version of the vaccine that was recommended by WHO.[12] (Adjuvants are compounds added to vaccines that stimulate the immune response.)

Priority groups not examined in this study included those living in remote and isolated settings or communities and household contacts and care providers of persons at high risk.[8]

Respondents who indicated that they had been diagnosed with diabetes, heart disease, asthma, chronic obstructive pulmonary disease, cancer, Alzheimer's disease or dementia, or were classified as obese (children aged 12 to 17) or class III obese (adults) were considered to have conditions that put them at *high risk for complications* should they contract the H1N1 virus.[13] The presence of chronic conditions was established by asking respondents if a health professional had diagnosed them with a condition that had lasted, or was expected to last, at least six months. Interviewers read a list of conditions.

Body mass index (BMI) was calculated by dividing self-reported weight in kilograms by the square of self-reported height in metres. Adults aged 18 or older with a BMI of 40 or more were classified as obese class III; children aged 12 to 17 were identified as obese according to the age- and sex-specific BMI cut-points defined by Cole et al.[14]

The CCHS does not determine the presence of kidney disease, blood disorders, liver disease or AIDS, each of which was considered to increase the risk of complications from H1N1.[13] People with neurological disorders were also at greater risk, but the only disease in this category on the CCHS was Alzheimer's disease or dementia. People with weakened immune systems, for example, those taking cancer drugs, were also at greater risk; the CCHS could identify people who reported that they had cancer, but not if they were taking cancer drugs.

Respondents who indicated that they had ever received a *seasonal flu shot* were asked when they had last done so: less than 1 year ago; 1 to 2 years ago; 2 years ago or more; and never.

Having a *regular family doctor* was determined with the question, "Do you have a regular family doctor?"

the end of January 2010 indicate lower rates for Americans: 37% of 6-month to 17-year-olds and 20% of adults.[15] The percentage of Canadians vaccinated for H1N1 exceeded the percentage who typically get the seasonal flu shot (32% in 2007 and 2008).[16] By contrast, American adults were more likely to have been vaccinated against seasonal (39%) than H1N1 influenza (20%) during the 2009/2010 flu season.[17]

The percentage vaccinated for H1N1 surpassed the national figure (41%) in six provinces: Newfoundland and Labrador (69%), Prince Edward Island (62%), Nova Scotia (58%), New Brunswick (62%), Quebec (56%) and Saskatchewan (46%) (Figure 1, Table 1). In British Columbia (36%), Alberta (37%), Manitoba (37%) and Ontario (32%), percentages were below the national level.

Socio-demographic characteristics

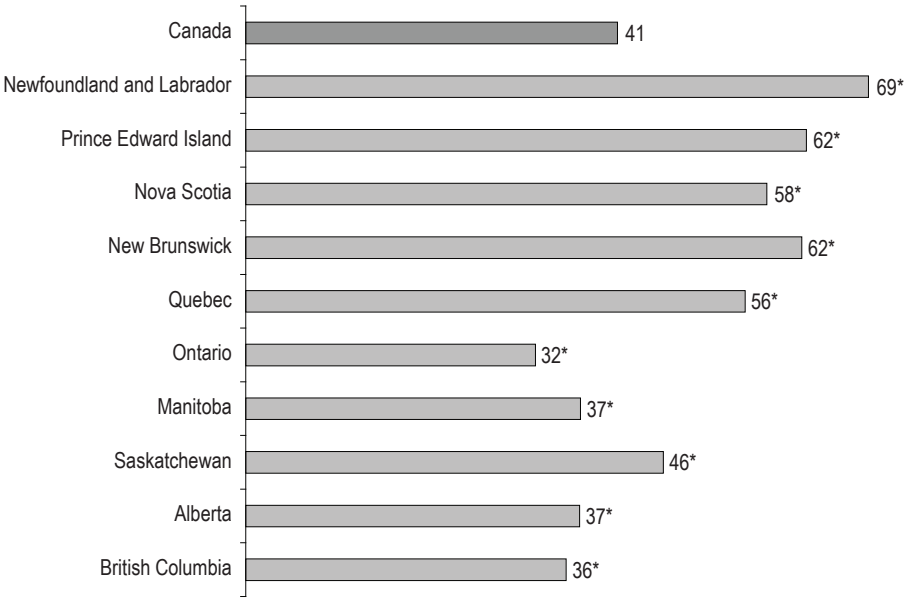
In Canada, females were more likely than males to report having had an H1N1 flu shot—45% versus 37% (Table 1). By contrast, in Australia,[18] Greece[19] and France,[20] women were *less* likely than men to report that they *intended* to get the H1N1vaccination, while studies in the Netherlands[21] and Malaysia[22] found

Table 1
Percentage vaccinated for H1N1, by selected characteristics, Canada excluding territories, 2010

