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Influenza and Pneumococcal Vaccination Rates among Vietnamese, Asian, and Non-Hispanic White Americans

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Abstract

Background—Vaccination data for Asian Americans are comparable to those for whites, possibly because they are reported in aggregate rather than for subgroups. We compared influenza and pneumococcal vaccination rates among eligible Asian Americans and white Americans, and for Vietnamese Americans as a subgroup, and assessed factors associated with these vaccinations.

Methods—Cross-sectional study of data collected from three ethnic groups over 4 years by telephone survey. Data were weighted for selection probability and population estimates and analyzed by multivariate logistic regression.

Results—Vietnamese Americans had a higher rate of influenza vaccination (61%) than Asian Americans (45%) and white Americans (52%), and lower rate of pneumococcal vaccination (41%) than Asian Americans (56%), both lower than white Americans (67%).

Conclusion—When analyzed as a subgroup, Vietnamese Americans had a higher influenza vaccination rate, but a lower pneumococcal vaccination rate, compared to Asian Americans and white Americans, which may indicate that health behaviors and outcomes can differ widely among Asian subgroups. Analyses of preventive care measures in Asian Americans should focus on subgroups to ensure accuracy and quality of assessments.

Keywords

Vietnamese Americans; Adult immunizations; Racial/Ethnic disparities

Introduction

Influenza and pneumococcal vaccinations reduce morbidity and mortality as well as health care costs [1–5]. The *Healthy People 2010* goals for these two types of vaccinations are 90% coverage in the elderly and 60% coverage for younger, at-risk populations, such as those with diabetes mellitus, lung disease, or heart disease. Data from the National Health Interview Survey (NHIS) show that influenza and pneumococcal vaccination rates are lower among older African Americans aged 65 years (48 and 33%, respectively) and older Latinos (54 and 32%, respectively) than among older non-Hispanic whites (66 and 57%, respectively) [6]. Rates for influenza and pneumococcal vaccination among Asian Americans are not usually reported because of the low numbers of respondents in such surveys, but these rates are generally thought to be comparable to those of whites [7, 8]. To date, however, most reported national health data on rates among Asian Americans have been in the aggregate, seldom including specific subpopulations, even though the Asian American population is made up of diverse groups of ethnic subpopulations with varied health behaviors and outcomes [9, 10].

Vietnamese Americans, the fourth-largest Asian population in the United States, are less likely than general population to receive some preventive health services, such as serologic testing and vaccinations for hepatitis B, information and testing for HIV/AIDS, screening for colorectal, breast, and cervical cancers [11–18]. Interventions and education have been successful in increasing rates of Papanicolaou testing for cervical screening and vaccination for hepatitis B, decreasing high rates of cigarette smoking, and improving rates for monitoring blood pressure and for organ donation/transplantation in the Vietnamese community [19–25].

The U.S. Centers for Disease Control and Prevention (CDC) currently recommends influenza vaccination for people at high risk for influenza-related complications and severe disease, such as people aged 50 years, people of any age with certain chronic medical conditions; and household contacts who have frequent interaction and who can transmit influenza to people at high risk, and health-care workers [26]. The Advisory Committee on Immunization Practices (ACIP) recommends that pneumococcal polysaccharide vaccine be administered to people aged 65 years; immunocompetent people aged 2 years who are at increased risk for illness and death from pneumococcal disease because of certain chronic medical conditions; people with functional or anatomic asplenia; and immunocompromised people who are at high risk for infection [27]. People aged 65 years should be administered

a second dose of pneumococcal vaccine if they received the first dose of vaccine 5 years previously and were aged <65 years at that time [27].

The objectives of the present study were to compare the rates of influenza and pneumococcal vaccination in Vietnamese Americans in Santa Clara County, California, which has the third-largest Vietnamese American population for any county/city in the United States, with rates for Asian Americans and white Americans in California, and to assess factors associated with receipt of these vaccinations in these older adults.

