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3 **Trends in influenza vaccine coverage and vaccine hesitancy in Canada, 2006-07 to 2013-14:**
4 **results from cross-sectional survey data**
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Abstract

Background

Influenza immunization is the most effective way to prevent infection. Past studies have reported coverage below national targets, but up-to-date estimates are needed to understand trends and to identify areas for intervention. The objective of this study is to describe recent trends in influenza immunization in Canada, timing of uptake, and reasons ~~reported~~ for not receiving the vaccine.

Methods

We pooled data from the 2007 to 2014 cycles of the Canadian Community Health Survey (n=481,526 respondents aged ≥ 12 years). Using bootstrapped survey weights, we examined influenza vaccine coverage by various groups, including by age and by presence of chronic medical conditions.

Results

Across all survey cycles combined, 29% of respondents reported receiving seasonal influenza immunization in the past twelve months. Coverage levels were fairly consistent over the study period, but varied by province/territory. Immunization coverage decreased over time for those aged ≥ 65 years, a group for which immunization is particularly important. Among those immunized, it was most common to do so in October or November. Among those not immunized, the most frequently cited reason was believing it is unnecessary.

Interpretation

Influenza immunization coverage continues to fall below national targets, with substantial declines seen in those aged ≥ 65 years. More intensive efforts are needed to improve coverage in Canada, particularly for high-risk groups.

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3 Annual influenza epidemics cause substantial mortality, morbidity, healthcare costs, and lost
4 economic productivity in Canada.(1–3) Influenza immunization is the most effective way to
5 prevent infection.(4) In 2001, national influenza vaccine coverage targets were set at 80% for
6 high-risk groups, specifically adults aged ≥ 65 years and individuals with chronic medical
7 conditions that increase the risk of complications from influenza infection.(5) However, trends in
8 influenza immunization measured using nationally representative data up to 2005 demonstrated
9 suboptimal coverage for high-risk groups; only those aged ≥ 75 years with chronic conditions
10 reached the target.(6) ~~At a meeting of immunization experts These recommendations were~~
11 ~~revisited~~ in 2005, ~~a~~ goal of 80% coverage by 2010 was again set for those aged ≥ 65 years and
12 those aged 18-64 years with chronic medical conditions.(5)

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15 Our earlier study also examined the impact of the introduction of publicly funded
16 universal influenza immunization in Ontario in 2000.(6) Many other provinces now provide
17 universal influenza immunization; by the 2013-14 influenza season, all provinces and territories
18 except New Brunswick, Quebec, and British Columbia had implemented comparable
19 programs.(7) Additionally, several provinces (Prince Edward Island, Nova Scotia, New
20 Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia) have implemented
21 policies allowing pharmacists to administer influenza vaccines to increase access to
22 immunization. So far, these policies have been associated with modest increases in vaccine
23 coverage.(8) The benefits of influenza immunization for both individuals and populations depend
24 on the timing of immunization (~~i.e., the month of vaccine receipt~~), particularly among high-risk
25 groups.(9–12) ~~While transmission factors may vary by year and geography, Since~~ immunization
26 is most beneficial ~~when it occurs~~ before ~~the seasonal~~ epidemics starts. ~~Therefore~~, early
27 administration of influenza vaccines is recommended.(4,13)

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3 Timely and reliable estimates of vaccine coverage are crucial for evaluating [influenza](#)
4 immunization programs and for identifying groups with suboptimal coverage. ~~Additionally,~~
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6 [Understanding the reasons for not receiving influenza immunization vaccines](#) can guide the
7 allocation of additional resources to increase coverage. Therefore, the objectives of this study
8 were to describe the most recent Canadian and provincial trends in influenza immunization, to
9 examine variations in the timing of influenza immunization, and to characterize reasons for not
10 receiving influenza vaccines.
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20 21 22 **Methods**

23 24 Study population

25 We used nationally representative data from the 2007 to 2014 cycles of the Canadian
26 Community Health Survey. This cross-sectional survey is conducted annually by Statistics
27 Canada since 2007 through telephone and in-person interviews, and it covers a range of
28 questions related to health status, healthcare utilization, and health determinants.(14) Using a
29 multistage stratified cluster design, each cycle includes a sample of approximately 65,000
30 respondents aged ≥ 12 years. The survey excludes persons living on Aboriginal reserves, full-
31 time members of the Canadian military, institutionalized persons, and two remote health regions
32 in Quebec (with all of these exclusions representing $<3\%$ of the population).(10) Response rates
33 ranged from 65.6% to 77.6% across the [Survey](#) cycles.(14) This study was approved by the
34 Ethics Review Board of Public Health Ontario.
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51 52 Definitions

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3 The dependent variable was self-reported influenza immunization within the past 12 months,
4 determined through responses to the questions, “Have you ever had a (seasonal) flu shot?” and
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6 “When did you have your last (seasonal) flu shot?” Individuals reporting receipt of their last flu
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8 shot in the preceding 12 months were considered immunized. These respondents were also
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10 asked, “In which month did you have your last flu shot?” Those whose response matched the
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12 month of the survey date were then asked, “Was that this year or last year?” We considered
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14 respondents who reported receipt of influenza vaccine during the same month as the survey date
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16 but in the preceding year as not immunized.
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22 To determine the presence of chronic medical conditions, respondents were asked
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24 whether they had been diagnosed by a health professional with asthma, chronic obstructive
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26 pulmonary disease (COPD), heart disease, stroke, diabetes, or cancer; these are conditions for
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28 which influenza vaccines are recommended.(4)
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32 Two sets of age groups were considered in this analysis: 1) 12 to 19, 20 to 49, 50 to 64,
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34 65 to 74, 75 to 84, and ≥ 85 years; and 2) 12 to 49, 50 to 64, and ≥ 65 years.
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37 Risk groups were defined as high or low. Those deemed high-risk were aged ≥ 65 years,
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39 or aged 12 to 64 years with at least one chronic condition. Individuals aged 12 to 64 years with
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41 no chronic conditions were considered low-risk.
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44 We defined universal influenza immunization funding policies as provincial public
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46 funding for influenza vaccines for all residents aged ≥ 6 months. We defined pharmacist policies
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48 as having legislation permitting pharmacists to administer influenza vaccines. We set the start of
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50 these policies to coincide with the start of the corresponding influenza immunization campaign,
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52 defined as October 1.
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55 Due to small sample sizes, the three territories were combined for certain analyses.
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3 The definitions of education, household income, smoking status, body mass index,
4 racial/cultural background, immigration status, marital status, rural residence, self-reported
5 health, and having a regular doctor have been previously described.(15,16)
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11 12 Statistical analysis

