

# Influenza vaccination coverage across ethnic groups in Canada

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See related commentary by Gessner on page 1661 and at [www.cmaj.ca/lookup/doi/10.1503/cmaj.120775](http://www.cmaj.ca/lookup/doi/10.1503/cmaj.120775)

## ABSTRACT

**Background:** The success of influenza vaccination campaigns may be suboptimal if subgroups of the population face unique barriers or have misconceptions about vaccination. We conducted a national study to estimate influenza vaccine coverage across 12 ethnic groups in Canada to assess the presence of ethnic disparities.

**Methods:** We pooled responses to the Canadian Community Health Survey between 2003 and 2009 ( $n = 437\ 488$ ). We estimated ethnicity-specific self-reported influenza vaccine coverage for the overall population, for people aged 65 years and older, and for people aged 12–64 years with and without chronic conditions. We used weighted logistic regression models to examine the association between ethnicity and influenza vaccination, adjusting for sociodemographic factors and health status.

**Results:** Influenza vaccination coverage ranged from 25% to 41% across ethnic groups. After

adjusting for sociodemographic factors and health status for people aged 12 years and older, all ethnic groups were more likely to have received a vaccination against influenza than people who self-identified as white, with the exception of those who self-identified as black (odds ratio [OR] 1.01, 95% confidence interval [CI] 0.88–1.15). Compared with white Canadians, Canadians of Filipino (OR 2.00, 95% CI 1.67–2.40) and Southeast Asian (OR 1.66, 95% CI 1.36–2.03) descent had the greatest likelihood of having received vaccination against influenza.

**Interpretation:** Influenza vaccine coverage in Canada varies by ethnicity. Black and white Canadians have the lowest uptake of influenza vaccine of the ethnic groups represented in our study. Further research is needed to understand the facilitators, barriers and misconceptions relating to vaccination that exist across ethnic groups, and to identify promotional strategies that may improve uptake among black and white Canadians.

### Competing interests:

Jennifer Pereira has been a consultant for GlaxoSmith-Kline for non-influenza-related work. No other competing interests were declared.

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Accurate and reliable data on vaccine coverage are essential for evaluating the success of influenza vaccination campaigns. Identifying populations with suboptimal coverage can help program planners design effective, targeted health-promotion strategies. Vaccine coverage has traditionally been described by age and sex;<sup>1</sup> little research in Canada has examined coverage by ethnicity.

Many studies in the United States have shown large ethnic disparities (> 15%) in coverage between people who self-identify as white, black or Hispanic among adults with high-risk conditions,<sup>2</sup> older adults<sup>3,4</sup> and Medicare beneficiaries.<sup>5</sup> The reasons for these disparities are complex and may be related to attitudes and knowledge about vaccination, access to health care, socioeconomic status and provider bias.<sup>6</sup> However, these findings cannot be applied to the Canadian

population, which is distinct in terms of the delivery of influenza vaccinations and ethnic composition. Since the late 1970s, the number of non-European immigrants to Canada has risen, contributing to a substantial increase in the visible minority population, from 4.7% of the total population in 1981 to 16.2% in 2006.<sup>7</sup> More than 200 different ethnic origins were reported in the 2006 Census,<sup>8</sup> with people of South Asian (4.0%), Chinese (3.9%) and black (2.5%) heritage representing the largest proportions of the population.

Canada's National Advisory Committee on Immunization recommends vaccination against influenza for people at high risk of serious infection and their contacts.<sup>9</sup> The largest risk groups are adults 65 years of age and older and people with certain chronic medical conditions (e.g., cardiac and pulmonary disorders, diabetes,

cancer, immune-compromising conditions, renal disease, anemia and obesity). Every province and territory provides free influenza vaccinations to these priority groups. Since 2000, Ontario has provided publicly funded influenza vaccinations to all people older than 6 months of age. Other jurisdictions (Alberta, Manitoba, Saskatchewan, Nova Scotia, Nunavut, Yukon and Northwest Territories) have subsequently adopted similar programs.<sup>10</sup> Although these initiatives should reduce financial barriers to vaccination, there may be other barriers or misconceptions unique to specific groups that affect behaviour.

