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Predictors of reported influenza vaccination in HIV-infected women in the United States, 2006-07 and 2007-08 seasons

Keri N. Althoff, PhD, MPH^a, Kathryn Anastos, MD^b, Kenrad E. Nelson, MD^a, David D. Celentano, ScD^a, Gerald B. Sharp, DrPH^c, Ruth M. Greenblatt, MD^d, Audrey L. French, MD^e, Don J. Diamond, PhD^f, Susan Holman, RN, MS^g, Mary Young, MD^h, and Stephen J. Gange, PhD^a

^aDepartment of Epidemiology, Johns Hopkins Bloomberg School of Public Health, 615 N. Wolfe St., Baltimore, Maryland, 21205, USA (kalthoff@jhsph.edu, kenelson@jhsph.edu, dcelenta@jhsph.edu, sjangange@jhsph.edu)

^bDepartment of Medicine and Department of Epidemiology, Montefiore Medical Center and Albert Einstein College of Medicine, 3311 Bainbridge Ave., 2nd Floor, Bronx, New York, 10467, USA (kanastos@verizon.net)

^cNational Institute of Allergy and Infectious Diseases, National Institutes of Health, 6700-B Rockledge Dr., Room 4103, MSC 7620, Bethesda, Maryland, 20892, USA (gsharp@niaid.nih.gov)

^dDepartment of Clinical Pharmacy, Department of Medicine and Department of Epidemiology, University of California, San Francisco, Box 1352, San Francisco, California, 94143, USA (ruth.greenblatt@ucsf.edu)

^eRush University Medical Center & John H. Stroger Jr. Hospital of Cook County, 1900 W. Polk St., Room 1243, Chicago, Illinois, 60612, USA (audrey_french@rush.edu)

^fBeckman Research Institute of the City of Hope, 1500 E. Duarte Rd., Duarte, California, 91010, USA (ddiamond@coh.org)

^gDepartment of Medicine, State University of New York (SUNY) Downstate Medical Center, 450 Clarkson Ave., Box 1240, Brooklyn, New York, 11203, USA (susan.holman@downstate.edu)

^hDepartment of Medicine, Georgetown University, 110 Kober-Cogan Building, 3800 Reservoir Rd., NW, Washington DC, 20007, USA (youngma@georgetown.edu)

Abstract

Objective—To estimate the cumulative incidence of self-reported influenza vaccination (“vaccination coverage”) and investigate predictors in HIV-infected women.

Methods—In an ongoing cohort study of HIV-infected women in five US cities, data from two influenza seasons (2006-07 n=1,209 and 2007-08 n=1,161) were used to estimate crude and adjusted prevalence ratios (aPR) and 95% confidence intervals ([I]) from Poisson regression with robust variance models using generalized estimating equations (GEE).

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Corresponding Author: Dr. Keri N. Althoff 615 N. Wolfe St., Rm E7137 Baltimore, MD 21205 Telephone: 410-614-4914 Fax: 410-955-7587 kalthoff@jhsph.edu.

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Results—In our study, 55% and 57% of HIV-infected women reported vaccination during the 2006-07 and 2007-08 seasons, respectively. Using data from both seasons, older age, non-smoking status, CD4 T-lymphocyte (CD4) count ≥ 200 cells/mm³, and reporting at least one recent healthcare visit was associated with increased vaccination coverage. In the 2007-08 season, a belief in the protection of the vaccine (aPR=1.38 [1.18, 1.61]) and influenza vaccination in the previous season (aPR=1.66 [1.44, 1.91]) most strongly predicted vaccination status.

Conclusion—Interventions to reach unvaccinated HIV-infected women should focus on changing beliefs about the effectiveness of influenza vaccination and target younger women, current smokers, those without recent healthcare visits, or a CD4 count < 200 cells/mm³.

