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Influenza vaccine uptake among adults living with young children

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ABSTRACT

Background: Many studies report vaccine uptake among young adults aged 18 to 49 years is low. In Canada, the National Advisory Committee on Immunization (NACI) recommends influenza vaccination for adults in contact with young children, however vaccination rates for this specific population are missing. An estimate is required to identify appropriate public health interventions. The objective of this study was to describe recent trends in influenza vaccination uptake among Canadian adults aged 18 to 49 years old living with or without young children.

Methods: The Canadian Community Health Survey (2013-2014) dataset, available for public use was used after grouping individuals by influenza vaccination uptake within the past year in adults aged 18 to 49 years. The relationship between living in a household with young children and influenza vaccination uptake was examined using a multivariable logistic regression model.

Results: Among Canadian adults aged 18 to 49 years, the influenza vaccination uptake was 24.1% in adult household contacts with young children compared to 18.2% in those without young children ($p < .0001$). After adjusting for socio-demographic characteristics and self-perceived health, we determined that vaccine uptake was associated with living in a household with young children (adjusted OR: 1.30 [95%CI: 1.17-1.44]). While socio-demographic characteristics and self-perceived health greatly influenced influenza vaccination uptake, we also found marital status was a strong influencer of influenza vaccine uptake (adjusted OR: 1.31 [95%CI: 1.16-1.48]).

Conclusion: Overall, influenza vaccination uptake among caregiving adults is low. Increased vaccine uptake was associated with living in a household with one or more young children. Targeted education and vaccination programs are required to improve uptake of the influenza vaccine in this age group.

Key Words: Influenza, Vaccine, Adults, Uptake, Children, Canada community health survey

1. INTRODUCTION

Every year, influenza causes substantial mortality and morbidity resulting in missed work, increased healthcare costs and loss of productivity in Canada.^[1-3] In particular, children less than 2 years, followed by children 2-4 years of age are at a greater risk of influenza infections, with an estimated an-

nual infection rate of 10%-40%,^[4-6] resulting in significant influenza related morbidity and mortality among children under five.^[7,8] In addition to hand hygiene, influenza vaccination is an effective way of preventing influenza infections.^[9]

The National Advisory Committee on Immunization (NACI) in Canada recommends influenza vaccination for all individu-

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als aged 6 months and older, but suggests particular focus on individuals at high risk of influenza-related complications or hospitalization, including individuals capable of transmitting influenza to those at high risk.^[10] This group includes parents or caregivers in contact with young children. This recommendation recognizes that homecare and daycare contacts with young children play a major role in the transmission of illness.^[11] Despite the NACI recommendations, vaccination rates continue to be low among Canadians aged 18 to 49 years.

In 2015-2016, influenza vaccination coverage among Canadian children under five was 30%, well below the national target of 80%.^[12] While influenza vaccination rates among Canadian adults differed greatly by their age groups, they were lowest among adults aged 18 to 49 years, ranging from 19.0% to 25.7%.^[12] At present, we do not have uptake rates for the vaccine in adults who are living with children. The objective of this study was to evaluate the most recent vaccination rates in adults aged 18 to 49 years old living with young children as well as to determine reasons for vaccine uptake using the Canadian Community Health Survey data.

2. METHODS

2.1 Study design and Database

The CCHS is a population-based survey conducted nationwide every two years by Statistics Canada.^[13] The purpose of CCHS is to provide regular and timely cross-sectional estimates of health determinants, health status, health system utilization and health behaviors at the provincial and health authority levels. The survey includes all individuals aged 12 years and older residing in a private dwelling within the ten provinces and three territories of Canada. The included sample is highly representative of the vast majority of the Canadian population, excluding institutionalized populations, members of Canadian Forces (full-time) and those living in remote areas or on reserves.^[13]

The data from the 2013-2014 CCHS survey were analyzed to provide decision makers in depth information on questions surrounding uptake of influenza vaccination in adults who were living in a household with or without children. We included individuals between the ages of 18 and 49 years who were living with “one or more children between the ages of 0 and 5 years” or “none”, as derived by Statistics Canada. Individuals who responded to any of the survey questions with “don’t know, refusal or not stated” answers were excluded from this analysis.