The purpose of this study was to estimate influenza vaccine coverage across 12 ethnic groups in Canada to assess possible disparities.

## Methods

### Survey sample

We conducted a cross-sectional study using nationally representative data from the 2003, 2005, 2007, 2008 and 2009 cycles of the Canadian Community Health Survey.<sup>11</sup> This voluntary survey by Statistics Canada collects information about health status, use of health care and health determinants from people aged 12 years and older. The survey uses a multistage stratified cluster design that samples 98% of the population, excluding people living on Aboriginal reserves or Crown land, regular members of the Canadian Forces, and residents of institutions (e.g., long-term care facilities, prisons) and certain remote regions.

We combined 5 cycles to increase the size of our sample of ethnic groups to improve the reliability of our estimates. We considered factors such as changes in the content of the survey or its method of delivery, coverage and geography before combining cycles.<sup>12,13</sup> The response rate across cycles ranged from 73% to 81%.<sup>11</sup>

This study received approval from the Health Sciences Research Ethics Board of the University of Toronto.

### Outcome measures

Our dependent variable was self-reported influenza vaccination, which we determined with responses to the questions “Have you ever had a flu shot?” and “When did you have your last flu shot?” We considered only those respondents who reported having had a flu shot within the past 12 months to be actively immunized against influenza.

We determined ethnicity, our primary independent variable, with the question “People living in Canada come from many different cultural

and racial backgrounds. Are you ... ?” The following choices of response were provided: white, Chinese, South Asian (e.g., Indian, Pakistani, Sri Lankan), black, Filipino, Latin American, Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese), Arab (e.g., Egyptian, Lebanese), West Asian (e.g., Afghan, Iranian), Japanese, Korean, Aboriginal (North American Indian [i.e., First Nations], Métis, Inuit) and other. Respondents who selected multiple categories were classified as multiracial, unless one of the categories they selected was Aboriginal. For this reason, some people in the Aboriginal group may have multiracial ancestry. We combined the West Asian and Arab groups owing to the small numbers of people who self-identified as belonging to them. In addition, we grouped together those respondents who self-identified as multiracial and other.

Potential confounders included age, sex, survey cycle, use of health services, immigration status, percentage of years spent in Canada (number of years in Canada divided by age), household income, education, self-perceived health status, living in a jurisdiction with a universal influenza vaccination program during all or most of the study period (i.e., Ontario, Northwest Territories and Nunavut), having a regular doctor, living in a rural area (population concentration < 1000 and population density < 400/km<sup>2</sup>), marital status, smoking status, ability to speak English or French, and the presence of at least 1 of the following self-reported chronic diseases: asthma, chronic obstructive pulmonary disease (chronic bronchitis or emphysema), diabetes, heart disease, cancer or stroke.

### Statistical analysis

We pooled individual-level responses from multiple survey cycles; the final dataset was considered a sample from an average population observed over all survey cycles.<sup>13</sup> We weighted all of our analyses to account for the survey’s complex sampling design. We calculated variance estimates and coefficients of variation using bootstrapping methods.<sup>14,15</sup>

We estimated ethnicity-specific influenza vaccine coverage for the overall population, for people aged 65 years and older, and for people aged 12–64 years with and without chronic conditions. We also estimated coverage stratified by the presence of a universal influenza vaccination program throughout most of the study period.

We used weighted logistic regression models to determine the association between ethnicity and vaccination, adjusting for potential confounders. We modelled the individual-level odds of influenza immunization, using the  $\chi^2$  test to

determine the significance of ethnicity in the adjusted model. To guide the regression analysis, we started with univariate models for each of the factors identified as important predictors from previous studies.<sup>1,2,5,16,17</sup> We then investigated the correlation matrix, consisting of pairwise correlations between variables, using Spearman rank (for categorical variables) and Pearson product-moment correlations. We tested highly correlated variables in and out of the saturated model to determine their impact on parameter estimates and on the Akaike information criterion, which is used to assess goodness of fit. To minimize the potential for multicollinearity and model overfitting, we removed variables that were highly correlated or resulted in complete separation of data. Finally, we examined linearity among continuous variables to determine whether higher-order terms were more appropriate for modelling. We conducted sensitivity analyses on several subpopulation models (immigrants, people aged 65 years and older, ethnic minorities).