Characteristic	Both sexes				Males				Females			
	Number '000	%	95% confidence interval from	to	Number '000	%	95% confidence interval from	to	Number '000	%	95% confidence interval from	to
Total	**11,609**	**41.3**	**40.2**	**42.4**	**5,141**	**37.1**	**35.6**	**38.7**	**6,468**	**45.4***	**43.9**	**46.8**
Age group												
12 to 19	1,200	37.0‡	34.1	39.8	586	35.6	31.7	39.5	614	38.3‡	34.2	42.5
20 to 44	3,673	32.2‡	30.6	33.8	1,542	26.9‡	24.6	29.1	2,131	37.6*‡	35.2	40.0
45 to 64	4,193	45.2‡	43.0	47.4	1,891	41.0‡	37.8	44.2	2,302	49.4*‡	46.5	52.2
65 to 84	2,326	60.9‡	58.7	63.1	1,053	60.7‡	57.5	64.0	1,273	61.0‡	58.2	63.8
85 or older	217	62.1‡	56.3	68.0	70	61.8‡	51.6	72.0	148	62.3‡	54.9	69.8
Marital status (age 25 or older)												
Married/Common-law†	7,232	45.5	43.9	47.2	3,454	42.3	40.1	44.6	3,778	48.9*	46.7	51.1
Widowed/Separated/Divorced	1,609	48.3	45.5	51.1	456	43.5	39.1	47.9	1,153	50.6*	47.0	54.1
Single	1,086	32.7‡	29.8	35.7	467	26.1‡	22.1	30.1	619	40.4*‡	36.2	44.6
Highest level of household education												
Less than secondary graduation†	865	49.9	46.7	53.1	345	46.6	41.9	51.3	520	52.4	48.1	56.7
Secondary graduation	1,007	36.7‡	33.7	39.7	412	31.0‡	26.9	35.1	595	42.1*‡	37.9	46.3
Some postsecondary	479	32.7‡	28.5	36.9	174	26.5‡	21.3	31.7	305	37.7*‡	31.0	44.5
Postsecondary graduation	8,477	42.3‡	40.9	43.6	3,850	38.7‡	36.8	40.6	4,627	45.8*‡	43.9	47.6
Immigrant status												
Immigrant	2,410	37.6‡	35.0	40.3	1,084	34.6	30.9	38.2	1,326	40.6*‡	37.0	44.1
Non-immigrant†	8,928	42.4	41.3	43.6	3,924	37.8	36.2	39.5	5,004	46.9*	45.3	48.5
Health care worker (ages 15 to 75)												
Yes	1,101	65.9‡	60.8	70.9	196	62.8‡	49.2	76.4	905	66.6‡	61.2	71.9
No†	5,200	34.8	33.3	36.3	2,780	32.9	30.9	34.9	2,420	37.3*	35.0	39.5
Children 5 or younger in household (ages 15 to 55)												
Yes	1,405	44.0‡	40.7	47.3	605	39.3‡	34.3	44.3	800	48.4*‡	43.9	52.8
No†	5,064	32.9	31.4	34.4	2,217	28.4	26.4	30.4	2,846	37.6*	35.4	39.8
Pregnant woman (ages 15 to 49)												
Yes	…	…	…	…	…	…	…	…	129	47.2	37.4	39.9
No†	…	…	…	…	…	…	…	…	2,907	37.8	35.6	57.0
High risk for complications§												
Yes	3,142	54.8‡	52.6	57.1	1,455	51.2‡	47.7	54.6	1,687	58.5*‡	55.6	61.5
No†	8,110	37.8	36.6	39.0	3,616	33.4	31.7	35.2	4,494	42.2*	40.5	43.8
Seasonal flu shot												
Less than 1 year ago	5,105	76.2‡	74.3	78.1	2,222	75.6‡	72.6	78.7	2,883	76.6‡	74.4	78.8
1 to less than 2 years ago	1,341	50.3‡	46.7	53.8	585	48.0‡	42.7	53.3	756	52.2‡	47.5	56.8
2 or more years ago	810	23.1‡	20.2	25.9	349	19.9‡	15.9	24.0	462	26.1*‡	22.2	30.1
Never	4,258	28.3‡	26.9	29.8	1,942	24.8‡	22.9	26.7	2,316	32.2*‡	30.0	34.4
Regular family doctor												
Yes	10,503	43.9‡	42.7	45.1	4,530	40.4‡	38.6	42.2	5,973	47.1*‡	45.5	48.6
No†	1,101	26.4	24.1	28.7	610	23.3	20.2	26.4	491	31.7*	27.5	35.8
Province												
Newfoundland and Labrador	301	69.2‡	63.8	74.6	131	63.5‡	55.4	71.5	170	74.4*‡	68.5	80.2
Prince Edward Island	75	62.3‡	56.3	68.3	32	55.9‡	46.5	65.2	43	68.2*‡	60.5	76.0
Nova Scotia	455	57.9‡	53.8	62.1	198	52.2‡	46.4	58.0	258	63.3*‡	57.2	69.3
New Brunswick	384	61.8‡	57.5	66.1	168	55.5‡	48.9	62.2	216	67.8*‡	62.5	73.0
Quebec	3,678	55.5‡	53.2	57.8	1,640	50.3‡	46.7	54.0	2,038	60.6*‡	57.5	63.6
Ontario	3,531	32.2‡	30.3	34.0	1,540	28.7‡	26.1	31.3	1,991	35.5*‡	32.9	38.0
Manitoba	356	37.2‡	33.2	41.2	171	36.6	30.7	42.6	185	37.7‡	31.4	44.0
Saskatchewan	377	46.4‡	42.5	50.4	168	41.6	37.1	46.2	209	51.2*	44.8	57.6
Alberta	1,103	37.1‡	33.9	40.2	470	30.7‡	26.7	34.7	633	43.8*	39.0	48.6
British Columbia	1,347	35.6‡	32.8	38.4	622	33.3‡	29.4	37.2	725	37.9‡	34.0	41.8