2.2 Statistical analysis

The binary outcome variable (vaccinated in the last year or not) for influenza vaccine uptake was obtained using the

survey question “When did you have your last seasonal flu shot?” Potential options for this question were “less than a year ago”, “1 year to less than 2 years ago”, “2 years ago or more”, “not applicable”, or “I don’t know”; respondents could also not state an answer (i.e., refusal/not stated). Survey respondents who specified their last vaccination beyond the last year (i.e., “1 year to less than 2 years ago”, “2 years ago or more”) were considered as not vaccinated within the last year and thus included from the analysis. The explanatory variable of living in a household with children 5 years and under (yes versus no) was a derived Statistics Canada variable, based on data on household composition. Potential confounders of the association between living in a household with children five and under and influenza vaccine uptake included were: 1) respondent’s age, 2) gender, 3) respondent household’s highest education status, 4) cultural/racial identity, 5) self-perceived health and 6) marital status.

Sampling weights provided by Statistics Canada were used to account for unequal selection probability and response rate, and to calculate appropriate variance estimates. Descriptive statistical analyses were conducted to estimate the proportion of individuals who obtained influenza vaccination in the past year stratified by their household contact status with young children, gender, age, education, racial/cultural identity, self-perceived health and marital status. Potential bias due to missing data was assessed using the chi-square test comparing proportions of excluded and included respondents. A multivariable logistic regression model was built to investigate the relationship between living in a household with children 5 years and under and influenza vaccine uptake, while accounting for the aforementioned confounders. All tests were two tailed with a $p < .05$ considered significant. All statistical analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC).^[14]

The CCHS data is kept confidential and private in accordance under the authority of the Statistics Act.^[15] Ethics approval for the study was covered by the University of British Columbia’s policy 89 for research on human subjects using publicly available data from Statistics Canada.^[16]

3. RESULTS

Of the 127,462 survey respondents, 36% (N = 45,299) were aged 18 to 49 years old (see Figure 1). Among the eligible sample, 883 individuals were excluded, as they did not provide an answer regarding their influenza vaccination status, leaving a sample of 44,416 respondents. After excluding invalid responses to confounders required for adjustment in the multivariable analysis, the final analytical sample consisted of 41,686 respondents. Compared with respondents who remained in the analytical sample, those who were excluded

based on their invalid responses were more likely to be living in a household with no children under 5 years of age ($p < .0001$), male ($p < .0001$), under 35 years ($p < .0001$), lower

education ($p = .0038$), never married ($p < .0001$) and to have poor self-perceived health ($p < .0001$). The two groups did not differ significantly in racial/cultural identity.

