

Influenza Vaccination Coverage in British Columbia Canadian Community Health Survey 2011 & 2012

Background

The [Canadian Community Health Survey](#) (CCHS) is a cross-sectional survey that collects information related to the health status, health care utilization and health determinants of the Canadian population. The target population is persons aged 12 years or older, living in private dwellings in the 115 health regions in all provinces and territories in Canada. The CCHS covers approximately 98% of the Canadian population aged 12 years and older.

The CCHS collects data on influenza vaccination receipt every year. The CCHS data are the best source of routinely collected data for influenza vaccination coverage estimates for the BC population aged 12 years and older living in the community. Annual coverage rates for residents of long term care facilities, who are excluded from the CCHS, are available from the BC Centre for Disease Control, as are annual coverage rates among health care workers employed in acute care and long term care facilities.

As of 2016, most provinces and territories in Canada have adopted universal public funding for influenza vaccine. BC, Quebec, and New Brunswick are the only provinces without universal programs; each have publicly funded programs for people considered at higher risk of complications if infected with influenza. Details of the BC program, including changes over time, are recorded in the [BC Communicable Disease Manual, Chapter 1, Immunization](#).

This report provides estimates of influenza vaccination coverage for the BC population including for groups at higher risk of serious illness and death related to influenza infection: people with chronic medical conditions and people 65 years and older. Comparisons across health regions in BC, and across the provinces and territories in Canada are also provided.

Objectives

To estimate influenza vaccination coverage for BC residents: overall, by age group, by presence of chronic conditions, and by health region.

To describe the most common reasons for not being vaccinated against influenza.

To estimate influenza vaccination coverage for Canadian residents by province or territory: overall, and by age group and presence of chronic conditions.

Methods

Prior to 2007, CCHS data were collected every two years. Since 2008, CCHS data have been collected on an ongoing basis and results are released every year and for combined two year periods. Interviewers were asked to obtain verbal permission from a parent or guardian to interview youths between the ages of 12 to 15 years.

The CCHS uses a probability sample designed to obtain a representative sample of Canadians. Each respondent represents several other persons not in the sample. Sampling weights were used to produce estimates that are representative of the population from which the sample was taken. For the two year 2011 & 2012 data file, the sampling weights were calculated by halving the annual weights.

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The sum of the final weights in the two year files is equal to the average population size over the two years.

Data sources

The 2011 & 2012 CCHS Public Use Microdata File was used for the analysis. The data are available from [Statistics Canada](#).

CCHS data quality

For the two year 2011 & 2012 CCHS, the combined response rate in BC was 65% and ranged from 59 to 71% across the Health Service Delivery Areas. For Canada the combined response rate was 67%. For the 2009 & 2010 CCHS, the combined response rate in BC was 72%, in 2007 & 2008 it was 74%, in 2005 it was 77%, and in 2003 it was 81%.

Exclusions from the CCHS sampling frame

Individuals living on Indian Reserves, on Crown Lands, institutional residents, full-time members of the Canadian Armed Forces and residents of certain remote regions were excluded from the CCHS sampling frame.

Chronic conditions

Influenza vaccine is recommended and publicly funded in BC for individuals who have conditions that place them at a higher risk of influenza-related complications or who are care givers or close contacts of such individuals. Influenza vaccine is also publicly funded and recommended for adults 65 years and older.

The conditions eligible for publicly funded influenza vaccine, as listed in the [BC Centre for Disease Control Immunization Manual](#), include:

- Anatomic or functional asplenia
- Sickle cell disease
- Immunosuppression related to disease or therapy, including
 - o HIV positive adult
 - o Hematopoietic stem cell transplant recipient
 - o Solid organ transplant recipient or awaiting transplant
- Chronic cardio-respiratory disease
- Chronic liver disease
- Chronic hepatitis B
- Chronic hepatitis C
- Chronic renal disease
- Diabetes
- Cystic fibrosis
- Morbid obesity (BMI \geq 40 kg/m²) [added prior to the 2010/11 season in BC]

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The CCHS did not include questions about all of these conditions. The chronic conditions used to define respondents as higher risk which were included in the CCHS are listed below:

- Asthma requiring medication
- Diabetes
- Heart disease
- Cancer
- Chronic bronchitis, emphysema or chronic obstructive pulmonary disease (COPD)
- Morbid obesity (BMI \geq 40 kg/m²)

Influenza vaccination coverage estimates

The 2011 & 2012 CCHS asked whether respondents had a flu shot less than one year ago, 1 year to less than 2 years ago, or 2 years ago or more (Appendix). For the analyses presented here, respondents were categorized as vaccinated if they reported being vaccinated against influenza less than one year ago. As a result of the time frame of the sampling period and wording of the question, the influenza vaccination coverage estimates from the 2011 & 2012 CCHS represent respondents' vaccination status for one of the 2010/11, 2011/12, or 2012/13 influenza seasons. Therefore, influenza vaccination coverage estimates from the 2011 & 2012 CCHS are an average of the coverage during these three influenza seasons.