13 We pooled individual-level responses from all survey cycles. We used cross-tabulations to
14 estimate the proportion of people who reported receipt of influenza immunization in the **previous**
15 **yearpast 12 months** for: a) the overall population aged ≥ 12 years; b) various subgroups defined
16 by sociodemographic characteristics, including province of residence; and c) risk groups for
17 influenza immunization. Analyses were repeated restricting to respondents who were surveyed
18 between February and August. We also used cross-tabulations to compare the reasons that people
19 who were not considered immunized reported for not receiving their influenza immunization.
20 Reasons for not receiving the flu shot were examined by whether or not the respondent reported
21 never having received a flu shot or if they had not received one in the last 12 months. We also
22 examined the reasons for not receiving a flu shot by province, age group, and presence of chronic
23 conditions. Reported month of receipt of last influenza immunization was also examined by
24 season, risk group, and province. We grouped those who reported receiving their vaccine
25 between March and August due to small numbers.
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46 We used sampling weights to account for an unequal probability of selection in the
47 sample. We calculated all estimates of coverage and coefficients of variation using bootstrap
48 weights, with normalized weights used for tests between proportions due to large sample sizes.
49 All tests were two-sided and used a significance level of $p < 0.05$. We compared estimates of
50 coverage for the 2006-07 influenza season to that for the 2013-14 season, but only differences of
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≥5 percentage points were considered to have public health relevance. We used SAS statistical software (version 9.4, SAS institute Inc., Cary, NC) for all analyses.

Results

Trends in influenza coverage

Across the eight influenza seasons overall, 29% of respondents reported receiving a seasonal influenza vaccine during the previous twelve months (Table 1). The annual proportion reporting immunization was fairly consistent throughout the study period across the country, but the level was lowest during the 2009 A/H1N1 pandemic. The 2010 survey cycle was the only one that included questions about the pandemic influenza vaccine. Of this cycle's respondents, 19% of respondents reported receiving both the pandemic and the seasonal vaccines, 52% reported receiving neither vaccine, 24% received the pandemic vaccine but not the seasonal vaccine, and 5% received the seasonal vaccine but not the pandemic vaccine. Seasonal influenza vaccine coverage remained depressed for the initial three post-pandemic seasons until an increase returning close to pre-pandemic levels for the most recent (2013-14) season.

Females and older age groups consistently achieved higher coverage. Amongst the provinces and territories, Nova Scotia consistently achieved the highest coverage, with an and increased of 5% (from 40% in 2006-07 to 45% in 2013-14) over the study period. The greatest net increase was observed in New Brunswick, from 28% in 2006-07 to 37% in 2013-14.

Whereas Quebec had the lowest coverage levels, Ontario experienced the greatest drop during the study period (from 37% to 33%). Coverage was consistently higher in provinces that provide universal funding of influenza vaccines for their residents. Coverage was stable in all income groups except for the lowest quartile, for whom a drop from 32% to 27% was observed.

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3 The results did not change when the analysis was restricted to those surveyed between
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6 February and August (data not shown).
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10 Coverage by risk group

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12 National immunization coverage decreased 9% over time for individuals aged ≥ 65 years, with a
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14 drop of 11% for those aged ≥ 85 years (Table-Figure 1). Substantial decreases in coverage were
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16 observed for those aged ≥ 65 years in all provinces and territories, except for Newfoundland and
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18 Labrador (Table 2). In those aged 12-64 years with a chronic medical condition, influenza
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20 vaccine coverage in most provinces remained relatively stable, but Ontario saw a significant
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22 decrease from 46% to 36% (Table 2). In the low-risk group, numerous provinces made
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24 significant gains in immunization coverage over time, including Nova Scotia, New Brunswick,
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26 Manitoba, Saskatchewan, and Alberta.
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37 Progress toward targets

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40 No group met the 80% target over the study period, including those at high risk (Figure 12).
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42 Those aged ≥ 85 years with a chronic condition were the closest to reaching this level (74%).
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44 Since reaffirming this target level, coverage has declined and was even further from this level
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46 than in 2005.
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53 Timing of influenza immunization

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~~Across risk groups, the most common month to receive influenza immunization was November (48%), followed by October (30%) (Table 3). Few people reported being immunized in December (7%), January (4%), February (1%), March-August (2%), or September (3%); 5% of those immunized did not recall the month of immunization.~~ The percentage of people reporting receiving influenza vaccines in October increased ~~10 percentage points over the study period~~ (from 24% in 2006-07 to 34% in 2013-14), while those reporting receiving influenza vaccines in November decreased ~~by 12% percentage points over the same period~~ (from 55% to 43%). Those aged ≥ 65 years had ~~significantly~~ higher vaccine uptake in October compared to those at low risk (35% vs 27%, $p < 0.001$). ~~Quebec, Ontario, and British Columbia had the lowest uptake in October.~~

Reasons for not receiving influenza vaccine

Across all groups, the most frequently reported reason for not receiving seasonal influenza immunization was perceiving it to be unnecessary (Table 43). ~~This was consistent across those who reported never having received a flu shot (“never flu shot”) and those who reported receiving one but not in the last 12 months, and in high- and low-risk groups.~~ Eighty-three percent of people who have never received a flu shot thought it unnecessary, ~~which was~~ significantly higher than the 53% reported by those who have had a previous flu shot ($p < 0.001$). Residents of Quebec cited this reason most frequently, with 80% of those not having received influenza immunization in the past 12 months deeming it unnecessary (Table 53).