Methods

Overview and Data Sources

We obtained approval for this study from the institutional review boards of the University of California, San Francisco (UCSF) and the CDC. For Vietnamese Americans, self-reported influenza and pneumococcal vaccination status was obtained from the Racial and Ethnic Approaches to Community Health (REACH) 2010 Risk Factor Survey conducted annually in Santa Clara County, California, from 2002 to 2005 [28]. Vietnamese Americans aged 18 years were sampled by random-digit dialing from area telephone listings of the 35 most common Vietnamese last names, which are estimated to cover 99% of the target population. The REACH survey was administered in Vietnamese or English, with a mean cooperation rate of 62% for households screening and 64% for family members interviewed over the 4-year period.

For non-Hispanic whites and Asians, vaccination status (based on self-reports) was obtained from the California Behavioral Risk Factor Surveillance System (BRFSS) conducted over the same 4 years. The BRFSS is an ongoing, state-based, random-digit-dialing telephone survey of the non-institutionalized U.S. civilian population aged 18 years. Data from the California BRFSS were used to create vaccination estimates for Asian Americans in the aggregate and for non-Hispanic whites. The BRFSS was administered in English and Spanish; the mean response rate was 53% for households screening and 60% for family members interviewed over the 4-year period.

Outcomes of Interest

The survey questions related to this report were similar on the two telephone surveys. In the REACH questionnaire, participants were asked: “During the past 12 months, have you had a flu shot?” and “Have you ever had a pneumonia vaccination?” In the BRFSS survey, participants were asked: “During what month and year did you receive your most recent flu vaccination?” and “Have you ever had a pneumonia shot? A pneumonia shot or pneumococcal vaccine is usually given only once or twice in a person’s lifetime and is different from the flu shot.” Analysis of the rates for influenza vaccination was restricted to persons who were aged 50 years, and analysis of the rates of pneumococcal vaccination was restricted to persons aged 65 years. These eligibility criteria are based on well-established clinical indications for these vaccinations and are in accordance with CDC guidelines.

Covariates

The covariates included in the multivariate models were age, sex, education (less than high school, high school, or at least some college), household income per year (<\$25,000, \$25–50,000, \$50,000, or unknown), smoking status (current, former, or never), diagnosed as having diabetes mellitus (yes or no), diagnosed as having heart disease (yes or no), and had a checkup within the last year (yes or no). Because the question of whether the participant had a checkup within the last year was asked in the BRFSS survey only in years 2002 and 2005, analyses of the BRFSS data that included that variable were limited to those two years.

Analytic Strategies

Bivariate analyses using the chi-square test were performed for categorical measures and using analysis of variance for continuous variables to explore any differences in socio-demographic and healthcare factors and vaccination receipt between the non-Hispanic white, Asian American, and Vietnamese American populations. Multivariate logistic regression analyses were then used to examine factors associated with receipt of vaccination among Vietnamese Americans and to examine racial differences in receiving vaccination using Vietnamese Americans as the reference group. Adjusted odds ratios with 95% confidence intervals are presented. SAS/STAT software, Version 9.1.2 (SAS Institute Inc., Cary, NC), was used in the analyses to account for the complex sampling design for both the REACH 2010 and BRFSS data.

Results

In all, 44.9% of the participants in the REACH survey and 35% of those in the BRFSS met the age and race/ethnic criteria and were included in the analysis. The mean age (in years) of non-Hispanic whites was 65; Asian Americans, 61; and Vietnamese Americans, 62 (Table 1). Of eligible whites, 46% were male, versus 48% of Asian Americans and 49% of Vietnamese Americans. Based on the self-reported data, 54% of whites had a history of cigarette smoking, versus 28% of Asian Americans and 27% of Vietnamese Americans. Ninety-five percent of whites had at least a high school education, versus 98% of Asian Americans and 59% of Vietnamese Americans. Twenty percent of whites had an annual income less than \$25,000, compared with 25% of Asian Americans and 59% of Vietnamese Americans. Seventy-four percent of whites had a checkup within the past year, versus 74% of Asian Americans and 84% of Vietnamese Americans. Ten percent and 2% of whites, respectively, had been diagnosed with diabetes or heart disease, versus 16 and 1% of Asian Americans and 11 and 7% of Vietnamese Americans. Vietnamese Americans had a higher rate of influenza vaccination (61%) than Asian Americans (45%) and whites (52%) but a lower rate of pneumococcal vaccination (41%) than either Asian Americans (56%) or whites (67%). Thus, Vietnamese Americans had the highest rate of influenza vaccination and whites, the highest rate of pneumococcal vaccination.