## Results

After excluding respondents for whom data on ethnicity or vaccination were missing ( $n = 24\ 670$ ), our total sample was 437 488 people, which we weighted to represent a Canadian population of 26.0 million people aged 12 years and older. People belonging to ethnic minority groups comprised 18% of the sample. The socio-demographic characteristics of the sample, by ethnicity, are presented in Table 1.

Among people 12 years of age and older, Canadians of Filipino (41%, 95% confidence interval [CI] 37–44), Japanese (38%, 95% CI 32–44) and Chinese (35%, 95% CI 33–36) descent showed significantly higher influenza vaccination coverage than white Canadians (32%, 95% CI 31–32) (Figure 1). Latin American (26%, 95% CI 23–29), West Asian/Arab (26%, 95% CI 23–29) and black Canadians (27%, 95% CI 25–29) had significantly lower levels of coverage (Figure 1). Among people aged 65 years and older ( $n = 93\ 982$ ), coverage was highest among Canadians of Chinese (78%, 95% CI 74–83), Southeast Asian (80%, 95% CI 68–89) and Japanese (80%, 95% CI 71–87) descent, compared with white Canadians (68%, 95% CI 68–69) (Figure 1). The West Asian/Arab (46%, 95% CI 34–63) and black (59%, 95% CI 50–66) groups showed significantly lower coverage levels than the white group (Figure 1).

Among respondents with no chronic disease ( $n = 285\ 953$ ), with the exception of people of Filipino and Japanese heritage, coverage was

significantly higher for each ethnic group in jurisdictions with a universal influenza vaccination program (Figure 2). Furthermore, Filipino, Southeast Asian and Chinese Canadians who had no chronic diseases had significantly higher vaccine coverage than white Canadians. For Canadians aged 12–64 years with a chronic disease ( $n = 56\ 697$ ), coverage ranged from 34% (95% CI 29–40) to 50% (95% CI 31–70).

Univariate analysis showed that 5 ethnic groups (black, West Asian/Arab, Latin American, Aboriginal and multiracial/other) were significantly less likely to receive the influenza vaccination than the white group; 3 ethnic groups (Filipino, Japanese, and Chinese) were more likely to receive the vaccination (Figure 3). However, after adjusting the model for socio-demographic characteristics, all ethnic groups were more likely to receive the vaccination than were white Canadians, with the exception of people who self-identified as black (adjusted odds ratio [OR] 1.01, 95% CI 0.88–1.15) (Figure 4). Compared with white Canadians, Filipino (OR 2.00, 95% CI 1.67–2.40) and Southeast Asian Canadians (OR 1.66, 95% CI 1.36–2.03) were the most likely to get the influenza vaccination; although still statistically significant, people in the West Asian/Arab (OR 1.22, 95% CI 1.00–1.47), Latin American (OR 1.24, 95% CI 1.00–1.52) and multiracial/other (OR 1.19, 95% CI 1.05–1.35) groups had only slightly higher odds of getting the vaccination than people in the white group. Health status and several socio-demographic characteristics were also independently associated with vaccination in the univariate and multivariate analyses (Figures 3 and 4).

## Interpretation

Our results show that all ethnic groups, with the exception of black Canadians, had significantly higher uptake of influenza vaccination than white Canadians. Variations in coverage levels persisted even after adjusting for other determinants of vaccine uptake, which suggests that there may be unique barriers and misconceptions influencing these groups differently.