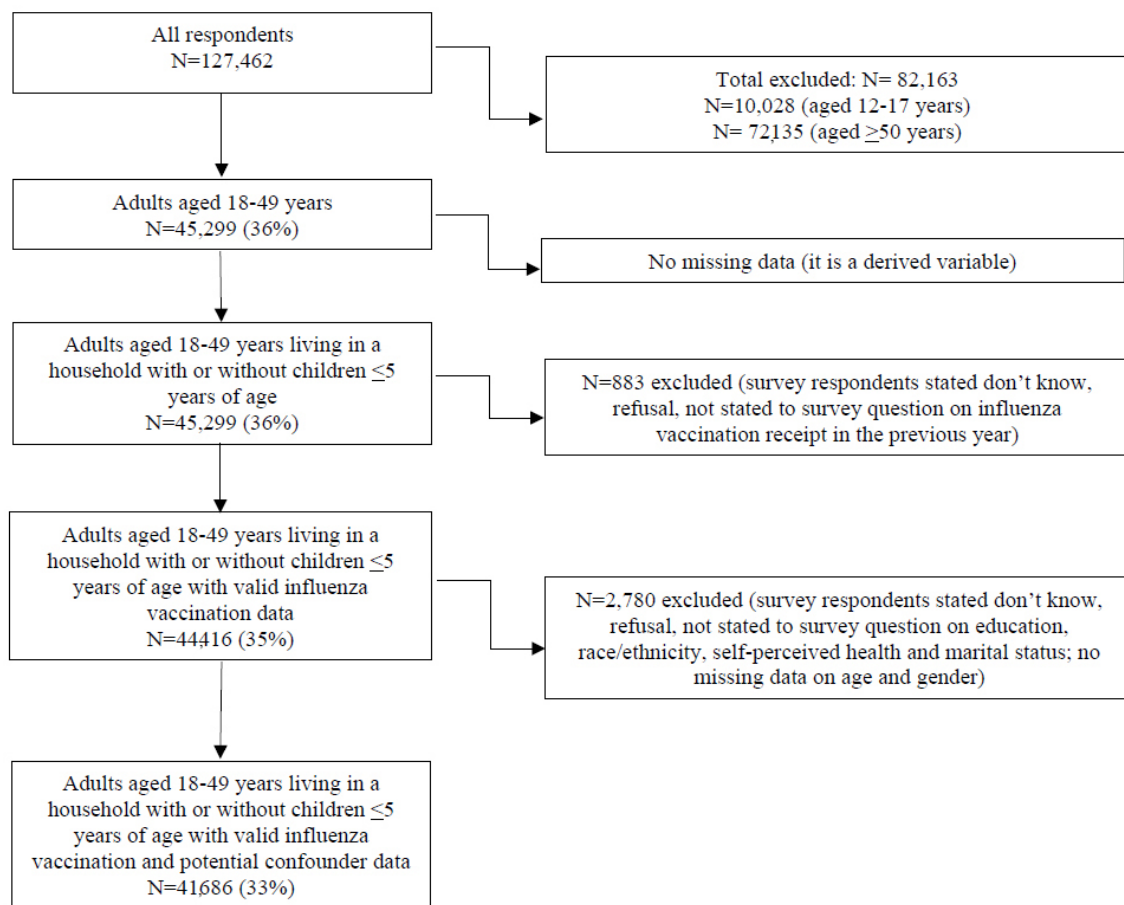


Figure 1. Final study sample from the Canada Community Health Survey, 2013-2014 cycle

The demographic characteristics of the overall study sample, along with the characteristics of the subgroups, stratified by vaccine uptake within the last year are presented in Table 1. The overall study sample had an equal proportion of gender, with males representing 49.9%, married (41.8%). Most of the respondents were aged 18 to 34 years (52.7%), reported the highest household education level of post-secondary graduation (83.1%), and were white (70.9%). Majority of the respondents reported excellent (23.6%), very good (41.8%) or good (27.9%) health compared to fair (5.4%) or poor health (1.3%). Notably, influenza vaccination rates were higher among those with poor health (41%) compared to excellent health (27%).

Amongst the 41,686 included respondents aged 18 to 49 years, the weighted influenza vaccine uptake in within the past year was 19.6%. Amongst Canadian adults aged 18 to 49 years, 23.6% lived in a household with young children five years

of age and under and 24.1% reported as having received the influenza vaccine within the last year compared to 18.2% for those who did not live with young children (see Table 1). In examining the relationship between the outcome and potential confounders, influenza vaccination rates were higher in females compared to males ($p < .0001$). Similarly, influenza vaccination rates were higher in those 35 to 49 years of age compared to those 18 to 34 ($p < .0001$). Likewise, influenza vaccination rates were higher in households with post-secondary graduate education compared to the lower education households ($p < .0001$). Influenza vaccination rates were higher among those who were married compared to never married individuals ($p < .0001$). Influenza vaccination rates were also higher in visible minorities compared to whites ($p = .003$). Influenza vaccination rates were higher in those with poor health and differed greatly by self-perceived health ($p = .01$).