Keywords

HIV/AIDS; highly active antiretroviral therapy; influenza vaccine; vaccine coverage; multi-center study; cohort study; United States; adult; female

INTRODUCTION

In the United States (US), seasonal influenza infection causes an estimated 226,000 hospitalizations and 36,000 deaths annually (Thompson et al., 2003, Thompson et al., 2004). Case studies and series have described prolonged illness and associated complications of influenza in HIV-infected individuals (Evans and Kline, 1995, Radwan et al., 2000, Safrin et al., 1990, Thurn and Henry, 1989). Further, three retrospective cohort studies have shown a substantial increase in influenza-associated morbidity and mortality in HIV-infected individuals (Lin and Nichol, 2003, Neuzil et al., 1999, Neuzil et al., 2003). Since 1988, the Advisory Committee on Immunization Practices (ACIP) has recommended annual influenza vaccination for HIV-infected individuals in the US (Immunization Practices Advisory Committee, 1988). HIV-infected individuals were also recommended to receive the monovalent 2009 H1N1 vaccine and were indicated for antiviral treatment in cases of likely H1N1 infection (Centers for Disease Control and Prevention, 2009). Among HIV-infected individuals, the influenza vaccine reduces symptomatic influenza illness by 66% (Anema et al., 2008).

A report of annual influenza vaccination coverage in HIV-infected individuals from 1990-2002 found $< 50\%$ compliance with the ACIP recommendation (Gallagher et al, 2007). Few studies have had the ability to examine medical and social factors with vaccination in the HIV population. The Adult and Adolescent Spectrum of HIV Disease (ASD) study relied on medical records and showed the combination of healthcare, HIV markers, and use of therapy were associated with influenza vaccination (Gallagher et al., 2007, Sorvillo and Nahlen, 1995, Wortley and Farizo, 1994). They did not have the opportunity to examine factors such as vaccination and illness beliefs that have been strongly associated with vaccine receipt among the elderly (Chi and Neuzil, 2004, Hornby et al., 2005, Janz and Becker, 1984, Lau et al., 2006, Lau et al., 2007, Nexøe et al., 1999).

The objectives of this study were two-fold: 1) to estimate the cumulative incidence of self-reported influenza vaccination (“vaccination coverage”) in the 2006-07 and 2007-08 influenza seasons in the largest cohort study of HIV-infected women in the US: the Women’s Interagency HIV Study (WIHS); and 2) to identify predictors of reported influenza vaccination.

METHODS

Study population

The WIHS enrolled a total of 3,766 women, of whom 2,902 were HIV-infected, in two recruitment waves (1994-5 and 2000-2001) at six clinical centers to study the natural history of HIV infection and has been described elsewhere (Bacon et al., 2005, Barkan et al., 1998). All participants were ≥ 13 years of age at study entry, reported high HIV transmission risk and gave informed consent. Although the response rate to recruitment is unknown, the demographics of the WIHS cohort reflect the characteristics of HIV-infected women in the general US population (Barkan et al., 1998). Participants completed study visits every six months that include detailed interviews, a physical examination, and collection of blood and other specimens. Study protocols and consent forms have been approved by institutional review boards at each study site.

Our nested influenza study investigated the 2006-07 and 2007-08 influenza seasons. HIV-infected WIHS participants were eligible if they completed at least one study visit between April 2006-September of 2007 or 2008, i.e. the study periods for the 2006-07 and 2007-08 influenza seasons, respectively. Women were included in our study if they completed three consecutive study visits and had complete vaccination reports during one or both of those influenza seasons; thus a participant could contribute information to one or both influenza seasons. Participants who seroconverted or transferred study sites during the 2007-07 or 2007-08 season were excluded from the analysis of that season.

Outcome: Influenza vaccination

Self-reports of the occurrence and date of influenza vaccination were collected via the interviewer-administered questionnaire. If a woman reported an influenza vaccination occurring between October 1 and April 30 she was categorized as vaccinated. In a review of 159 Chicago participants, 138 (87%) of the self-reported influenza vaccinations were confirmed using outpatient medical records (A. French, personal communication).