Two recent systematic reviews that examined factors associated with vaccination for 2009 A (H1N1) pandemic influenza found that ethnicity was associated with vaccine uptake in the United Kingdom (UK), Australia and the US.<sup>18,19</sup> Furthermore, our results concur with those from other studies that showed higher uptake of childhood vaccinations among certain ethnic populations.<sup>20,21</sup> In a UK study involving children aged 18 months to 3 years, Mixer and colleagues found that Asian children were more likely to

**Table 1:** Sociodemographic characteristics of the survey respondents, weighted to the Canadian population of 26.0 million people aged 12 years and older, by ethnicity (2003–2009)

Characteristic	Ethnicity, %*											
	White	Chinese	South Asian	Aboriginal	Black	Filipino	West Asian/Arab	Latin American	Southeast Asian	Korean	Japanese	Multiracial/ Other
Unweighted sample, no.	385 800	7355	5778	19 286	4478	2360	2324	2123	1643	884	614	5843
Weighted population, no. (%), 1000s	21 281 (81.8)	877 (3.4)	850 (3.3)	710 (2.8)	562 (2.2)	315 (1.2)	337 (1.3)	281 (1.1)	215 (0.8)	105 (0.4)	48 (0.2)	445 (1.7)
Female sex	51	51	48	52	51	57	45	49	49	53	57	49
Age, yr												
12–64	84	90	92	94	94	95	95	96	95	92	80	93
≥ 65	16	10	8	6	6	5	5	4	5	8	20	8
Has a chronic disease	19	11	14	22	15	14	12	12	13	8	13	17
High use of health services†	22	18	24	26	17	15	19	18	15	14	19	21
Immigration status												
Nonimmigrant	88	18	19	98	26	14	15	14	22	19	61	49
Recent immigrant (< 10 yr)	2	32	37	1	25	40	46	36	27	51	19	19
Long-term resident (≥ 11 yr)	10	50	44	1	50	47	40	50	51	31	20	32
Household income‡												
Low	6	11	9	17	16	6	21	15	10	13	5	11
Lower-middle	16	21	26	22	26	21	26	25	23	22	16	19
Upper-middle	32	32	31	30	33	36	28	36	34	37	31	33
High	35	36	34	32	26	37	25	25	33	29	49	37
Level of education												
Less than high school	23	19	22	37	24	15	21	20	25	18	12	23
High school	16	16	15	15	15	9	12	17	18	13	17	15
More than high school	61	64	63	48	61	76	67	63	57	69	72	62
Self-reported health status												
Good	89	88	90	84	90	92	91	89	91	90	92	90
Poor	11	12	10	16	10	8	9	11	9	10	8	10
Has a regular doctor	86	88	90	77	80	86	77	72	83	78	83	83
Smoking status												
Never	35	71	75	28	69	67	58	50	69	61	51	51
Former	42	19	15	31	19	21	24	34	17	23	35	27
Daily or occasional	23	10	10	41	12	12	18	17	14	16	14	22
Married or common-law	60	60	63	49	41	56	54	56	55	55	62	49

\*Unless otherwise specified.  
 †People who had five or more visits or telephone contacts with a nurse, family physician or medical specialist in one year.  
 ‡Data were missing for 16% of respondents. Income levels were defined previously by Kwong and colleagues.<sup>1</sup>

receive the measles–mumps–rubella (MMR) vaccine than black or white children.<sup>21</sup> These differences were attributed to varying levels of exposure to mass media on the controversy surrounding the MMR vaccine, as well as the influence of family and health professionals on decisions about vaccinations. In addition, the authors suggested that “shielding” from negative media

coverage, owing to language barriers and different levels of integration into British society, may have contributed to higher vaccine coverage in certain populations.

Our results could be related to the level of exposure to and support for antivaccination media, because it is unknown whether certain groups in Canada are more likely to be exposed