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The other most frequently cited reasons included not getting around to it (15%), having a bad reaction to a previous shot (6%), fear (4%), and their doctor saying it is unnecessary (2%) (Table 43).

The reported reasons were consistent over the study period. The only change in reasons was for those who had previously received their influenza immunization but had not done so in the past 12 months, with 49% in this groups reporting thinking it unnecessary in 2006-07 and increasing to 54% in 2013-14.

Interpretation

Main findings

Seasonal influenza vaccine coverage in Canada was essentially stable between the 2006-07 and 2013-14 influenza seasons, except for a dip during the 2009 A/H1N1 pandemic that required a few influenza seasons to recover from. Although seasonal influenza vaccine coverage dipped slightly in the pandemic year, overall coverage for any influenza vaccine (i.e., either the seasonal trivalent vaccine or the pandemic monovalent vaccine) was highest for that year, likely due to the pandemic situation and messaging about the additional need for immunization. Surprisingly, we observed a substantial drop in coverage over time among those aged ≥ 65 years, with an even larger drop for those aged ≥ 85 years. Coverage also declined for individuals younger than 65 years with chronic conditions, another high-risk group, although this trend was only observed in a few provinces. Consequently, vaccine coverage levels in Canada are even further from the target of 80% for high-risk groups set in 2005. Individuals with asthma comprised a substantial proportion of those with chronic conditions, and they had the lowest coverage; further efforts to target this group could result in overall gains amongst high-risk groups. While coverage dropped

for high-risk age groups, gains were seen in the low-risk population in some provinces. We also observed variations in coverage by sex, age group, risk group, and province. Variations across provinces may be partially due to differences in immunization policies, such as universal funding for influenza vaccines or the ability for pharmacists to administer vaccines.(8,15)

~~We noted a shift in the timing of influenza immunization to earlier in the campaign; the proportion of people who reported receiving seasonal immunization in October increased over time, and the proportion immunized during this month was highest for those at high risk. The variability in timing by province/territory might be attributable to the size of the province in terms of the logistical challenges and resources needed to immunize such large numbers of people at the beginning of the season.~~

The most frequently cited reason for not receiving seasonal influenza immunization was perceiving it to be unnecessary, and this was consistent across risk groups and provinces. However, the proportion citing this reason was lower in those classified as having a chronic condition.

Comparison with other studies

~~Overall Coverage estimates in selected countries were higher than in Canada for the 2013-14 season (Table 4). In the United States, for example, immunization coverage was higher for those aged ≥ 65 years, with 65% coverage obtained; this estimate, however, still falls below their national target of 70%.(17) in the United States (aged ≥ 18 years) were higher than in Canada during the study period, but they still fell below national targets.(17) Coverage in those aged ≥ 65 years was very similar between the two countries, and neither met their immunization goals for this high-risk group. Few countries have met their targets for this group. Countries such as the~~

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3 Netherlands, who have attained the highest coverage in Europe in past seasons, might be able to
4 offer strategies to increase uptake in Canada.(18) Other trends noted in Canada were also
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6 observed in the United States, such as relatively stable coverage across time and the greatest
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8 proportion of immunizations being provided in October and November.(17) Large variability in
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10 coverage between states has been reported in the United States and in Australia. The Australian
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12 Adult Vaccination Survey also reported similar results regarding reasons for not being
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14 immunized, with the first two reasons being that the respondent does not get the flu or is not at
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16 risk, followed by not getting around to it; these responses echo those reported in Canada.(19) In
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18 this study, perceiving influenza vaccines to be unnecessary was the main reason reported for not
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20 receiving seasonal influenza immunization across all characteristics examined, including risk
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22 group; this was true for both those who have never received a flu shot and for those who have
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24 had one in the past but not in the last twelve months. Further work is needed to explore why
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26 individuals believe the influenza immunization is unnecessary, so that efforts to tackle this
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28 barrier to immunization can be made. This may include enhanced education and discussion by
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30 healthcare providers.(20) Additional efforts to enhance vaccination access, increase community
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32 demand, and improve provision by providers or the healthcare system may also improve
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34 coverage.(21,22)

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44 The conclusions from our study are similar to a recently-published report,(23) although
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46 our study differed slightly by reporting coverage by influenza season (as opposed to survey
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48 cycle) and using a stricter definition for influenza immunization. This study updates previous
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50 work on trends in influenza immunization, using data after the survey was conducted annually,
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52 as opposed to every two years. Since this study includes data from the latest Survey cycle, this is
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3 the most up-to-date information on immunization coverage at the national level and highlights
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5 where further targeted prevention efforts are needed.
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8 ~~Up-to-date data are of critical importance for public health programming and~~
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10 ~~immunization campaign efforts, and understanding those groups in particular need of~~
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12 ~~intervention guides appropriate allocation of resources.~~
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15 Limitations

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18 This study also has some limitations. The Survey does not include children aged <12 years or
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20 institutionalized elderly, both of which are important risk groups who should be immunized.