Data management and calculations

Stata SE 14 was used for all data management and analysis. CCHS sampling weights were used in all calculations; results displayed are for the underlying population from which the study sample was selected (the actual number or percentage of respondents is not displayed). MS Excel was used to prepare all tables.

95% Confidence intervals (95% CI) for vaccination coverage estimates were calculated using the coefficients of variation as outlined in the CCHS User Guide for the Public Use Microdata Files. Estimates with high sampling variability which are likely to be unreliable (using a cut off of a coefficient of variation >16.5%) are indicated in tables and figures.

Results

When interpreting the results, keep in mind:

- Vaccination status and presence of chronic conditions were self-reported
- Influenza vaccination coverage estimates from the 2010 & 2011 CCHS are an average for the 2010/11, 2011/12, 2012/13 influenza seasons.
- Results apply to the community based population aged 12 years and older. Residents of residential care facilities and several other groups were excluded.

Over the two year period of 2011 and 2012, there were 15,413 survey respondents from BC, sampled to represent 3,937,400 residents 12 years and older.

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56% of BC residents have received an influenza vaccination at least once in their lifetime. 29% were vaccinated against influenza within the last year, 9% received their most recent influenza vaccination one to two years ago, and 18% more than two years ago (Table 1).

Table 1: Influenza vaccination history of the BC population

Most recent influenza vaccination	BC population 12 years and older n	% (95% CI)
<1 year ago	1,144,100	29 (28-30)
1 to <2 years ago	356,800	9 (8-10)
2+ years ago	689,700	18 (17-19)
Never	1,623,800	41 (40-42)
Unknown	123,000	3 (2-4)

Characteristics of the BC population and influenza vaccination coverage (vaccinated <1 year ago) are displayed in Table 2. Influenza vaccination coverage was strongly associated with age. Coverage was 25% for 12 to 17 year olds, dropped to 14% for 18 to 29 year olds, and increased with increasing age to 63% for individuals 70 years and older. Coverage was higher for women (32%) than men (26%). Individuals who self-reported a chronic medical condition that puts them at higher risk of complications if infected with influenza had 51% coverage compared to 25% coverage for individuals who did not report a chronic medical condition. Across the five regional Health Authorities, influenza vaccination coverage ranged from 26 to 30%.

Table 2: Characteristics of BC residents aged 12 years and older and influenza vaccination coverage

	% of BC population %	Vaccinated <1 year ago n	Total n	Vaccinated <1 year ago % (95% CI)
Age group (years)				
12 to 17	8	77,800	311,100	25 (21-30)
18 to 29	19	106,900	739,500	14 (12-16)
30 to 39	15	118,500	574,100	21 (18-25)
40 to 49	17	146,200	654,700	22 (19-25)
50 to 59	18	180,900	702,800	26 (23-29)
60 to 64	7	106,400	279,000	38 (33-43)
65 to 69	6	131,600	239,100	55 (49-61)
70+	11	275,800	437,000	63 (58-68)
Total	100	1,144,100	3,937,400	29 (28-30)
Sex				
Male	49	496,900	1,941,100	26 (24-28)
Female	51	647,200	1,996,300	32 (30-24)
Chronic medical condition				
None	83	809,700	3,281,300	25 (24-26)
One or more	17	334,300	656,100	51 (47-55)
Health Authority				
Interior	16	178,800	619,100	29 (25-33)
Fraser	36	405,400	1,406,000	29 (27-31)
Vancouver Coastal	26	308,300	1,022,000	30 (27-33)
Vancouver Island	17	192,100	657,300	29 (25-33)
Northern	6	59,600	233,000	26 (21-31)

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The age distribution of women overall was slightly older than men overall, and women were slightly more likely to report a chronic medical condition, which accounts for some of the difference in influenza vaccination coverage (data not shown). Similarly, the age distribution of the group who reported a chronic medical condition was older than those who did not report a condition; and, differences in the age structure of the populations in each of the regional Health Authorities explains some of the difference in coverage across regions (data not shown, e.g. NHA had the lowest coverage partly due to having the youngest population).