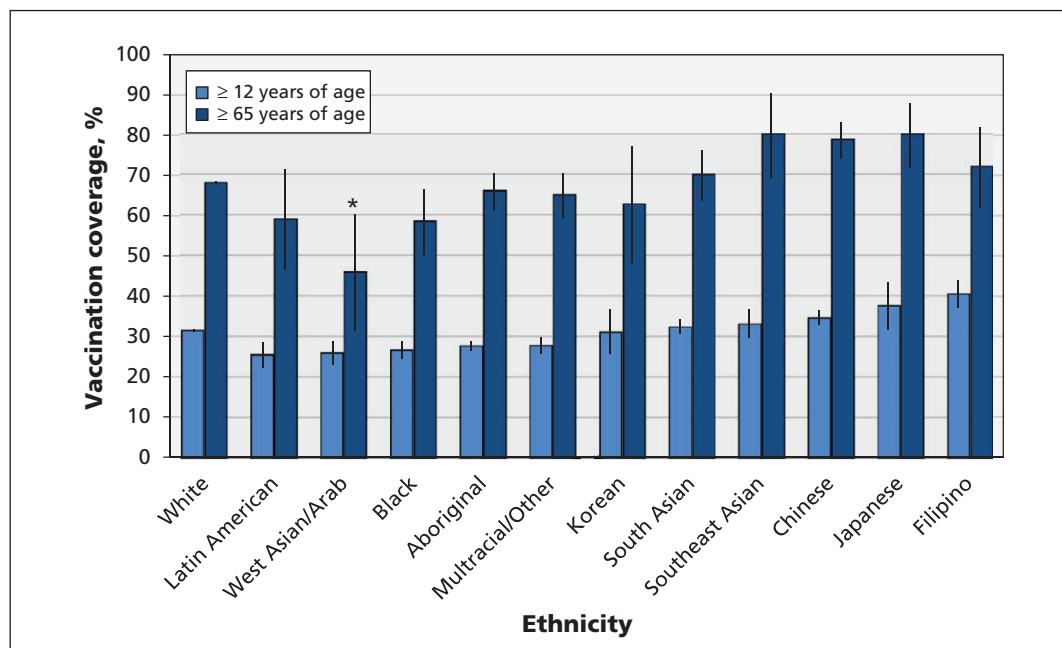


Figure 1: Influenza vaccine coverage, by ethnic group and age, in Canada (2003–2009). Error bars represent 95% confidence intervals. \*A marginal coefficient of variation suggests high sampling variability is associated with this estimate.

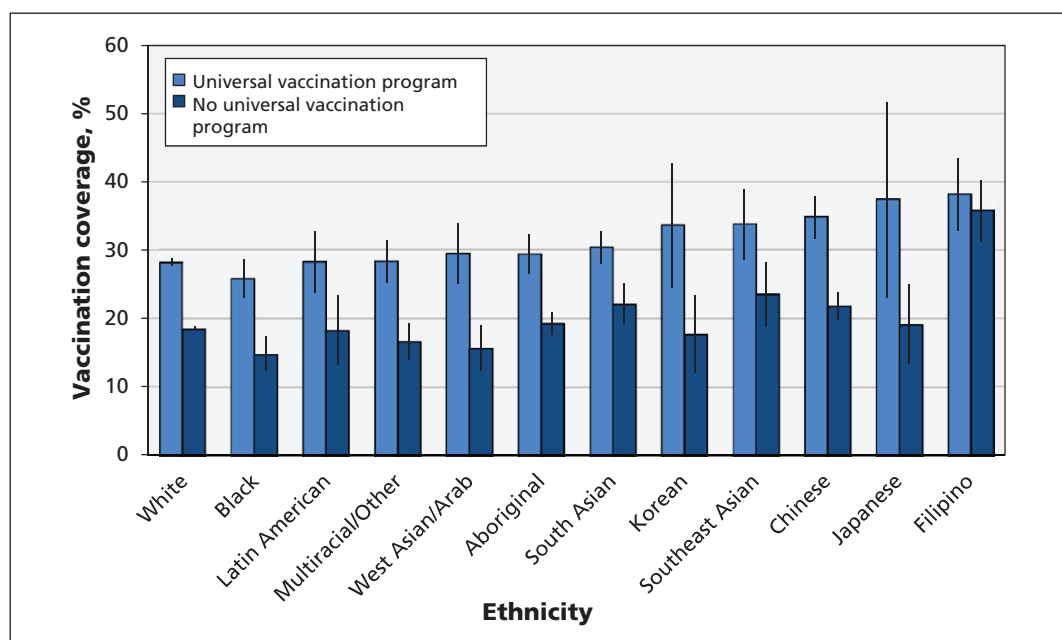


Figure 2: Influenza vaccine coverage, by ethnic group and availability of a universal influenza vaccination program, in Canadians aged 12–64 years without chronic diseases (2003–2009). Error bars represent 95% confidence intervals.

to, or supportive of, such media. Further research is needed to understand exposure to antivaccination media by ethnicity, and whether this affects willingness to receive vaccinations.