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22 Additionally, we relied on self-report to assess vaccine coverage. However, this outcome has
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24 been frequently used in influenza immunization reporting and has been shown to be valid.(24–
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26 33) There may be some recall bias regarding the receipt of seasonal influenza immunization in
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28 the last twelve months, but this was partially mitigated by incorporating the follow-up questions
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30 regarding timing of immunization into our outcome definition. The cross-sectional nature of the
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32 data also limits our ability to make conclusions about temporal associations between predictors
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34 and immunization status.
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43 Conclusion

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46 Seasonal influenza vaccine coverage remains below national targets and is lower than in 2005.
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48 Of particular concern is [the](#) drop in coverage observed in those aged ≥ 65 years and the
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50 perception that influenza immunization is unnecessary. Targeted efforts are needed to restore
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52 high coverage in high-risk groups.
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36. [http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/762A8FB9101D1759CA257D49002227B6/\\$File/summ-report-flu-vaccinations-survey2014.pdf](http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/762A8FB9101D1759CA257D49002227B6/$File/summ-report-flu-vaccinations-survey2014.pdf)
Institute of Environmental Science and Research Ltd. Influenza Surveillance in New Zealand 2014. Wellington, New Zealand; 2015. Available from:
https://surv.esr.cri.nz/PDF_surveillance/Virology/FluAnnRpt/Influenzasurveillance2014Final.pdf

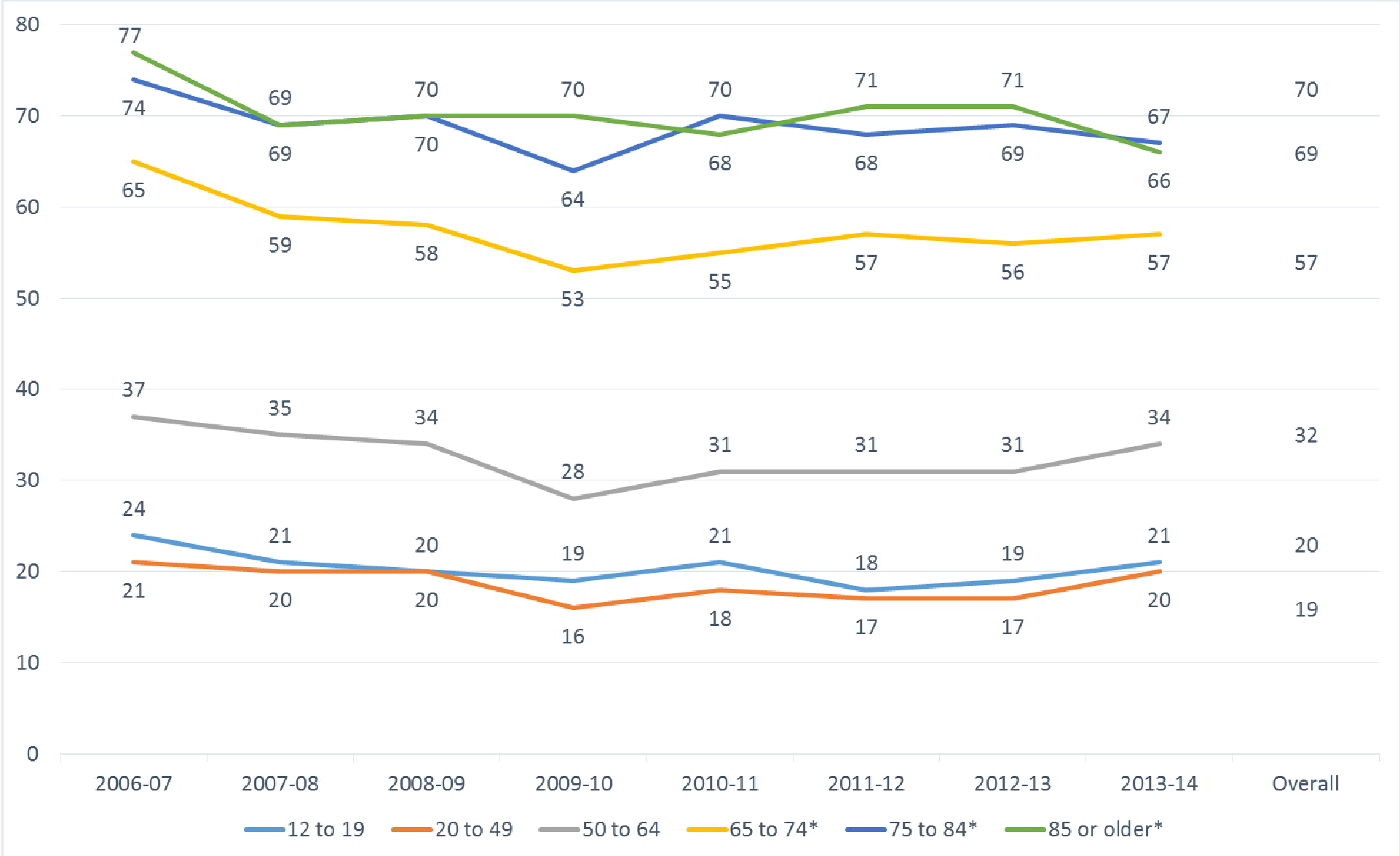
Confidential

Table 1. Percentage reporting influenza immunization within the prior twelve months 2006-07 to 2013-14 influenza seasons