Age and self-report of a chronic medical condition were strongly associated with each other (Figure 1). Only 8% of 12 to 17 year olds reported a chronic medical condition and this increased with age to 44% of individuals 70 years and older.

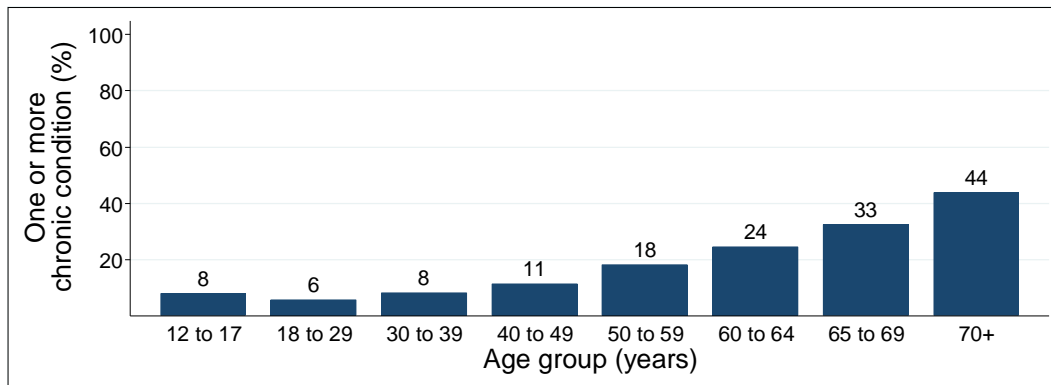


Figure 1: Percent of BC population with one or more chronic medical condition by age group

Influenza vaccination coverage was most strongly associated with age and self-report of a chronic medical condition (Figure 2). A similar pattern of increasing influenza vaccination coverage with increasing age, with a dip in coverage for the 18 to 29 year age group, was observed for both the no chronic condition and one or more chronic condition groups. The chronic condition group had higher influenza vaccination coverage than the no chronic condition group, for all age groups except the 18 to 29 year old group.

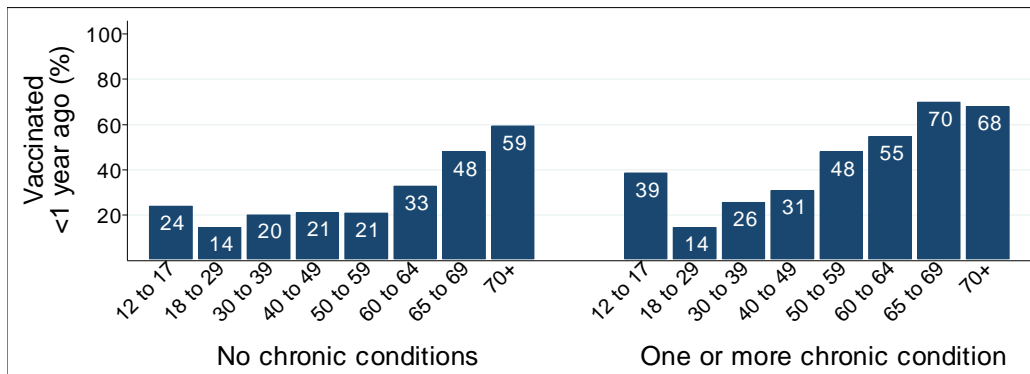


Figure 2: Influenza vaccination coverage by age group and presence of a chronic condition, BC

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The most commonly reported reason for refusal of influenza vaccination within the past year was ‘Unnecessary’: 69% of the unvaccinated who had no chronic medical conditions, and 54% of the unvaccinated with a chronic medical condition (Table 3). This was followed by ‘Did not get around to it’ (15% of the no chronic condition group, 17% of the chronic medical condition group); ‘Bad reaction to previous shot’ (5% of the no chronic condition group, 10% of the chronic medical condition group); and ‘Fear (e.g. painful)’ (4% of the no chronic condition group, 5% of the chronic medical condition group). Other reasons for refusal of influenza vaccination were ‘Doctor didn’t think it was necessary’, ‘Personal or family responsibilities’, ‘Not available at time required’, ‘Not available at all in area’, ‘Waiting time was too long’, ‘Transportation problems’, ‘Language problem’, ‘Cost’, ‘Did not know where to go’, ‘Unable to leave house / health problem’. When combined into an ‘Other reason’ category, these were reported by 8% of the no chronic condition group and 12% of the chronic medical condition group.