† reference category
* significantly different from estimate for males ($p<0.05$)
‡ significantly different from estimate for reference category ($p<0.05$); where reference category not indicated, estimate compared with Total
§ respondents with chronic conditions that could put them at high risk for complications from H1N1 virus: heart disease, diabetes, asthma, chronic obstructive pulmonary disease, Alzheimer's or dementia, cancer, any obesity for ages 12 to 17 and obesity class III for adults 18 or older
... not applicable
Source: 2010 Canadian Community Health Survey, partial content file January to April 2010.

Figure 1
Percentage vaccinated for H1N1, by province, household population aged 12 or older, Canada excluding territories, 2010



* significantly different from estimate for Canada (p<0.05)
Source: 2010 Canadian Community Health Survey, partial content file January to April 2010.

no significant differences between the sexes in intentions to be vaccinated. However, intentions may not reflect ultimate behaviour and could change during a pandemic or be influenced by cultural issues, media coverage, or vaccine promotion campaigns.[19,22]

Compared with seasonal influenza,[2,23,24] the H1N1 virus affected a much younger age group. Possible reasons include pre-existing immunity in older people due to prior exposure to H1N1 strains, or less contact with younger age groups.[2,25] Nonetheless, the age pattern of H1N1 vaccination paralleled that of the seasonal flu shot,[16,26-28] with the percentage immunized generally rising with age: an estimated 45% at ages 45 to 64 and just over 60% at age 65 or older. To some extent, this may be because older people were more likely than younger age groups to have chronic conditions that could put them at risk for complications from H1N1 (data not shown).

Single people were less likely to have been vaccinated than were people with a partner, an association that persisted even when the generally younger age distribution of single people was taken into account (data not shown).

Residents of households where no member had graduated from secondary school were more likely to have been vaccinated (50%) than were those in households where the level of educational attainment was higher. However, the apparent association between education and H1N1 vaccination did not persist in multivariate analysis controlling for socio-demographic, priority group and health service variables (data not shown).

Immigrants were less likely than non-immigrants to have been vaccinated: 38% versus 42%.

Priority groups

While the Government of Canada obtained enough H1N1 vaccine for all Canadians, certain populations were given priority for early immunization.[7,13] The priority groups that could be assessed with CCHS data were health-care workers, children aged 6 months to 5 years, pregnant women, and people with certain chronic conditions.

Vaccination of health-care workers helps reduce transmission of the virus to patients at risk of complications from influenza.[29,30] Health-care workers were nearly twice as likely as other Canadians to have had an H1N1 shot: 66% versus 35% (Table 1). In the United States, the percentage of health-care workers vaccinated was much lower, at 37%.[31]

Although children aged 6 months through 5 years were not covered by the CCHS, it was possible to identify respondents who lived in a household with children in this age range. Such respondents were more likely to have received the H1N1 vaccine than were those who did not live with young children (44% versus 33%) (Table 1). Similarly, a French study[20] found that the presence of a child in the household was associated with greater acceptability of the H1N1 vaccine, compared with households with no child. The French study also found that only a small percentage (4%) of parents who stated that they would accept the H1N1 vaccination for themselves would refuse it for their children. If this relationship prevails in Canada, the majority of people with children younger than 5 years in the household who received the H1N1 vaccine themselves would have also ensured their young children were vaccinated.

While the percentage of pregnant women vaccinated against the H1N1 virus exceeded the percentage for women who were not pregnant (47% versus 38%), the difference was not statistically significant.

The presence of chronic conditions (see *The data*) increases the risk of complications from H1N1 influenza.[14] People with such conditions were more likely to have been vaccinated than were those without them (55% versus 38%).