In bivariate analyses (Table 2), older age, lower education, and income, having a checkup in the past year, and having been diagnosed with diabetes and heart disease were positively associated with influenza vaccination in whites and Vietnamese Americans, while current

smoking was negatively associated with vaccination in whites and Vietnamese Americans. Among whites, women had a higher influenza vaccination rate than men. In whites, female sex and having a recent checkup in the past year were associated with pneumococcal vaccination.

In the multivariate logistic regression model including all three racial and ethnic groups and employing Vietnamese Americans as the referent group (Table 3), Vietnamese ethnicity, increasing age, having had a checkup in the past year, and having been diagnosed with diabetes or heart disease were all significantly associated with receipt of the influenza vaccine. Factors significantly associated with having had the pneumococcal vaccination included white race, increasing age, female sex, being a former smoker, having a checkup in the past year, and having been diagnosed with heart disease.

In a multivariate analysis for Vietnamese Americans (Table 4), increasing age, having had a recent health checkup, and having been diagnosed with diabetes or heart disease were all significantly associated with influenza vaccination; in contrast, level of education had an inverse relationship with influenza vaccination. Only increasing age was associated with having had pneumococcal vaccination.

Discussion

We found that Vietnamese Americans in Santa Clara County, California, had a higher rate of influenza vaccination than California's Asian Americans as a group or than California's non-Hispanic whites, but we also found that these Vietnamese Americans had a lower rate of pneumococcal vaccination than Asian Americans or whites. To our knowledge, this is the first report to compare influenza and pneumococcal vaccination rates for Vietnamese Americans, an immigrant population with generally low socioeconomic status (SES), to other racial and ethnic groups. Regardless, the rates reported here for all three population groups do not approach the *Healthy People 2010* goal for influenza and pneumonia vaccinations of 90% coverage in persons 65 years and older and 60% coverage for at-risk populations.

Our finding of higher rates of influenza vaccination (versus those for whites) in a low-SES population may reflect the better medical infrastructure in Santa Clara County, a wealthy, high-technology County south of San Francisco. The counterintuitive fact that lower education was associated with increased vaccination rates for Vietnamese Americans, may also be attributable to superior health services available in Santa Clara County. Furthermore, when the influenza vaccine is made widely available (e.g., through local pharmacies, facility-based flu clinics) as an annual "shot," it seems to be less of a problem for Vietnamese Americans who have traditionally been receptive to injections [25]. Vietnamese Americans may believe that the influenza shot is effective because of its widespread favorable publicity, and they may be more likely to ask their doctors and pharmacists about the shot and willing to receive it when their doctors or pharmacists offer it. In contrast, the pneumococcal polysaccharide vaccine, which is generally recommended only once for persons age 65, or at most twice for those with specific chronic diseases (e.g., diabetes or chronic lung or heart disease), tends to be less well publicized to all racial and ethnic groups

and depends more on visits to a physician's office and thus on access to medical care. Since it is unlikely that Vietnamese Americans would refuse the pneumococcal vaccine, their lack of receipt is most likely because they are not aware of the vaccine and thus do not ask their doctors (most of whom are themselves Vietnamese) about it. In general, it is believed that Vietnamese doctors tend to do less preventive care than most other physicians [16, 25], and thus the pneumococcal vaccine may be underused in the Vietnamese community. The only way to know for certain would be to perform additional studies to assess the relation of physician characteristics (e.g., physician ethnicity) to the offering of pneumococcal vaccines in the Vietnamese American community. Use of mass media and other strategies may help to raise consciousness among Vietnamese Americans of the need for this office-based vaccination. One controlled trial demonstrated successful promotion of hepatitis B vaccinations among Vietnamese American children aged 3–18 years through use of mass media and community mobilization strategies [25].