Table 3: Reasons for refusal of influenza vaccination by one or more chronic medical condition, BC

Reason for refusal	No chronic condition	One or more chronic condition	All
	% (95% CI)	% (95% CI)	% (95% CI)
Unnecessary	69 (67-71)	54 (48-60)	68 (66-70)
Did not get around to it	15 (14-16)	17 (13-21)	15 (14-16)
Bad reaction to previous shot	5 (4-6)	10 (7-13)	6 (5-7)
Fear (e.g. painful)	4 (3-5)	5 (3-7)*	4 (3-5)
Other reason	8 (7-9)	12 (9-15)	8 (7-9)

*Estimate has high sampling variability and should be interpreted with caution

Chronic medical conditions

About 656,100 BC residents 12 years and older (17% of the population) reported having one or more chronic medical conditions and just over half (51%, 334,000 people) of this group reported vaccination against influenza within the last year (Table 4). Coverage was lower for 12 to 64 year olds (39%) than those 65 years and older (69%). A similar pattern was observed for influenza vaccination coverage for individual chronic medical conditions; respondents 65 years and older had higher reported coverage than 12 to 64 year olds for all conditions assessed.

The reasons reported for refusing influenza vaccination were similar across the chronic medical condition groups (Table 5). For each chronic medical condition ‘Unnecessary’ was the most commonly reported (49 to 72%) followed by ‘Did not get around to it’ (9 to 19%), ‘Bad reaction to a previous shot’ (5 to 12%), and then ‘Fear’ (1 to 8%). Other reasons for refusal were reported by 8 to 14% of respondents across the chronic medical condition groups.

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Table 4: Influenza vaccination coverage by chronic medical conditions and age group, BC

Medical condition	% of BC population %	Vaccinated <1 year ago n	Total n	Vaccinated <1 year ago % (95% CI)
One or more chronic medical condition*				
12 to 64 years	10	149,700	386,700	39 (34-44)
65 years and older	7	184,600	269,400	69 (62-76)
Total	17	334,300	656,100	51 (47-55)
Asthma requiring medication				
12 to 64 years	4	67,800	177,000	38 (31-45)
65 years and older	1	33,400	44,100	76 (62-90)
Total	6	101,200	221,100	46 (40-52)
BMI 40kg/m² or higher				
12 to 64 years	1	7,400	28,200	26 (11-41)*
65 years and older	0	4,000	5,600	72 (37-100)*
Total	1	11,500	33,800	34 (19-49)*
Cancer				
12 to 64 years	1	14,400	30,900	47 (30-64)*
65 years and older	1	27,500	46,300	59 (44-74)
Total	2	41,900	77,200	54 (43-65)
Chronic bronchitis, emphysema, or COPD				
12 to 64 years	1	24,600	55,500	44 (32-56)
65 years and older	1	34,200	46,500	74 (61-87)
Total	3	58,700	102,000	58 (48-68)
Diabetes				
12 to 64 years	3	48,800	104,800	47 (37-57)
65 years and older	3	74,200	106,200	70 (62-78)
Total	5	122,900	210,900	58 (51-65)
Heart disease				
12 to 64 years	1	21,300	49,900	43 (30-56)
65 years and older	3	76,900	110,700	69 (59-79)
Total	4	98,200	160,600	61 (53-69)

*Estimate has high sampling variability and should be interpreted with caution

Table 5: Reasons for refusal of influenza vaccination by chronic medical condition, BC

Reason for refusal	Vaccinated <1 year ago % (95% CI)					
	Asthma	BMI ≥40kg/m ²	Cancer	Chronic bronchitis, Emphysema, or COPD	Diabetes	Heart disease
Unnecessary	52 (43-61)	72 (54-90)	59 (42-76)	57 (42-72)	49 (38-60)	49 (37-61)
Did not get around to it	18 (12-24)*	14 [†]	9 [†]	19 (8-30)*	19 (11-27)*	13 (5-21)*
Bad reaction to previous shot	11 (6-16)*	5 [†]	6 [†]	12 [†]	11 (5-17)*	8 [†]
Fear (general)	7 (3-11)*	3 [†]	8 [†]	6 [†]	1 [†]	4 [†]
Other reason	14 (8-20)*	9 [†]	10 [†]	8 [†]	12 (6-18)*	8 [†]