Predictors of influenza vaccination

Predictors were measured prior to the start of each influenza season (i.e. April – September). Mode of transmission, year of birth, race/ethnicity, educational attainment, annual household income, country of birth, drug and alcohol use in the prior six months, cigarette smoking status, medical insurance status, reporting at least one visit with a healthcare professional in the prior 6 months and pneumonia in the prior six months (excluding *Pneumocystis (carinii) jiroveci* pneumonia) were self-reported. Subjects were classified as having depressive symptoms if they had a Center for Epidemiologic Studies Depression Scale (CESD) score ≥ 23 for injection drug users and ≥ 16 for all others (Golub et al., 2004). Participants who reported receiving vaccination to prevent any of the following conditions were classified as having received another vaccination in the prior six months: hepatitis A, hepatitis B, *Pneumococcal* disease including pneumonia, varicella, tetanus or the human papillomavirus vaccine.

We used ACIP recommendations to categorize the following conditions as clinical indications for influenza vaccination: pregnancy (tested at each visit), diabetes mellitus (current or prior measure of fasting glucose ≥ 126 mg/dL measured at two consecutive study visits, or self-reported diabetes mellitus, or use of anti-diabetic medication), chronic kidney disease (estimated MDRD glomerular filtration rate < 60 mL/min/1.73m²), and self-reported asthma, congestive heart failure, or immunosuppression due to chemotherapy (Fiore, et al., 2009). Information regarding chronic lung disease was not available.

Self-reported clinical AIDS used the 1993 CDC surveillance definition, excluding CD4 count <200 cells/mm³ (Centers for Disease Control and Prevention, 1992). CD4 count was measured using standard flow cytometry techniques and dichotomized at 200 cells/mm³. Plasma HIV viral loads were measured using the isothermal nucleic acid sequence-based amplification method (NucliSens, BioMerieux, Boxtel, NC). Current therapy use was self-reported using a standard definition consistent with the US DHHS Guidelines (Panel on Clinical Practices for Treatment of HIV infection from the US Department of Health and Human Services and the Henry J. Kaiser Family Foundation, 1998). Medication photo-ID cards and the option to bring medications to study visits assist in recall and accurate identification of self-reported HIV treatment.

Beliefs about influenza illness and vaccination were only available for the 2007-08 season. Belief predictors were measured using questions modified from vaccination coverage studies in the elderly that utilized the Health Belief Model and a 5-category Likert scale (Chi and Neuzil, 2004, Nexø et al., 1999, Rosenstock, 1974, Schwartz et al., 2006) (see Supplement).

Statistical Analyses

Data were combined for the two influenza seasons and examined with person-seasons used as the denominator of vaccination coverage. Crude and adjusted prevalence ratios (PR and aPR, respectively), and 95% confidence intervals (95% CI) were estimated using Poisson approximations to log-binomial regression models with robust variance and the generalized estimating equations (GEE) approach to adjust for within-individual correlations from women contributing information for both seasons (Skov et al., 1998, Spiegelman and Hertzmark, 2005, Zeger et al., 1988, Zocchetti et al., 1997). All demographic and clinical characteristics previously shown to be associated with influenza vaccination were included in multivariate models (Gallagher et al., 2007). We also included non-clinical predictors with scientific plausibility of an association with influenza vaccination, many of which have not been previously examined in HIV-infected individuals. We created parsimonious models with statistically significant variables and compared the point estimates to those from saturated models (that included all predictors examined) to determine estimate stability.

Data regarding influenza vaccination and illness beliefs and vaccination in the previous influenza season were only collected during the 2007-08 season and examined separately using similar methods. All analyses were conducted using SAS version 9.2 (Carey, North Carolina).