Our study has several limitations. First, because of the cross-sectional nature of the data, our findings do not suggest causality but instead suggest the need for additional research into the relation between race/ethnicity and receipt of adult vaccinations. Second, although the two surveys we used were similar in methodology and consisted of similar questions on vaccination, the California BRFSS and the local Santa Clara County REACH 2010 surveys were still somewhat different. The BRFSS questions are in English for Asian Americans and non-Hispanic whites, but the REACH questions for Vietnamese Americans were in Vietnamese and English, and almost all respondents chose Vietnamese (99%). Third, the REACH 2010 survey sampled from a list of Vietnamese surnames while BRFSS was based on random-digit-dialing. In addition, the reliability in such surveys of self-reported vaccination rates is largely unknown in community-based populations. The comparison between Vietnamese Americans in Santa Clara County on the REACH survey and the Asian and non-Hispanic white American population in California at large on the BRFSS survey may not take into account regional variations in receipt of vaccines across the state. Data in non-Hispanic white and other Asian groups were not available for Santa Clara County. Finally, there is often confusion in the general public between influenza and pneumococcal vaccinations. In one focus study on adult vaccinations, participants reported that they lacked information about the benefits or potential side effects of influenza and pneumococcal vaccinations and that their physicians were not routinely informing them of, or recommending, these vaccinations [29].

The strengths of the present study include the large samples for different racial, ethnic, and socioeconomic groups as well as the random nature of the selection of study participants from the general community. Our study also highlights with importance of racial/ethnic subgroup analysis for Asian Americans because simply reporting aggregated data on Asian Americans in general would obscure the differences in the Vietnamese subgroup.

Our study shows that, although it is prudent to recommend that all persons, regardless of race or ethnicity, be vaccinated against influenza and pneumococcal disease, it is important that we understand the racial/ethnic factors that might cause disparities in vaccination rates in certain racial groups as well as the ethnic subgroups within them. The finding in this study of an influenza vaccination rate among Vietnamese Americans, a predominantly low-

SES immigrant community, in Santa Clara County that was higher than that of other populations in the state suggests that communities with efficient public health and medical infrastructures can overcome potential disparities in adult vaccinations. But the less-than-optimal rates for both immunizations in all three populations studied indicates that further work is needed to improve vaccination rates against both influenza and pneumococcal disease—two important, continuing, vaccine-preventable causes of morbidity and mortality.

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Table 1

Sociodemographic characteristics, influenza (Age ≥ 50 years) and Pneumococcal vaccinations (Age ≥ 65 years) among non-Hispanic White, Asian, and Vietnamese American, 2002–2005