	%	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Overall
Overall (N=481,526 [†])	<u>100.0</u>	32	30	30	26	28	28	28	31	29
Sex										
Male	<u>49.0</u>	29	26	27	23	25	24	25	27	26
Female	<u>51.0</u>	35	33	33	28	31	31	30	34	32
Chronic Conditions										
One or more	<u>22.5</u>	51	47	47	42	45	45	45	47	46 [‡]
Heart disease	<u>4.7</u>	63	60	60	53	58	56	57	59	58
Stroke*	<u>1.0</u>	61	55	54	53	50	55	55	46	53
Diabetes*	<u>6.1</u>	61	57	57	50	57	54	54	55	55
Cancer	<u>1.9</u>	55	56	53	56	59	53	49	54	54
Asthma	<u>8.2</u>	40	37	37	34	35	35	34	38	36
COPD*	<u>2.2</u>	67	60	58	48	55	58	54	55	55
None	<u>77.5</u>	27	25	25	21	23	23	23	26	24
Income quartile [§]										
Lowest*	<u>5.6</u>	32	30	27	23	27	25	25	27	27
Lower-middle	<u>14.2</u>	34	33	33	29	33	31	31	33	32
Upper-middle	<u>27.5</u>	33	30	30	26	29	30	29	31	30
Highest	<u>44.2</u>	30	28	28	24	27	26	26	30	27
Province / Territory										
Newfoundland & Labrador*	<u>1.5</u>	22	23	25	23	25	24	24	27	24
Prince Edward Island	<u>0.4</u>	33	28	27	26	30	32	28	35	30
Nova Scotia*	<u>2.8</u>	40	40	37	43	47	43	40	45	42
New Brunswick*	<u>2.2</u>	28	30	28	32	36	34	35	37	33
Quebec	<u>23.4</u>	25	25	25	16	21	22	22	24	22
Ontario	<u>39.1</u>	37	34	34	27	31	29	30	33	32
Manitoba	<u>3.4</u>	28	25	27	31	26	26	27	30	27
Saskatchewan	<u>2.9</u>	27	28	28	26	30	30	25	30	28
Alberta	<u>10.8</u>	28	26	29	29	29	27	27	31	28
British Columbia	<u>13.3</u>	32	28	29	29	28	30	28	32	30
Yukon	<u>0.1</u>	29	27	24	45	33	27	27	30	31
Northwest Territories	<u>0.1</u>	35	33	30	33	39	36	29	35	34
Nunavut	<u>0.1</u>	37	34	44	42	43	26	27	33	35
Presence of universal funding for influenza vaccines										
Yes	<u>51.7</u>	37	34	33	27	31	29	29	33	31
No	<u>48.3</u>	28	27	28	24	24	25	25	27	26

COPD: Chronic Obstructive Pulmonary Disease. [†]Representing 27,291,380 Canadians. *Changed by ≥ 5 percentage points over the study period. [‡]When asthma was removed group, coverage in the "One or more chronic conditions" group increased to 54%. [§]8.6% did not report their income over the study period; the percent reporting immunization in this group was 30% overall.

Figure 1: Percentage reporting influenza immunization within the prior twelve months, 2006-07 to 2013-14 influenza seasons, by age group



*Changed by ≥5 percentage points over the study period.

Table 2: Percentage reporting influenza immunization during the 2006-07 to 2013-14 influenza seasons, by risk group

		2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Overall
	%	High-Risk Group: Aged ≥65 years								
Canada* (N=74,491[†])	100.0	69	63	63	58	61	61	61	60	62
Newfoundland & Labrador	1.6	52	51	51	55	51	53	50	56	52
Prince Edward Island*	0.5	67	49	57	59	63	60	55	58	58
Nova Scotia*	3.2	76	72	72	71	73	75	74	70	73
New Brunswick*	2.4	64	59	57	62	65	66	61	59	62
Quebec*	25.1	63	59	58	37	52	53	55	54	54
Ontario*	38.4	76	67	67	68	65	67	67	66	67
Manitoba*	3.5	66	64	60	68	59	56	61	56	61
Saskatchewan*	3.1	61	62	61	58	61	59	53	50	58
Alberta*	8.3	70	60	59	58	65	56	60	58	60
British Columbia*	13.9	67	60	61	62	59	63	60	60	61
Territories* [‡]	0.1	76	74	66	69	68	57	56	63	65
		High-Risk Group: Aged 12 to 64 years with at least one chronic condition								
Canada (N=71,366[†])	100.0	39	36	35	32	34	33	32	36	34
Newfoundland & Labrador	1.7	34	28	34	30	33	28	29	34	31
Prince Edward Island	0.5	37	39	32	32	36 ^E	36 ^E	29 ^E	38	35
Nova Scotia	3.4	48	55	49	58	56	47	57	52	53
New Brunswick	2.5	40	39	32	43	47	35	42	44	40
Quebec	23.5	31	31	31	23	25	30	26	30	28
Ontario*	39.1	46	39	39	31	36	33	35	36	36
Manitoba	3.5	34	32	36	42	35	29	30	30	33
Saskatchewan	2.8	32	37	32	36	27	37	27	36	33
Alberta	10.8	35	33	32	33	36	33	30	37	34
British Columbia	11.9	39	36	33	36	35	35	30	39	35
Territories* [‡]	0.3	38	36	32 ^E	47	40	37	30	37	37
		Low-Risk Group: Aged 12 to 64 years with no chronic conditions								
Canada (N=335,699[†])	100.0	23	21	22	17	20	19	19	22	20
Newfoundland & Labrador	1.5	14	16	17	14	16	16	16	17	16
Prince Edward Island	0.4	24	20	19	16	20	24	20	28	21
Nova Scotia*	2.6	29	28	25	32	38	32	26	35	31
New Brunswick*	2.1	17	21	20	22	26	25	25	29	23
Quebec	23.0	16	17	16	10	13	12	13	14	14
Ontario	39.3	28	26	26	17	22	20	20	24	23
Manitoba*	3.4	18	15	18	19	17	18	18	23	18
Saskatchewan*	2.8	18	18	20	16	23	22	18	24	20
Alberta*	11.3	20	19	23	23	22	21	21	25	22
British Columbia	13.4	23	21	21	21	19	21	21	23	21
Territories* [‡]	0.3	29	26	28	36	34	27	24	29	29