RESULTS

A total of $n=1,462$ HIV-infected women completed at least one study visit from April 2006-September 2007 or April 2007-September 2008. Of these eligible women, $n=1,293$ (88%) met our inclusionary and exclusionary criteria. Compared to women who contributed data to one or both seasons, women who did not meet our eligibility criteria in either season ($n=169$) were more likely to be non-Hispanic White or of another race/ethnic group (31% vs. 15%, $p<0.01$), had attained a greater level of education (education after high school: 46% vs. 31%, $p<0.01$), annual household income (income $\geq \$36,000$: 37% vs. 14%, $p<0.01$), and were more likely to have private medical insurance (34% vs. 17%, $p<0.01$). Excluded women were less likely to report cigarette smoking (33% vs. 41%, $p=0.05$). Excluded and included women were similar by HIV characteristics. $N=1,077$ women contributed to both seasons, $n=132$ and $n=84$ women contributed solely to the 2006-07 and 2007-08 seasons, respectively, for a total of $n=2,370$ person-seasons. Demographic and clinical characteristics are shown in Table 1.

In the 2006-07 ($n=1,209$) and 2007-08 ($n=1,161$) seasons, similar percentages of HIV-infected women in our study population reported being vaccinated (55% and 57%, respectively; p -value=0.54), with vaccinations occurring primarily in October and November with slower

uptake of vaccine in December, January and February (Figure 1). In the 2006-07 season, $n=3$ ($<1\%$) women reported receiving the live attenuated intranasal vaccine (LAIV), which is contraindicated in HIV-infected individuals; no women reported LAIV in the 2007-08 season. Of the $n=656$ women reporting vaccination in the 2007-08 season, $n=503$ (77%) were asked to report a location of vaccination. The majority of vaccinations were received in a clinical setting (91% or 495/503).

In the analysis of data for both seasons, vaccination coverage increased with increasing age in a dose-response pattern (p -value for trend <0.01) (Table 2). Women attending visits at study sites in San Francisco and Los Angeles, CA, were significantly less likely to report influenza vaccination compared to women attending visits in Bronx, NY. Cigarette smokers were significantly less likely to report being vaccinated than non-smokers. Women who reported at least one healthcare visit in the prior 6 months were more likely to report influenza vaccination. Finally, women with lower CD4 counts were less likely to report influenza vaccination compared to those with a higher CD4 count. Point estimates in the parsimonious model changed $<10\%$ points compared to the saturated model estimates, with the exception of the point estimates for age, which attenuated by 14%.

Influenza illness and vaccination belief predictors in the 2007-08 influenza season

Beliefs about influenza illness and vaccination strongly predicted reported influenza vaccination (Table 3). In the crude analysis, all influenza illness and vaccination beliefs statistically significantly predicted reported influenza vaccination, except a dislike for needle sticks in a health-care setting and knowledge of where to access an influenza vaccination free-of-charge. Women who agreed with “The flu shot made me sick” were less likely to report vaccination; however the relationship had borderline statistical significance ($p=0.06$).

After adjustment for other predictors, women with neutral or affirmative beliefs that influenza vaccination protects them from influenza illness were more likely to report influenza vaccination (Table 3). Also in the adjusted analysis, the strongest predictor of reported influenza vaccination was reporting an influenza vaccination in 2006-07. Among women who contributed to the 2007-08 season ($n=1,161$), $n=485$ (42%) reported vaccination in 2007-08 and 2006-07 seasons, $n=300$ (26%) reported no vaccination in either season, $n=171$ (15%) reported vaccination in 2007-08 but not 2006-07, and $n=205$ (18%) reported no vaccination in 2007-08 but previous vaccination in 2006-07. Vaccination coverage was higher among women who had at least one healthcare visit in the prior 6 months, and lower among women with a lower CD4 count. Point estimates in the parsimonious model changed $<10\%$ points compared to the saturated model estimates. Estimates were similar in a sensitivity analysis that restricted to women contributing in both seasons (i.e. $n=84$ women that did not contribute data to the 2006-07 season were excluded).