Variable	White N = 6,508	Asian N = 259	Vietnamese N = 1,922
Age, years (mean)*	64.7 (64.4, 65.0)	61.2 (59.7, 62.8)	62.1 (61.7, 62.6)
Male sex (%) [‡]	45.5 (45.2, 45.7)	48.4 (41.0, 55.9)	49.3 (47.2, 51.5)
Smoker (%) [*]			
Current	11.2 (10.3, 12.1)	8.4 (4.3, 12.5)	12.2 (10.6, 13.8)
Former	42.5 (41.1, 43.9)	19.9 (14.1, 25.7)	15.0 (13.3, 16.7)
Never	46.3 (44.9, 47.7)	71.7 (65.0, 78.3)	72.7 (70.6, 74.8)
Education (%) [*]			
Some college	73.2 (74.5, 72.0)	84.0 (78.4, 89.6)	31.4 (29.1, 33.8)
High school	21.6 (20.4, 22.8)	14.6 (9.1, 20.0)	27.3 (25.1, 29.4)
Less than high school	5.1 (4.5, 5.7)	1.5 (0.01, 2.9)	41.3 (38.8, 43.7)
Income (%) [*]			
< \$25K	20.1 (19.0, 21.2)	24.7 (18.2, 31.2)	59.0 (56.4, 61.5)
\$25K–\$50K	22.9 (21.7, 24.0)	19.1 (13.2, 24.9)	15.7 (13.8, 17.5)
> \$50K	46.7 (45.3, 48.1)	47.8 (40.4, 55.2)	9.6 (8.1, 11.1)
Unknown	10.3 (9.4, 11.1)	8.4 (4.5, 12.3)	15.7 (14.0, 17.5)
Last check-up [†]	73.7 (71.5, 75.8)	73.9 (62.6, 85.3)	84.4 (82.7, 86.2)
Diagnosed with diabetes mellitus (%)	10.7 (9.8, 11.5)	16.1 (10.4, 21.9)	11.4 (9.9, 13.0)
Has heart disease (%) [*]	2.1 (1.7, 2.4)	1.2 (0.0, 2.9)	7.4 (6.0, 8.7)
Had influenza vaccination (%) [*]	51.7 (50.3, 53.1)	45.3 (37.9, 52.7)	60.6 (58.2, 63.1)
Had pneumococcal vaccination (%) [*]	67.0 (65.1, 68.9) [*]	56.0 (41.6, 70.5)	41.0 (37.2, 44.7)

* $P < 0.0001$ value comparing ethnic groups

[‡] $P < 0.05$

[†] Check-up within past year was measured only in the 2002 and 2005 BRFSS surveys

Values in parenthesis are lower and upper limit of 95% confidence interval

Table 2

Prevalence of influenza (Age 50 years) and Pneumococcal (Age 65 years) vaccination by sociodemographic variables among non-Hispanic White, Asian, and Vietnamese American adults, 2002–2005