*Changed by ≥5 percentage points over the study period. [†]Representing 4,221,945, 4,044,776 and 19,024,659 Canadians, respectively. [‡]Territories category includes Northwest Territories, Yukon and Nunavut combined ^EUse with caution (coefficient of variation 16.6% to 33.3%). Due to high sampling variability, estimates denoted with ^E should be interpreted with caution as the respective coefficient of variation is between 16.6% and 33.3%.

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Figure 12: Percentage reporting influenza immunization during the 2013-14 influenza season, by age group and presence of chronic conditions

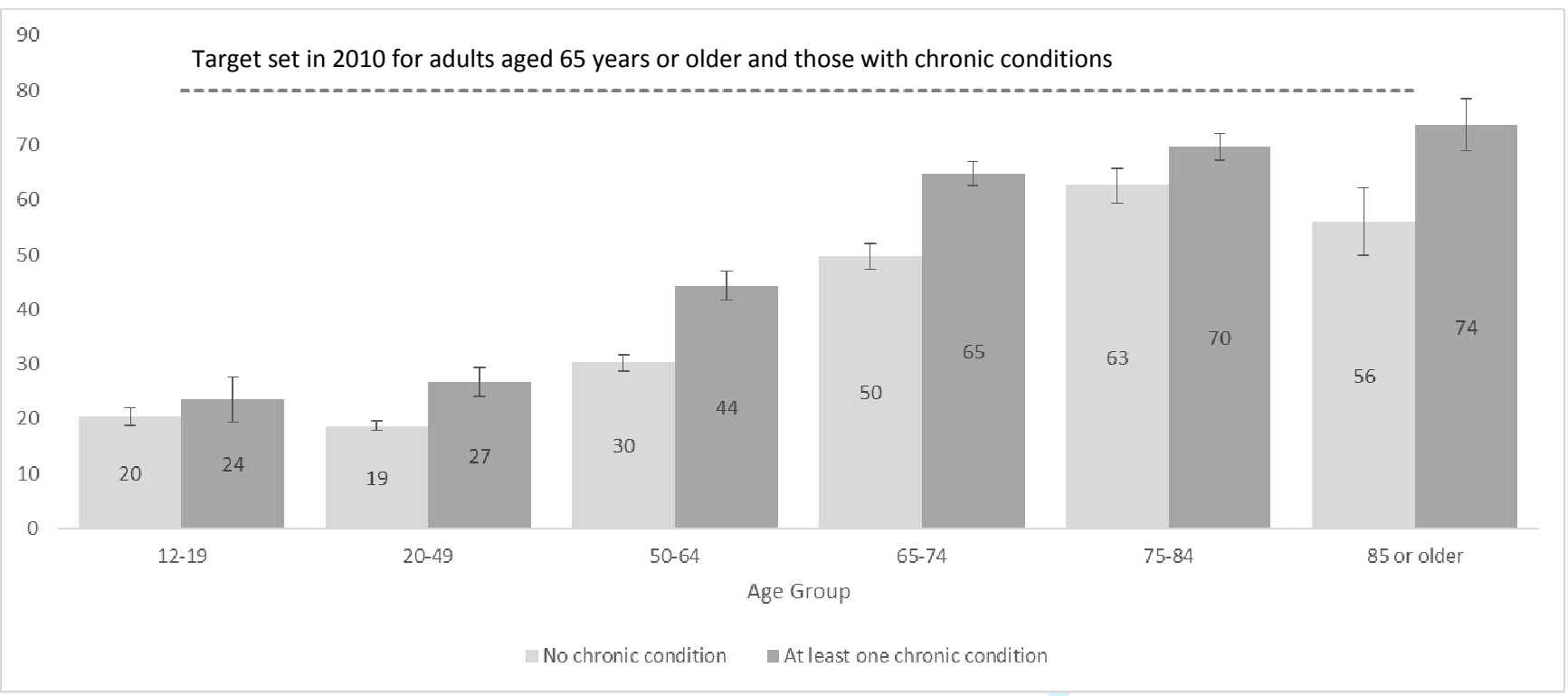


Table 3. Timing of influenza immunization for those immunized in last 12 months during the 2006-07 to 2013-14 influenza seasons, by risk group and province

	September	October	November	December	January	February	March-August	Don't Know
Overall	3	30	48	7	4	1	2	5
Risk Group								
High risk (Aged ≥ 65)	2	35	49	5	2	1	1	4
High risk (Aged 12-64 with at least one chronic condition)	3	30	48	8	4	2	2	4
Low risk	3	27	47	9	4	2	3	6
Province/Territory								
Newfoundland & Labrador	3	38	43	5	3	2 ^E	2 ^E	5
Prince Edward Island	2 ^E	40	41	5	3	2 ^E	2 ^E	5
Nova Scotia	3	41	41	4	3	1	2	5
New Brunswick	3	43	42	4	2	1	1	4
Quebec	1	16	63	9	5	1	1	3
Ontario	3	29	47	9	3	1	2	5
Manitoba	4	41	38	5	3	1 ^E	2	7
Saskatchewan	3	49	32	4	3	1	2	6
Alberta	4	44	32	5	3	2	3	6
British Columbia	3	28	49	6	4	2	2	5
Territories	5	37	38	5	4	3	5	5