DISCUSSION

Despite current vaccination guidelines (Fiore et al., 2009), and evidence of benefit from influenza vaccination (Ranieri et al., 2005, Tasker et al., 1999, Yamanaka et al., 2005), 55% and 57% of HIV-infected women reported receiving influenza vaccination during the 2006-07 and 2007-08 influenza seasons, respectively. Our findings indicate beliefs about influenza illness and vaccination, access to healthcare, and CD4 count are important predictors of reported influenza vaccination.

During the 2007-08 influenza season, 30% and 50% of 19-to-49-year-olds and 50-to-64-year-olds who were recommended for vaccination self-reported influenza vaccination, respectively (National Health Interview Survey, 2008). Our estimates of vaccination coverage in HIV-infected women are greater than these estimates, however they are congruent with a previous

report of an increasing trend in influenza vaccination among HIV-infected adults (21% to 42% from 1995 to 2002, p-value for trend <0.01) (Gallagher, 2007); further, the demographics of the WIHS cohort reflect the characteristics of HIV-infected women in the general US population (Barkan et al., 1998). HIV-infected individuals may have a higher vaccination coverage compared to individuals of similar age who are recommended to receive the annual vaccine due to contact with infectious disease physicians, as our studies and previous studies have shown health care visits are an important predictor of vaccination (Gallagher et al, 2007, Wortley and Farizo, 1994, Sorvillo and Nahlen, 1995). Further, infectious disease physicians may have greater access to vaccine and/or a greater focus on preventing infections in those who have deficient immune systems compared to other specialists caring for individuals who are recommended to receive influenza vaccine. In addition, compared to other groups recommended for vaccination, HIV-infected individuals maybe more conscientious about vaccination to prevent illness due to their immune deficiency. Another source of bias resulting in overestimation of vaccine coverage in our population may be the high sensitivity and low specificity of self-reported influenza vaccination, as seen in the elderly (Zimmerman et al., 2003). Sensitivity and specificity could not be assessed because women who did not report influenza vaccination were not included in the medical record review. Conversely, the WIHS participants who did not meet our study criteria and were excluded had a higher socioeconomic position were less likely to report cigarette smoking than those who were included in our study. If the HIV-infected non-smoking women of higher socioeconomic position have higher influenza vaccination coverage, our results are underestimated. Despite these potential biases, our estimates suggest the attainability of the *Health People 2010* goal of 60%, but also substantial non-compliance with ACIP recommendations (Fiore et al., 2009).

Our combined data from two influenza seasons suggest influenza vaccination promotion efforts to HIV-infected women should target younger, current smokers with lower CD4 counts and those who have not have recent access to healthcare. Vaccination coverage increased in a dose-response pattern with increasing age, as seen in other studies (Gallagher et al., 2007, Wortley and Farizo, 1994). Reported influenza vaccination was lower among cigarette smokers, a novel predictor among HIV-infected individuals. Previous studies have reported frequency of healthcare visits during the influenza season as a strong predictor of influenza vaccination (Gallagher et al, 2007, Wortley and Farizo, 1994, Sorvillo and Nahlen, 1995). This variable was not available here, but having a recent healthcare visit was a strong predictor of vaccination status. Although the mechanisms of these relationships were not investigated, these predictors can inform interventions. Data from both seasons also showed reduced vaccination coverage in Los Angeles and San Francisco, CA. Self-reported influenza vaccination coverage during the 2005-06 season among adults aged 18-64 who are recommended to receive annual influenza vaccine was lower in California (25%) than the states in which the other WIHS study sites were located (Maryland 28%, Illinois 29%, New York 32%, Washington DC 33%) (Lu et al., 2007). Further research is needed to understand the lower vaccination coverage in California.

Belief in the protection of the vaccine and vaccination in the previous season were strong predictors of influenza vaccination. Interventions that provide education about vaccine effectiveness in HIV-infected individuals may alter beliefs and increase vaccination coverage. Although non-clinical interventions are also needed, healthcare providers clearly play an important role in influenza vaccination.