Variable	Had Influenza Vaccination (%)			Had Pneumococcal Vaccination (%)		
	White N = 6,508	Asian N = 259	Vietnamese N = 1,922	White N = 3,132	Asian N = 76	Vietnamese N = 630
Age, years						
< 65	34.4 (32.5, 36.2)*	29.9 (22.1, 37.8)*	48.4 (45.4, 51.4)*	—	—	—
65	72.5 (70.7, 74.2)	75.0 (62.9, 87.1)	82.0 (78.6, 85.4)	67.0 (65.1, 68.9)	56.0 (41.6, 70.5)	43.5 (39.2, 47.7)
Sex (%)						
Male	48.8 (46.6, 51.0)*	40.7 (29.3, 52.0)	60.1 (56.6, 63.6)	60.8 (57.7, 64.0)*	41.3 (20.8, 61.8)	43.6 (38.0, 49.3)
Female	54.2 (52.5, 56.0)	49.6 (40.0, 59.3)	61.1 (57.9, 64.3)	71.4 (69.2, 73.7)	67.3 (49.2, 85.5)	43.3 (37.1, 49.5)
Smoker (%)						
Current	37.2 (33.1, 41.4)*	36.9 (11.4, 62.5)	50.4 (43.3, 57.4) [†]	64.4 (57.3, 71.5)	51.8 (0.0, 100.0)	45.0 (30.2, 59.9)
Former	56.5 (54.4, 58.6)	47.0 (30.8, 63.3)	64.7 (58.7, 70.6)	69.4 (66.7, 72.0)	55.8 (28.6, 82.9)	46.7 (37.3, 56.2)
Never	50.8 (48.8, 52.9)	45.8 (36.8, 54.7)	61.6 (58.7, 64.5)	64.9 (62.0, 67.7)	56.3 (39.2, 73.4)	42.6 (37.6, 47.6)
Education (%)						
Some college	51.3 (49.7, 52.9) [‡]	43.9 (35.7, 52.2)	52.4 (48.0, 56.9)*	67.0 (64.7, 69.3)	57.5 (41.6, 73.4)	48.2 (38.8, 57.6)
High school	51.2 (48.2, 54.3)	55.0 (35.6, 74.5)	57.1 (52.5, 61.7)	66.8 (62.9, 70.6)	50.5 (20.4, 80.5)	47.9 (39.2, 56.6)
Less than high school	59.6 (53.5, 65.8)	13.9 (0.0, 41.3)	69.3 (65.8, 72.8)	67.7 (60.6, 74.8)	100.0 (—)	40.1 (34.4, 45.8)
Income (%)						
< \$25K	56.4 (53.5, 59.4)*	56.9 (42.0, 71.8)	66.2 (63.1, 69.3)*	67.1 (63.6, 70.6) [‡]	42.2 (20.3, 64.2)	45.3 (40.2, 50.4) [‡]
\$25K–\$50K	54.1 (51.3, 57.0)	38.4 (21.7, 55.1)	48.6 (42.5, 54.7)	70.1 (66.6, 73.5)	50.1 (18.5, 81.8)	52.8 (35.7, 70.0)
> \$50K	47.0 (45.0, 49.1)	40.8 (30.1, 51.6)	44.7 (36.7, 52.8)	62.6 (59.0, 66.2)	78.3 (58.6, 98.1)	51.5 (27.0, 76.1)
Unknown	58.6 (54.2, 62.9)	52.3 (28.6, 76.0)	61.4 (55.4, 67.3)	70.1 (65.2, 75.1)	65.9 (28.4, 100.0)	32.4 (23.8, 41.1)
Last check-up (%) ^a						
Within past year	48.7 (45.8, 51.6)*	31.3 (17.5, 45.1)	65.3 (62.8, 67.9)*	66.7 (63.2, 70.3)*	47.1 (15.9, 78.3)	44.0 (39.5, 48.5)
No	30.7 (26.2, 35.1)	33.2 (8.5, 57.9)	35.6 (29.6, 41.6)	53.8 (45.4, 62.2)	72.2 (28.1, 100.0)	37.1 (23.2, 51.1)
Diagnosed with diabetes mellitus (%)						
Yes	67.6 (63.6, 71.6)*	61.0 (42.3, 79.7)	76.1 (70.0, 82.1)*	68.8 (63.6, 73.9)	49.4 (20.3, 78.4)	44.1 (33.9, 54.3)

Variable	Had Influenza Vaccination (%)			Had Pneumococcal Vaccination (%)		
	White N = 6,508	Asian N = 259	Vietnamese N = 1,922	White N = 3,132	Asian N = 76	Vietnamese N = 630
No	49.8 (48.3, 51.3)	42.3 (34.2, 50.3)	58.6 (55.9, 61.2)	66.7 (64.7, 68.8)	57.8 (42.4, 73.2)	43.4 (38.7, 48.1)
Has heart disease (%)						
Yes	68.3 (60.1, 76.5)*	50.5 (0.0, 100.0)	76.7 (68.7, 85.6) [†]	74.1 (66.0, 82.2)	57.0 (42.5, 71.6)	51.3 (37.6, 65.0)
No	51.4 (50.0, 52.8)	45.2 (37.8, 52.7)	59.6 (57.0, 62.2)	66.8 (64.9, 68.7)	0.0 (–)	42.7 (38.2, 47.1)

* $P < 0.0001$ based on bivariate logistic regression models comparing those who had versus those not having the vaccine

[†] $P < 0.01$

[‡] $P < 0.05$

^a Check-up within past year was only measured in 2002 and 2005 for the BRFSS survey

CI = confidence interval

Table 3

Multivariate logistic regression model examining factors associated with influenza (Age ≥ 50 years) and Pneumococcal (Age ≥ 65 years) vaccinations, in 2002–2005 Santa Clara County, CA REACH 2010 and California BRFSS