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

Table 43: Reasons reported for not receiving influenza immunization during the 2006-07 to 2013-14 influenza seasons, by selected characteristics^a

Reason (%; 95%CI)	%	Unnecessary	Did not get around to it	Previous bad reaction	Fear	Doctor said unnecessary
Overall (N=336,109 [†])	<u>100.0</u>	72	15	6	4	2
Never had a shot immunized	<u>62.4</u>	83	9	2	5	2
Ever had a shot immunized but not in last 12 months	<u>37.6</u>	53	27	12	3	2
High-risk (aged ≥65 years)	<u>7.8</u>	69	11	11	5	4
High-risk ≥65 with a chronic condition	<u>3.2</u>	63	12	14	5	4
High-risk ≥65 without a chronic condition	<u>4.6</u>	73	10	9	5	3
High-risk (aged 12-64 with a chronic condition)	<u>13.6</u>	64	18	8	5	3
Low risk group	<u>78.6</u>	73	15	4	4	2
Province/Territory	<u>100.0</u>					
Newfoundland & Labrador	<u>1.6</u>	<u>75</u>	<u>13</u>	<u>5</u>	<u>4</u>	<u>2</u>
Prince Edward Island	<u>0.4</u>	<u>67</u>	<u>18</u>	<u>6</u>	<u>5</u>	<u>2</u>
Nova Scotia	<u>2.3</u>	<u>65</u>	<u>20</u>	<u>7</u>	<u>5</u>	<u>2</u>
New Brunswick	<u>2.1</u>	<u>71</u>	<u>15</u>	<u>6</u>	<u>5</u>	<u>2</u>
Quebec	<u>25.6</u>	<u>80</u>	<u>9</u>	<u>4</u>	<u>3</u>	<u>1</u>
Ontario	<u>37.4</u>	<u>68</u>	<u>18</u>	<u>7</u>	<u>5</u>	<u>2</u>
Manitoba	<u>3.5</u>	<u>71</u>	<u>15</u>	<u>5</u>	<u>4</u>	<u>2</u>
Saskatchewan	<u>2.9</u>	<u>68</u>	<u>19</u>	<u>5</u>	<u>4</u>	<u>1</u>
Alberta	<u>10.9</u>	<u>69</u>	<u>18</u>	<u>6</u>	<u>4</u>	<u>2</u>
British Columbia	<u>13.1</u>	<u>71</u>	<u>16</u>	<u>5</u>	<u>4</u>	<u>2</u>
Territories	<u>0.1</u>	<u>63</u>	<u>21</u>	<u>8</u>	<u>5</u>	<u>1</u>

^aThose who reported not receiving their influenza immunization in the last 12 months were asked why. Respondents could pick more than one reason. [†]Representing 19,049,608 Canadians.

Table 4: Comparison of influenza immunization coverage in all respondents and those aged ≥ 65 years for the 2013-14 season, by country

	<u>Overall*</u>	<u>Aged ≥ 65 years</u>
<u>Canada</u>	<u>31</u>	<u>60</u>
<u>United States (17)</u>	<u>42</u>	<u>65</u>
<u>England (34)</u>	<u>NR</u>	<u>73</u>
<u>Scotland (34)</u>	<u>NR</u>	<u>77</u>
<u>Australia (35)</u>	<u>39</u>	<u>73</u>
<u>New Zealand (36)</u>	<u>NR</u>	<u>68</u>

* >12 years in Canada; >18 years in the United States and Australia. NR: Not Reported

Table 5. Reasons reported for not receiving influenza immunization during the 2006-07 to 2013-14 influenza seasons, by province/territory of residence

Reason (%)	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	Territories
Unnecessary	75	67	65	71	80	68	71	68	69	71	63
Did not get around to it	13	18	20	15	9	18	15	19	18	16	21
Previous bad reaction	5	6	7	6	4	7	5	5	6	5	8
Fear	4	5	5	2	3	5	4	4	4	4	5
Doctor said unnecessary	2	2	2	4	1	2	2	1	2	2	1

NL: Newfoundland and Labrador; PE: Prince Edward Island; NS: Nova Scotia; NB: New Brunswick; QC: Quebec; ON: Ontario; MB: Manitoba; SK: Saskatchewan; AB: Alberta; BC: British Columbia

Table S1. Percentage reporting influenza immunization within the prior twelve months 2006-07 to 2013-14 influenza seasons, by additional characteristics