*Estimate has high sampling variability and should be interpreted with caution

†Estimate has very high sampling variability and confidence interval not calculated

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Geographic region in BC

Influenza vaccination coverage ranged from 26 to 29% for the population 12 years and older across the five regional health authorities in BC (Table 6). Coverage was lowest for 12 to 64 year olds with no chronic medical condition (16 to 23% across health authorities), followed by 12 to 64 year olds with a chronic medical condition (32 to 46% across health authorities), then the group 65 years and older with no chronic medical condition (48 to 59% across health authorities), and highest for the group 65 years and older with a chronic medical condition (59 to 75% across health authorities).

Table 6: Influenza vaccination coverage by health authority, one or more chronic condition, and age group, BC

Health Region	No chronic conditions		One or more chronic condition		All
	12 to 64 Years	65 years and older	12 to 64 Years	65 years and older	
Interior	16 (13-19)	59 (48-70)	46 (33-59)	64 (49-79)	29 (25-33)
Fraser	22 (19-25)	51 (43-59)	38 (30-46)	68 (57-79)	29 (27-31)
Vancouver Coastal	23 (20-26)	56 (46-66)	41 (31-51)	75 (63-87)	30 (27-33)
Vancouver Island	18 (15-21)	57 (46-68)	32 (22-42)	69 (54-84)	29 (25-33)
Northern	18 (13-23)	48 (26-70)*	38 (21-55)*	59 (31-87)*	26 (21-31)
British Columbia	20 (19-21)	55 (50-60)	39 (34-44)	69 (62-76)	29 (28-30)

*Estimate has high sampling variability and should be interpreted with caution

Influenza vaccination coverage by health service delivery area is described in Table 7: 20 to 32% coverage was the range for all HSDA residents, 13 to 24% coverage for 12 to 64 year olds with no chronic medical condition, 25 to 52% coverage for 12 to 64 year olds with one or more chronic condition, 42 to 66% coverage for the group 65 years and older with no chronic conditions, and 52 to 89% for the group 65 years and older with one or more chronic conditions. However, confidence intervals were wide and overlapping.

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Table 7: Influenza vaccination coverage by HSDA, one or more chronic condition, and age group, BC

Health Region	Vaccinated <1 year ago % (95% CI)									
	No chronic conditions				One or more chronic condition				All	
	12 to 64 Years		65 years and older		12 to 64 Years		65 years and older			
East Kootenay	18	(12-24)*	53	(34-72)*	48	(26-70)*	65	(38-92)*	29	(23-35)
Kootenay Boundary	17	(11-23)*	50	(32-68)*	28 [†]		63	(37-89)*	26	(21-31)
Okanagan	15	(11-19)	66	(51-81)	44	(27-61)*	59	(41-77)	29	(25-33)
Thompson Cariboo Shuswap	17	(12-22)	52	(35-69)*	52	(34-70)*	74	(55-93)	30	(25-35)
Fraser East	23	(17-29)	53	(34-72)*	35	(18-52)*	71	(53-89)	31	(26-36)
Fraser North	19	(15-23)	49	(32-66)*	35	(21-49)*	65	(43-87)*	25	(21-29)
Fraser South	24	(19-29)	51	(35-67)	42	(28-56)*	70	(53-87)	31	(26-36)
Richmond	21	(15-27)	63	(39-87)*	50	(30-70)*	89	(63-115)	31	(25-37)
Vancouver	24	(19-29)	53	(37-69)	39	(23-55)*	70	(52-88)	30	(26-34)
North Shore / Coast Garibaldi	21	(15-27)	57	(40-74)	36	(13-59)*	74	(52-96)	30	(25-35)
South Vancouver Island	20	(16-24)	62	(49-75)	31	(20-42)*	72	(58-86)	31	(27-35)
Central Vancouver Island	15	(11-19)	52	(38-66)	25	(10-40)*	64	(46-82)	26	(22-30)
North Vancouver Island	20	(13-27)*	55	(35-75)*	49	(25-73)*	70	(48-92)	32	(25-39)
Northwest	20	(13-27)*	51	(24-78)*	46	(20-72)*	64	(30-98)*	28	(22-34)
Northern Interior	20	(14-26)	49	(27-71)*	36	(21-51)*	60	(29-91)*	27	(22-32)
Northeast	13	(7-19)*	42 [†]		37	(15-59)*	52 [†]		20	(14-26)
BRITISH COLUMBIA	20	(19-21)	55	(50-60)	39	(34-44)	69	(62-76)	29	(28-30)

*Estimate has high sampling variability and should be interpreted with caution

†Estimate has very high sampling variability and confidence interval not calculated

Influenza vaccination coverage across the provinces and territories

Over the two year period of 2011 and 2012, there were 124,929 survey respondents included across Canada, sampled to represent 29,335,200 Canadians 12 years and older.