Health care use

People who get annual flu shots or who have a regular doctor may have health-care attitudes and practices that predispose them to be vaccinated

against the H1N1 virus. In fact, 76% of Canadians who had had the seasonal flu shot within the last year, and half (50%) of those who had done so one or two years earlier, had the H1N1 vaccine; this compared with 23% of those whose last flu shot had been more than two years earlier, and 28% of those who had never had a flu shot.

About four in ten (44%) Canadians with a regular family doctor were vaccinated, compared with 26% of those without a regular doctor. It is not known if respondents sought the advice of their doctors about the H1N1 vaccine. However, a survey of Canadian family physicians and paediatricians estimated that 75% of them intended to recommend the vaccine to their patients.[32]

Why not?

The majority of Canadians aged 12 or older—59% or 16.5 million—did not get vaccinated against the H1N1 virus. The most frequent reason was "did not think it was necessary," cited by 74% of those not vaccinated (Table 2). This is consistent with results of a small survey conducted by the Strategic Counsel,[33] which found that 67% of Canadians were not worried that they would catch the H1N1 virus, and that 78% believed that the media had exaggerated the threat. An EKOS survey found that 53% of Canadians believed that the level of concern about H1N1 was exaggerated, given the level of risk.[34] Studies of attitudes in other countries also found that the belief that the illness did not pose a serious threat[35] or that vaccination was not necessary[18,36] were leading reasons for not intending to be vaccinated.

Males were more likely than females to give "did not think it was necessary" as a reason for not getting the H1N1 vaccine (76% versus 73%). At ages 85 or older, this reason was cited by a smaller percentage of people: 60% (data not shown). The percentages of the non-vaccinated who said that they did not think that vaccination was necessary ranged from about two-thirds in Nova Scotia, New Brunswick and Manitoba to 80% in Quebec (data not shown).

"Have not gotten around to it yet" was the second most common reason for not being vaccinated, reported by 13% of Canadians who did not get the H1N1 shot. Males were more likely than females to give this reason: 14% versus 11%.

Fear was cited as a reason for not being vaccinated by 7% of those who did not receive the H1N1 vaccination. Women were more likely than men to report fear (9% versus 5%). Although the nature of the fear was not specified, studies from other countries found concerns about safety and side-effects.[17-20,35,37-39]

Relatively few people who were not vaccinated (3% or less) cited access problems (for example, not available at time required, not available in area, respondent did not know where to go), their doctor advising them they did not need it, long wait times, a previous bad reaction, personal barriers (family responsibilities, being unable to leave the house because of a health problem, or transportation problems) (Table 2).

Concluding remarks

The information in this article about who did and did not get vaccinated against H1N1 will aid in the evaluation of the program, support public health planning and help target messages about vaccination in the event of another pandemic. Province of residence, socio-demographic characteristics, belonging to a priority group, and health service factors were associated with the likelihood of receiving the H1N1 vaccination. As in other studies, the belief that the vaccination was not necessary was the most common reason for non-vaccination. ■

Table 2
Reasons for not getting H1N1 vaccination, household population aged 12 or older who were not vaccinated, Canada excluding territories, 2010

	Both sexes				Males				Females			
			95% confidence interval				95% confidence interval				95% confidence interval	
Reason	Number '000	%	from	to	Number '000	%	from	to	Number '000	%	from	to
Did not think it was necessary	12,137	74.2	72.8	75.6	6,525	75.7	73.8	77.7	5,612	72.5*	70.6	74.4
Have not gotten around to it	2,088	12.8	11.7	13.8	1,208	14.0	12.5	15.6	879	11.4*	10.0	12.7
Fear	1,067	6.5	5.8	7.3	413	4.8	3.8	5.7	654	8.5*	7.4	9.6
Access problems	555	3.4	2.9	3.9	290	3.4	2.6	4.1	265	3.4	2.7	4.2
Doctor did not think it was necessary	385	2.4	1.9	2.8	154	1.8	1.2	2.4	231	3.0*	2.3	3.6
Waiting time too long	347	2.1	1.7	2.6	228	2.7	1.9	3.4	119	1.5*	1.1	2.0
Bad reaction to previous flu shot	342	2.1	1.7	2.5	119[E]	1.4[E]	0.9	1.9	223	2.9*	2.1	3.7
Personal barriers	186	1.1	0.9	1.4	81[E]	0.9[E]	0.6	1.3	105	1.4	0.9	1.8
Other	501	3.1	2.5	3.6	247	2.9	2.0	3.7	255	3.3	2.6	4.0

* significantly different from estimate for males ($p<0.05$)
[E] use with caution (coefficient of variation 16.6% to 33.3%)
Note: Respondents could give more than one reason.
Source: 2010 Canadian Community Health Survey, partial content file January to April 2010.

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