Our results are similar to those of American studies that have documented ethnic differences in influenza vaccination among Asian populations.<sup>2-4,16,22,23</sup> The 2008 Behavioural Risk Factor

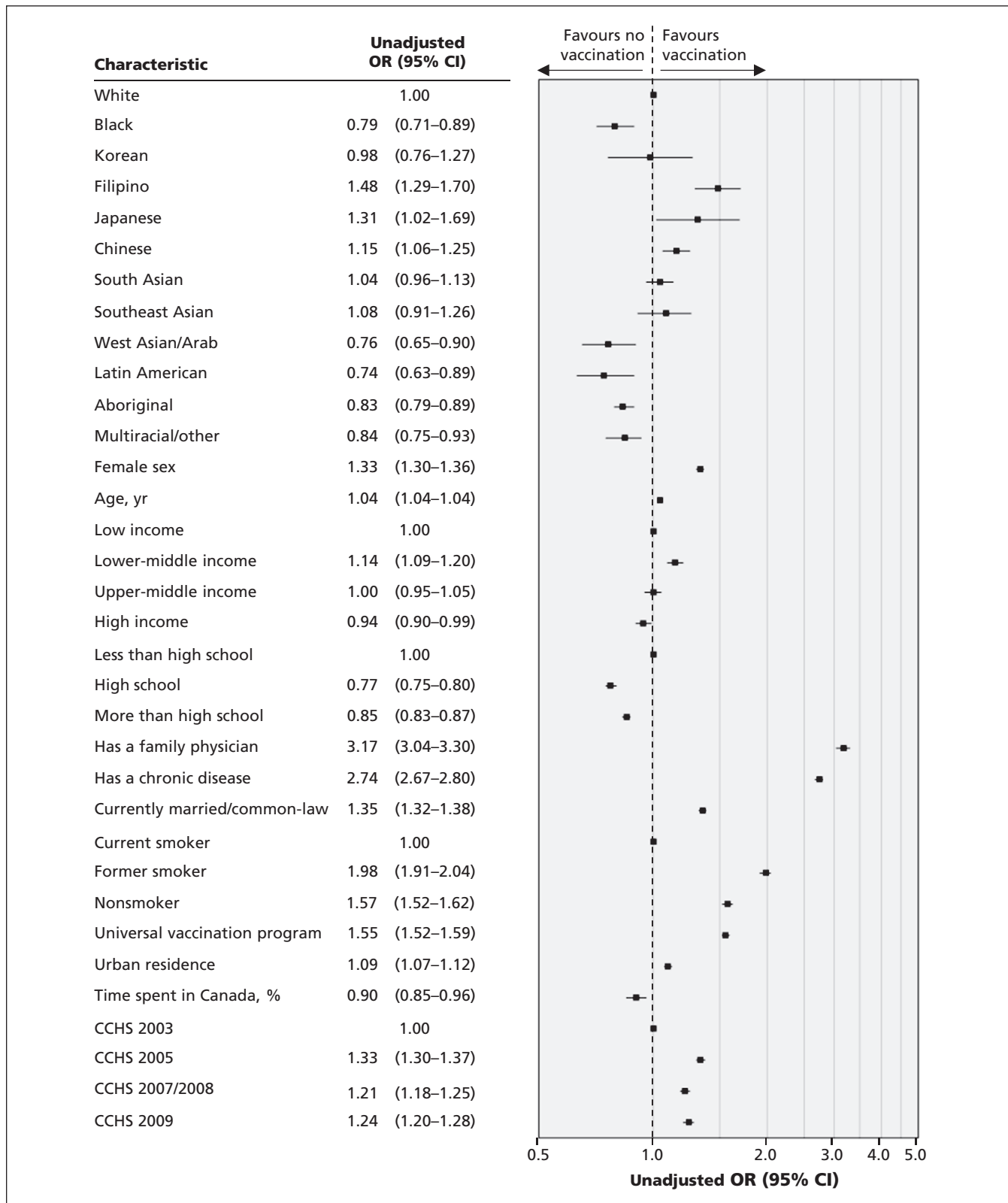


Figure 3: Unadjusted odds ratios for influenza vaccination by ethnicity, sociodemographic characteristic and health status for Canadians aged 12 years and older (2003-2009). CCHS = Canadian Community Health Survey, CI = confidence interval, OR = odds ratio.