Overall, influenza vaccination coverage ranged from 22% to 45% across the provinces and territories and was 29% for Canada (Table 8). In every province, coverage was lowest for 12 to 64 year olds with no chronic medical conditions (13 to 34%); coverage was second lowest for 12 to 64 year olds with one or more chronic medical condition (30 to 60%); coverage was second highest for individuals 65 years and older with no chronic medical condition (48 to 67%); and, coverage was highest for individuals 65 years and older with one or more chronic medical condition (57 to 78%).

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Table 8: Influenza vaccination coverage by province, age group, and one or more chronic medical condition

Province	Vaccinated <1 year ago against influenza % (95% CI)					
	No chronic conditions		One or more chronic conditions		All	
	12 to 64 Years	65 years and older	12 to 64 Years	65 years and older	12 years and older	
NFLD & LAB.	17 (15-19)	48 (39-57)	30 (24-36)	58 (49-67)	25 (23-27)	
PEI	24 (20-28)	48 (36-60)	36 (27-45)	69 (55-83)	32 (29-35)	
Nova Scotia	34 (31-37)	67 (59-75)	60 (54-66)	78 (70-86)	45 (43-47)	
New Brunswick	25 (23-27)	59 (51-67)	43 (37-49)	70 (63-77)	35 (33-37)	
Quebec	13 (12-14)	50 (46-54)	30 (27-33)	57 (52-62)	22 (21-23)	
Ontario	22 (21-23)	61 (57-65)	37 (34-40)	70 (67-73)	31 (30-32)	
Manitoba	19 (17-21)	52 (45-59)	32 (26-38)	69 (58-80)	28 (26-30)	
Saskatchewan	23 (21-25)	52 (45-59)	35 (29-41)	65 (57-73)	30 (28-32)	
Alberta	22 (20-24)	56 (49-63)	36 (31-41)	68 (59-77)	29 (27-31)	
British Columbia	20 (19-21)	55 (50-60)	39 (34-44)	69 (62-76)	29 (28-30)	
Territories	31 (29-33)	52 (41-63)	41 (34-48)	66 (46-86)	34 (32-36)	
Canada	20 (19-21)	56 (54-58)	36 (34-38)	66 (63-69)	29 (28-30)	