	<u>%</u>	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Overall
Educational attainment										
Some secondary	<u>19.7</u>	36	32	31	29	33	30	31	32	32
Secondary	<u>16.4</u>	30	27	27	25	26	27	25	29	27
Some post-secondary	<u>7.0</u>	25	24	25	20	21	20	20	22	22
Post-secondary	<u>54.3</u>	31	30	31	25	28	28	28	31	29
Not stated	<u>2.7</u>	33	35	34	27	29	30	28	34	31
Marital status										
Single	<u>29.5</u>	21	20	20	17	20	18	18	20	19
Separated/widowed/divorced	<u>12.2</u>	44	41	41	36	40	39	40	41	40
Married/common-law	<u>58.4</u>	34	32	33	27	30	31	30	34	31
Immigration status										
Canadian-born	<u>76.9</u>	31	29	29	25	28	27	28	30	28
Long-term resident (≥11 years)	<u>16.4</u>	40	36	36	30	33	33	32	36	34
Recent immigrant (<10 years)	<u>6.7</u>	26	25	23	18	18	20	18	22	21
Racial or cultural group										
White	<u>76.2</u>	32	30	30	26	29	28	29	31	29
Black*	<u>2.4</u>	32	26	22	20	26	21	22	24	24
Korean*	<u>0.4</u>	31 ^E	33 ^E	31 ^E	27 ^E	32 ^E	F	30 ^E	26 ^E	28
Filipino*	<u>1.6</u>	44	39	39	31	37	30	27	37	35
Japanese*	<u>0.2</u>	24 ^E	31 ^E	59	38 ^E	36 ^E	40 ^E	31 ^E	50 ^E	39
Chinese	<u>3.4</u>	34	32	34	27	27	31	28	30	30
South Asian	<u>3.8</u>	31	33	31	29	28	28	26	29	29
Southeast Asian*	<u>0.9</u>	39	31	29	26	27	28 ^E	37	34	31
Arab*	<u>1.0</u>	31	21 ^E	19 ^E	14 ^E	16 ^E	11 ^E	13 ^E	13 ^E	16
West Asian*	<u>0.6</u>	25 ^E	31 ^E	25 ^E	F	13 ^E	30 ^E	13 ^E	32 ^E	22
Latin American	<u>1.3</u>	25	20	24	22 ^E	16 ^E	22 ^E	16	23 ^E	21
Aboriginal	<u>3.4</u>	26	26	27	23	26	23	24	26	25
Multiple*	<u>1.1</u>	31	31	27	22 ^E	21	23	23	23	24
Other*	<u>0.7</u>	26 ^E	19 ^E	31 ^E	16 ^E	20 ^E	17 ^E	23	31	23
Not stated	<u>2.9</u>	35	32	33	27	29	29	28	33	31
Self-reported health status										

1											
2											
3	Poor	<u>2.5</u>	53	46	47	44	47	44	43	49	46
4	Fair*	<u>8.3</u>	47	43	43	38	40	38	38	41	41
5	Good/very good/excellent	<u>89.2</u>	30	28	28	24	27	26	26	29	27
6	Body mass index category										
7	Normal/underweight	<u>48.7</u>	29	27	27	23	26	25	25	27	26
8	(≤24.9)										
9	Overweight (25.0-29.9)	<u>31.7</u>	35	32	31	26	30	29	30	33	31
10	Obese (≥30.0)	<u>16.7</u>	36	34	36	30	33	33	31	34	33
11	Not stated	<u>2.9</u>	32	31	30	30	31	29	30	31	30
12	Child <5 years of age in	<u>13.1</u>	25	24	23	20	22	22	22	25	23
13	household										
14	Smoking										
15	Never	<u>42.1</u>	32	30	30	26	29	27	27	30	29
16	Former	<u>37.5</u>	37	34	35	30	32	33	33	36	34
17	Daily/occasional	<u>20.4</u>	22	22	21	17	20	19	19	21	20
18	Has a regular doctor										
19	Yes	<u>84.7</u>	35	33	33	28	31	31	31	33	32
20	No	<u>15.3</u>	14	14	14	10	12	11	11	14	13
21	Place of residence										
22	Urban	<u>81.9</u>	32	30	30	26	28	28	28	31	29
23	Rural	<u>18.1</u>	31	29	29	25	28	27	27	29	28
24	Pharmacist Policy										
25	Yes	<u>27.9</u>	n/a	n/a	n/a	29	29	29	29	33	30
26	No*	<u>72.1</u>	32	30	30	25	28	27	25	25	28

*Changed by ≥5 percentage points over the study period. ^bUse with caution (coefficient of variation 16.6% to 33.3%). ^cToo unreliable to be published (coefficient of variation greater than 33.3%). Due to high sampling variability, estimates denoted with ^E should be interpreted with caution as the respective coefficient of variation is between 16.6% and 33.3%. Estimates with a coefficient of variation above 33.3% (F) are not reported as they may be unreliable and do not meet Statistics Canada's quality standards.

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract [Abstract – methods, p.2] (b) Provide in the abstract an informative and balanced summary of what was done and what was found [Abstract- methods and results, p.2]
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported [p.3]
Objectives	3	State specific objectives, including any prespecified hypotheses [p.3-4]
Methods		
Study design	4	Present key elements of study design early in the paper [Methods- study population, p.4; statistical analysis – p.6]
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection [Methods- study population, p.4]
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants [Methods- study population, p.4]
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable [Methods- definitions, p.4-6]
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group [Methods- definitions, p.4-5]
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at [Abstract- p.2; Methods- study population, p.4; Table 1]
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why [Methods- definitions, p.4-6]
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding [Methods- statistical analysis, p.6-7] (b) Describe any methods used to examine subgroups and interactions [Methods- statistical analysis, p.6-7] (c) Explain how missing data were addressed [N/A] (d) If applicable, describe analytical methods taking account of sampling strategy [Methods- statistical analysis, p.6] (e) Describe any sensitivity analyses [N/A]
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed [Abstract, p.2, Table 1] (b) Give reasons for non-participation at each stage [N/A] (c) Consider use of a flow diagram [N/A]
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders [Results, p.7] (b) Indicate number of participants with missing data for each variable of interest [N/A]
Outcome data	15*	Report numbers of outcome events or summary measures [Results- Trends in

influenza coverage, p.7]		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included [Results-, p.7-9]
		(b) Report category boundaries when continuous variables were categorized [N/A]
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period [N/A]
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses [Results- p.7-9]
Discussion		
Key results	18	Summarise key results with reference to study objectives [Interpretation- Main findings, p.10]
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias [Interpretation- Limitations, p.12]
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence [Interpretation, p.10-11]
Generalisability	21	Discuss the generalisability (external validity) of the study results [Interpretation, p.10]
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based [p.1]

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.