Variable	Influenza Vaccination Odds ratio (95% CI)	Pneumococcal Vaccination Odds ratio (95% CI)
<i>Ethnicity</i>		
Asian American	0.28 (0.13, 0.56)*	1.10 (0.31, 3.88)
White American	0.38 (0.31, 0.47)*	1.54 (1.11, 2.15)*
Vietnamese American (reference)		
Age, years	1.09 (1.07, 1.10)*	1.04 (1.02, 1.06)*
<i>Gender</i>		
Male	0.89 (0.75, 1.06)	0.67 (0.52, 0.87)*
Female (reference)		
<i>Smoker</i>		
Current	0.92 (0.71, 1.20)	1.32 (0.85, 2.05)
Former	1.18 (0.97, 1.44)	1.45 (1.11, 1.88)*
Never (reference)		
<i>Education</i>		
Some college	0.82 (0.65, 1.04)	1.34 (0.93, 1.92)
High school	0.81 (0.64, 1.03)	1.29 (0.91, 1.84)
Less than high school (reference)		
<i>Income</i>		
< \$25K (reference)		
\$25K–\$50K	0.98 (0.78, 1.22)	1.41 (0.99, 2.00)
> \$50K	1.11 (0.87, 1.40)	0.99 (0.68, 1.42)
Unknown	0.91 (0.71, 1.16)	0.79 (0.57, 1.10)
<i>Check-up within the past year</i>		
Yes	1.93 (1.58, 2.36)*	1.48 (1.06, 2.07) [†]
No (reference)		
<i>Diagnosed with diabetes mellitus</i>		
Yes	1.42 (1.10, 1.83)*	1.06 (0.77, 1.46)
No (reference)		
<i>Has heart disease</i>		
Yes	1.92 (1.38, 2.67)*	1.48 (1.03, 2.12) [†]
No (reference)		

* $P < 0.0001$

[†] $P < 0.05$

CI = confidence interval

Table 4

Multivariate logistic regression model examining factors associated with having influenza (Age ≥ 50 years) and Pneumococcal (Age ≥ 65 years) vaccinations, Vietnamese American in Santa Clara County, 2002–2005

Variable	Influenza Vaccination Odds Ratio (95% Confidence Interval)	Pneumococcal Vaccination Odds Ratio (95% Confidence Interval)
Age, years	1.09 (1.07, 1.11)*	1.04 (1.00, 1.04) [†]
<i>Sex</i>		
Male	0.96 (0.72, 1.29)	0.67 (0.42, 1.07)
Female (referent)		
<i>Smoker</i>		
Current	0.95 (0.64, 1.29)	1.17 (0.57, 2.40)
Former	1.14 (0.78, 1.67)	1.29 (0.77, 2.16)
Never (referent)		
<i>Education</i>		
Some college or more	0.73 (0.54, 0.98) [†]	1.53 (0.90, 2.60)
High school	0.79 (0.59, 1.06)	1.53 (0.96, 2.44)
Less than high school (referent)		
<i>Income</i>		
< \$25K (referent)	0.89 (0.65, 1.23)	1.49 (0.71, 3.12)
\$25K–\$50K	0.85 (0.57, 1.28)	1.47 (0.53, 4.04)
> \$50K	0.79 (0.58, 1.09)	0.59 (0.37, 0.95) [†]
Unknown		
<i>Check-up within the past year</i>		
Yes	2.72 (2.01, 3.67)*	1.40 (0.72, 2.74)
No (referent)		
<i>Diagnosed with diabetes</i>		
Yes	1.55 (1.05, 2.28) [†]	1.02 (0.62, 1.66)
No (referent)		
<i>Diagnosed with heart disease</i>		
Yes	1.69 (1.02, 2.81) [†]	1.35 (0.74, 2.48)
No (referent)		

* $P = 0.0001$

[†] $P = 0.05$