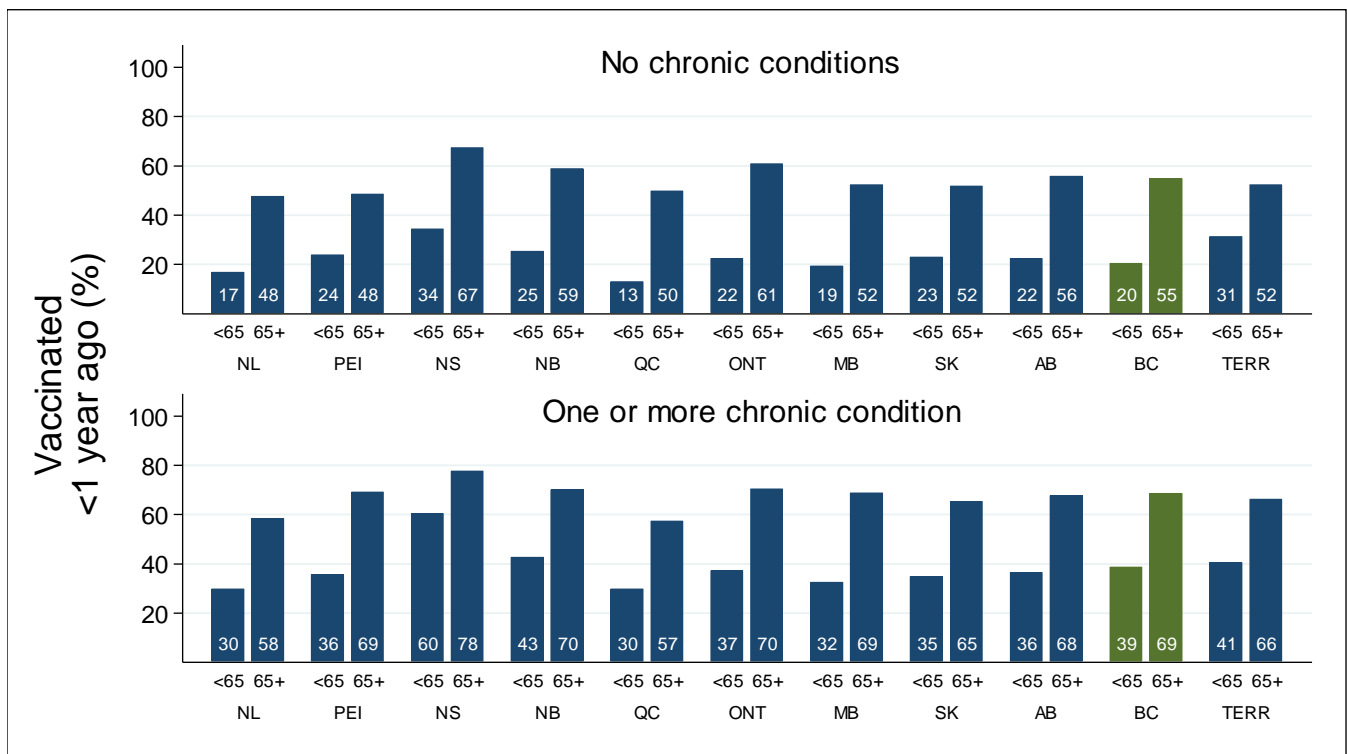


Figure 3: Influenza vaccination coverage by province or territory, age group, and chronic conditions

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Vaccine doses distributed in British Columbia, 2010/11 to 2012/13

To assess whether the 2011 2012 CCHS influenza vaccination coverage estimates over or underestimated the actual coverage, the net doses of publicly funded influenza vaccine utilized in BC (doses distributed minus doses returned at the end of the season) were calculated and compared to the number of doses needed to achieve the CCHS coverage estimates. All publicly funded influenza vaccine in BC is distributed by the BC Centre for Disease Control (BCCDC) and the net doses distributed are a proxy for the total doses administered.

There were an average of 1,063,800 net doses of publicly funded influenza vaccine distributed over the 2010/11, 2011/12, and 2012/13 influenza seasons: 1,017,900 doses for the 2010/11 season, 1,018,000 doses for the 2011/12 season, and 1,155,400 doses for the 2012/13 season.

Based on responses from the 2011 & 2012 CCHS, an estimated 1,144,000 seasonal influenza vaccinations were administered to BC residents 12 years and older living in the community. This estimate reflects an average of the doses administered over the 2010/11, 2011/12, and 2012/13 influenza seasons and is approximately 80,000 (14%) doses higher than the average net doses distributed over the same time period.

The CCHS-based estimates of doses administered include both publicly funded and privately purchased influenza vaccinations but are restricted to the population of BC residents aged 12 years and older who are included in the survey sample. The CCHS estimates appear to overestimate uptake, especially because the doses required for the CCHS population exclude the population of BC under 12 years of age. Possible reasons for the apparent overestimation include that the survey question did not distinguish season of vaccine receipt, respondents may over-report receipt of vaccine, vaccine recipients may be over-represented among those responding to the survey, or a portion of recipients eligible for publicly funded vaccine may have been vaccinated using privately purchased vaccine.

Summary

Influenza vaccination coverage was 29% for BC residents 12 years and older living in the community, based on a self-report of vaccine receipt within the past year. This estimate represents an average of the coverage over the 2010/11, 2011/12, and 2012/13 influenza seasons. Coverage was strongly associated with age and self-report of one or more chronic medical conditions. Older age groups were more likely to be vaccinated against influenza. Also, within the same age group, individuals who reported a chronic medical condition had higher influenza vaccination coverage. The same pattern of increasing influenza vaccination coverage with increasing age was observed when the chronic medical conditions were analyzed individually. The most commonly reported reason for refusal of influenza vaccination was that it was 'Unnecessary', followed by 'Did not get around to it', which was consistent across age groups, and presence of one or more chronic medical condition, and each individual chronic medical condition.