Surveillance Survey showed that influenza vaccination among Asian Americans aged 50 years or more was significantly higher than among peo-

ple from the non-Hispanic white, non-Hispanic black and Native American groups, after adjusting for other variables.<sup>4</sup> The reasons for this

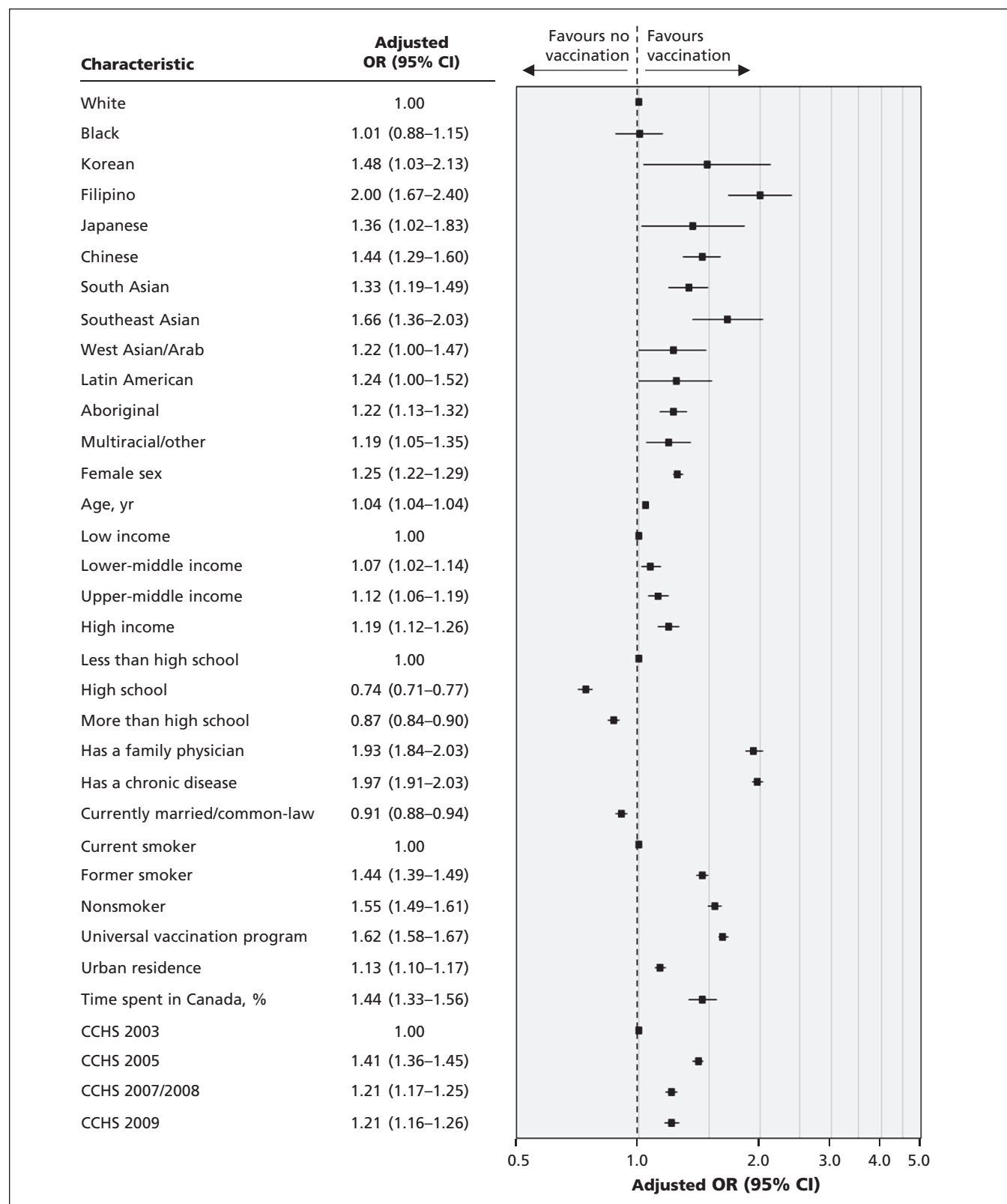


Figure 4: Adjusted odds ratios for influenza vaccination by ethnicity, sociodemographic characteristic and health status for Canadians aged 12 years and older (2003–2009). CCHS = Canadian Community Health Survey, CI = confidence interval, OR = odds ratio.

higher rate of coverage among Asian Americans are not well studied.

A recent survey involving students and staff at an Australian university found that, compared with participants from other regions, Asian-born respondents were significantly more likely to have anxiety concerning the 2009 A (H1N1) influenza pandemic, rate the situation as serious and change specific behaviours to comply with public health measures.<sup>24</sup> During the past century, 2 influenza pandemics and the severe acute respiratory syndrome coronavirus have originated in Asia; the increased media exposure and precautionary actions resulting from these health events may have heightened awareness among Asian populations. In addition, the psychological impact on people who directly or indirectly experienced negative events as a result of these outbreaks may provide additional motivation to receive vaccinations. Furthermore, people who lived through both of the most recent influenza pandemics that originated in Asia would be at least 50 years old; in our study, the range of coverage among elderly participants was more than twice that of the respondents aged 12–64 years (i.e., 31% v. 14%). Similarly, estimates of coverage among Asian Americans aged 18–64 years and at high risk of infection with the influenza virus were close to the US national average for the 2006–2007 influenza season, but higher coverage was seen among Asian Americans aged 65 years and older.<sup>17</sup>

### Limitations

Currently, there is no efficient method to routinely assess ethnic disparities in influenza vaccination in Canada, because ethnic identifiers are generally not collected on vaccination records. Relying on data from the CCHS does not permit regional or annual estimates, because sample sizes are restrictive among ethnic minority groups.

Self-reported vaccination status is subject to response and recall biases, resulting in over- or underestimates of coverage. However, previous studies have validated self-reported influenza vaccination status.<sup>25–27</sup>