Table 1. Characteristics and influenza vaccine uptake of the survey respondents aged 18 to 49 years in the Canada Community Health Survey from the 2013-2014 cycle

	Overall		Vaccine Uptake Within Last year				P
			Yes		No		
	N	(%)	N	(%)	N	(%)	
Living in a household with children 5 and younger	41,686	32.6	8,949	19.6	32,687	80.4	
No	30,719	76.4	6,050	18.2	24,669	81.8	
Yes	10,917	23.6	2,899	24.1	8,018	75.9	<.0001
Gender							
Male	19,103	49.9	3,193	15.9	15,910	84.1	
Female	22,533	50.1	5,756	23.2	16,777	76.8	<.0001
Age							
<35 years	21,930	52.7	4,114	16.9	17,816	83.1	
≥35 years	19,706	47.3	4,835	22.6	14,871	77.4	<.0001
Education							
Less than Post-secondary	7,953	19.1	1,330	14.3	6,623	85.7	
Post-secondary	33,683	80.9	7,619	20.7	26,064	79.4	<.0001
Marital Status							
Never married	16,949	37.0	3,017	15.6	13,932	84.5	
Common-law	6,121	15.4	1,143	16.6	4,978	83.4	
Married	15,736	41.7	4,153	23.9	11,583	76.2	
Widow/Separated/ Divorced	2,830	5.9	636	22.5	2,194	77.5	<.0001
Racial/Cultural Identity							
White	32,652	70.9	6,815	18.9	25,837	81.1	
Visible Minority	8,984	29.1	2,134	21.3	6,850	78.7	.0034
Self-perceived health							
Excellent	9,460	23.6	2,029	20.3	7,431	79.8	
Very Good	17,338	41.8	3,706	19.1	13,632	80.9	
Good	11,750	27.9	2,420	18.8	9,330	81.2	
Fair	2,442	5.4	605	23.0	1,837	77.0	
Poor	646	1.3	189	25.2	457	74.7	.0107

*Percentages are weighted to the Canadian population to account for CCHS multistage stratified sampling strategy

Table 2 shows the results of the logistic regression that evaluated the relationship between living in a household with children five and under and influenza vaccine uptake within the last year. In the unadjusted model, the odds of influenza vaccine uptake in adults with children was 1.44 (95%CI: 1.30-1.56) times the odds of vaccine uptake in those with no young children in the household. In terms of the confounding variables in the unadjusted model, the odds of influenza vaccine uptake were higher among women, those who were married, visible minorities; adults aged 35 to 49 years, and those with the highest education level, when compared to

their reference group. The main effect estimate for the association between having young children and vaccination in the past year was slightly attenuated in the multivariable logistic regression model that adjusted for age, gender, marital status, racial/cultural identity, education status and self-perceived health (OR 1.30; 95%CI: 1.17-1.43). The strongest confounder was marital status, independently attenuating the main effect by more than 10%, as married individuals were more likely to receive influenza vaccination when living in a household with children compared to those who are not married.

Table 2. Logistic regression analysis of the relationship between living in a household with children and influenza vaccination uptake within the past year among Canadian adults aged 18-49 years, Canadian Community Health Survey cycle for 2013/2014

	Unadjusted Odds Ratio (95% Confidence Interval)	Adjusted Odds Ratio (95% Confidence Interval)
Living in a household with children 5 and younger		
No	Reference	Reference
Yes	1.44 (1.30-1.56)	1.30 (1.17-1.44)
Gender		
Male	Reference	Reference
Female	1.60 (1.47-1.74)	1.56 (1.43-1.71)
Age		
<35 years	Reference	Reference
≥35 years	1.43 (1.32-1.56)	1.26 (1.14-1.39)
Education		
Less than Post-secondary	Reference	Reference
Post-secondary	1.56 (1.39-1.76)	1.49 (1.32-1.68)
Marital Status		
Never married	Reference	Reference
Common-law	1.08 (0.95-1.23)	0.95 (0.82-1.09)
Married	1.70 (1.55-1.87)	1.31 (1.16-1.48)
Widow/Separated/ Divorced	1.57 (1.29-1.92)	1.24 (1.01-1.53)
Racial/Cultural Identity		
White	Reference	Reference
Visible Minority	1.16 (1.05-1.28)	1.11 (1.01-1.23)
Self-perceived health		
Poor	Reference	Reference
Fair	0.88 (0.63-1.25)	0.87 (0.61-1.22)
Good	0.68 (0.50-0.93)	0.64 (0.47-0.87)
Very Good	0.70 (0.51-0.95)	0.65 (0.48-0.89)
Excellent	0.75 (0.55-1.03)	0.69 (0.51-0.95)

4. DISCUSSION

This is the first study to undertake an analysis of influenza vaccine uptake among Canadian adults living in a household with young children using CCHS data. We found that individuals living with young children had a 30% increased odds of obtaining influenza vaccination compared to those adults who did not. We also found young Canadian adults living in a household with young children are more likely to receive vaccination if they are women, married, self-identify as a visible minority, older individuals, or have higher household education levels. In contrast, those with better self-perceived health are less likely to receive vaccination, even when living in a household with young children.