Influenza vaccination coverage was similar across the five regional health authorities in BC. More variation was observed at the health service delivery area level but the confidence intervals for these estimates were wide and overlapping. Similar patterns were observed across all regions of increasing coverage with increasing age and report of one or more chronic medical condition.

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For all of Canada, influenza vaccination coverage was 29% for residents 12 years and older living in the community. Most provinces and the territories, including BC, had similar coverage to the national estimate. However, the largest differences compared to the national estimate were observed for Quebec where only about a fifth of residents were vaccinated against influenza and in Nova Scotia where almost half were vaccinated.

The estimated vaccination coverage for seasonal influenza in BC was likely slightly overestimated by the CCHS, based on comparing CCHS estimates with the net number of publicly funded influenza vaccine doses distributed by the BC Centre for Disease Control.

The main strength of using CCHS data to estimate influenza vaccination coverage is the random sampling design, which ensures the coverage estimates should be representative of the underlying population. Also, the use of the same questions across Canada allows for regional, and provincial and territorial comparisons of coverage estimates and reasons for refusal of influenza vaccination.

The main weakness of using CCHS data was that influenza coverage estimates from the 2011 & 2012 data file represent an average of coverage for the 2010/11, 2011/12, and 2012/13 influenza seasons, which makes the results more difficult to interpret. Also, the response rate to the CCHS is dropping over time, which may make the results less reliable. Due to the exclusion of individuals living on Reserves and residents in certain remote regions, estimates for the Northern Health Authority in BC may not be as representative of the Health Authority's population as estimates for other Health Authorities. Healthy infants aged 6 to 59 months (6 to 23 months prior to 2012/13 season), children aged 5 to 11 years at higher risk if infected with influenza, and residents of long term care facilities were eligible for publicly funded influenza vaccine in BC but were not included in the CCHS. Other groups included in the CCHS which were not identifiable in the survey include some chronic medical condition groups, household contacts of people at higher risk if infected with influenza, health care workers, emergency responders, and pregnant women.

Influenza vaccination coverage in BC (29%) is equal to the national coverage for Canada (29%). The majority of people unvaccinated against influenza reported that it was 'Unnecessary'. If influenza vaccination coverage is going to be increased, for the population in general or specific higher risk groups, research is needed into what would make people more likely to get vaccinated against influenza targeting both those who have previously been vaccinated against influenza and those who have never been vaccinated against influenza.

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Appendix

Key CCHS Questions and Response Options

Influenza vaccination history

When did you have your last seasonal flu shot?

- Less than 1 year ago
- 1 year to less than 2 years ago
- 2 years ago or more
- Not applicable
- Don't know
- Refusal
- Not stated

Reasons for influenza vaccine refusal

What are the reasons that you have not had a flu shot in the past year?

[Yes, No, Not Applicable, Don't know, Refusal, Not stated]

- Respondent did not think it was necessary
- Have not gotten around to it
- Bad reaction to previous shot
- Fear (e.g., painful, embarrassing, find something wrong)
- Other
- Cost
- Did not know where to go / uninformed
- Doctor did not think it was necessary
- Language problem
- Not available at all in the area
- Not available at time required
- Personal or family responsibilities
- Transportation problems
- Unable to leave the house because of a health problem
- Waiting time was too long

**Influenza Vaccination Coverage in British Columbia
Canadian Community Health Survey 2011 & 2012**

Higher risk chronic medical conditions

Asthma requiring medication

[Yes, No, Not Applicable, Don't know, Refusal, Not stated]

- In the past 12 months, have you taken any medicine for asthma such as inhalers, nebulizers, pills, liquids or injections?

Cancer

[Yes, No, Not Applicable, Don't know, Refusal, Not stated]

- Do you have cancer?

Chronic bronchitis, emphysema or chronic obstructive pulmonary disease (COPD)

[Yes, No, Not Applicable, Don't know, Refusal, Not stated]

- Do you have chronic bronchitis, emphysema or chronic obstructive pulmonary disease or COPD?

Diabetes

[Yes, No, Not Applicable, Don't know, Refusal, Not stated]

- Do you have diabetes?

Heart disease

[Yes, No, Not Applicable, Don't know, Refusal, Not stated]

- Do you have heart disease?

Morbid obesity (BMI ≥ 40 kg/m²)

[Yes, No, Not Applicable, Don't know, Refusal, Not stated]

- Self-reported body mass index