Ethnic categories were based on those of the CCHS questionnaire, and some groups were heterogeneous (e.g., black, white, South Asian, Latin American, multiracial/other). In an effort to avoid exacerbating this heterogeneity, we refrained from combining East Asian or Southeast Asian groups to assess the variability in coverage between these groups, given the pre-existing evidence of disparities.<sup>16</sup>

It was not possible to distinguish people identifying solely as Aboriginal in the CCHS data

because Aboriginal people were not asked to state whether they also belonged to other ethnic groups. Therefore, some of the people in the self-identified Aboriginal group included in our study may be of multiracial heritage.

We did not control for status as a health care worker in our analysis, but we are unsure if this would have a significant impact on our results given that less than 7% of the population work in health occupations, and the proportions of people working in health-related occupations are similar between immigrants and nonimmigrants.<sup>28</sup>

Finally, although the CCHS is conducted in multiple languages, people with language difficulties may be less likely to participate. Because these people may have reduced access to information about vaccinations, coverage among ethnic minorities in this sample may have been overestimated. Language issues may also contribute to a higher response rate among the Aboriginal and white populations compared with other groups, resulting in a larger sample of both groups in this survey.

### Conclusion

All ethnic groups in Canada, with the exception of black Canadians, had higher uptake of influenza vaccination than white Canadians. These differences remained significant even after controlling for sociodemographic characteristics and health status. These results suggest a public health concern that requires further validation and study to determine whether there are barriers to vaccination that are unique to black and white Canadians.

Our findings should not understate the importance of tackling issues of sociodemographics and access to health care that influence uptake and extend across all ethnic groups in Canada. To ensure optimal vaccine coverage, it will be important for public health to work with health care providers, clients and community-based organizations to understand the unique challenges and barriers that affect their communities, and to design appropriate interventions for different populations.

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