Despite clinical guidelines and public health efforts to target adult household contacts of children who are at high-risk of influenza-related hospitalization and morbidity, rates of influenza vaccination are very low with only 24% of the household contacts of young children obtaining influenza vaccination in our study. Our findings align with a 2009 hospital based survey study conducted in Saskatchewan, Canada that used convenience sampling of 82 adults who were living with children under 17 years of age.^[17] In this study, influenza vaccination rates were 21% among those living with children with cystic fibrosis and 25% among household contacts of children under 2 years of age.^[17]

Studies that have evaluated reasons for low influenza vaccination uptake rates suggest that low uptake is related to good self-perceived health, difficulty taking time away from work and difficulty finding time to be vaccinated with young children in the household, inconvenient vaccination locations, having to make appointments at public health clinics or physician offices or believing influenza vaccine do not prevent influenza and side effects outweigh benefits.^[17-20] For example, one US study exploring influenza vaccination acceptability amongst 285 household contacts of infants in a county hospital setting, reported willingness of adult caregivers to be vaccinated during hospital or clinic visits with their infant.^[21] They also reported statistically significant higher willingness in women (87.1%) compared to men (67.5%) among 18-49 years old.^[21] In a similar 2010 hospital based pediatric clinic US study, 85.6% of the 336 study participants, parents and caregivers of at risk children, due to age or chronic conditions, obtained influenza vaccination at the pediatric clinic compared to 23.7% in the previous year at a non-pediatric clinic.^[22] In another US study, based on Behavioral Risk Factor Surveillance System (BRFSS), the prevalence of influenza vaccination among 18-64 years old individuals was found to be higher, if they were women, of white race, married or lived with a partner, had higher education, poor health, income < \$35,000 per year and health coverage.^[23] Finally a

study evaluating physician behavior found that physician advice had a positive influence on influenza vaccination uptake in parents of children at risk.^[17]

One of the main strengths of this study was the use of CCHS's large survey dataset, which was obtained through national sampling methodology, giving it high external validity. Further, the large dataset meant we could adjust for many confounders, including age, gender, household education status, marital status, racial/cultural identity and self-perceived health. While this study has strengths, it is not without limitations. We have specifically focused on the age group 18 to 49 to report on influenza vaccination trend, as this group tends to have low vaccination rates, with a potential caregiving responsibility of young children. It is possible adults above 49 years of age are likely to live in a household with young children, if so, influenza vaccination rates were much higher in the older adults than 18-49 years old.^[12] In addition, we have focused on self-reporting of the influenza vaccination uptake, which is likely to be biased due to social desirability, resulting in over reporting of vaccination uptake.^[24,25] We noted non-responders were significantly different from responders, which would result in response bias in our study.^[26]

Considering, 14.5% of the Canadians do not have regular access to a physician, especially those in the age group of 20 to 34 years,^[27] it is imperative to educate caregivers and household contacts of young children on the benefits of influenza vaccination through public health campaigns. In addition, increasing access to vaccination by setting up vaccination clinics at daycares and community centers for children and their household contacts, availability of vaccines through pharmacies which have extended clinic hours^[28] are likely to increase vaccination rates among these individuals.

5. CONCLUSION

Influenza vaccine uptake was low in young adults aged 18 to 49 years old, although individuals living in a household with young children are more likely to obtain influenza vaccination compared to those who are not. Other factors influencing influenza vaccination rates were gender, household education level, marital status, racial/cultural identity and self-perceived health. Given the low vaccination coverage in young children and their household contacts, targeted public health campaigns are necessary to inform individuals of the benefits of vaccination and special vaccination promotion programs are required to increase vaccine coverage in these age groups.

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CONFLICTS OF INTEREST DISCLOSURE

The author declares that there is no conflict of interest regarding the publication of this paper.

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