The strengths of this study include: 1) updated estimates of vaccination coverage among HIV-infected women in two recent influenza seasons; 2) the availability of non-clinical predictors, especially beliefs regarding influenza illness and vaccination; 3) the utility in the identified predictors to describe unvaccinated women and inform interventions. Limitations to this study beyond self-reported influenza vaccination include the inability to infer temporality of belief

predictors with vaccination status. One previous study showed women were 11% more likely to receive the influenza vaccine compared to men (Gallagher et al., 2007); generalizability of these findings to HIV-infected men is restricted.

CONCLUSION

Our data supports the attainability of the *Health People 2010* goal of 60% influenza vaccination coverage among HIV-infected women; however, there was a large proportion (approximately 44%) who were not vaccinated, demonstrating non-compliance with ACIP recommendations. Interventions to reach unvaccinated HIV-infected women should focus on changing beliefs about the effectiveness of the influenza vaccination and target younger, current smokers, without recent healthcare visits and CD4 counts <200 cells/mm³.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Month of influenza vaccination reported by HIV-infected women in the Women's Interagency HIV Study, 2006-07 (n=1,209) and 2007-08 (n=1,161) influenza seasons, United States

Table 1

Selected characteristics of HIV-infected participants in the Women's Interagency HIV Study (WIHS) at enrollment^a, 2006-07 and 2007-08 influenza seasons, United States

Characteristics	Participants n= 1,293 n % ^b	Number of person- seasons of observation ^c n=2,370
Age		
<30 years	73 6	118
30-<40 years	372 29	638
40-<50 years	544 42	1,017
≥50 years	304 24	597
Race/ethnicity		
Non-Hispanic Black	740 57	1,357
Hispanic	362 28	667
Non-Hispanic White & other	191 15	346
Educational attainment		
< High school	507 39	936
High school diploma	380 29	698
More than high school	404 31	764
Annual household income		
≤\$12,000	594 46	1,148
\$12,001-\$24,000	299 23	544
\$24,001-\$36,000	142 11	276
≥\$36,000	173 13	313
Country of birth		
United States & territories	1,005 78	1,837
Other	287 22	531
Center		
Bronx	245 19	454
Brooklyn	264 20	490
Washington, D.C.	187 14	334
Los Angeles	234 18	426
San Francisco	180 14	333
Chicago	183 14	333
Mode of HIV transmission		
Intravenous drug use	298 23	540
Heterosexual contact	542 42	997
Transfusion	23 2	44
None identified	422 33	774
Clinical AIDS ^d	521 40	962
CD4 T-lymphocyte count		
≥200 cells/mm ³	1,094 85	2,031
<200 cells/mm ³	194 15	329

Characteristics	Participants n= 1,293 n % ^b	Number of person- seasons of observation ^c n=2,370
Taking HAART	837 65	1,560

Abbreviations: AIDS: acquired immunodeficiency virus; HAART: highly-active antiretroviral therapy; HIV: human immunodeficiency virus

^a Participants could contribute independent information to one or both influenza seasons examined. Enrollment is the first season to which the participant contributes.

^b Percentages may not add to 100% due to missing data.

^c Numbers may not total to n=2,370 person-seasons due to missing data.

^d Clinical AIDS was classified as a prior report of a clinical diagnosis defined by the 1993 Centers for Disease Control and Prevention surveillance definition, excluding CD4 count <200 cells/mm³.

Table 2

Predictors of influenza vaccination in n=1,293 HIV-infected participants in the Women's Interagency HIV Study (WIHS), the 2006-07 and 2007-08 influenza seasons, United States

Predictors ^a	No. of person-seasons	Vaccinated women		
		n % ^b	aPR ^c	95% CI
Influenza season				
2006-07	1209	667 55	REF	
2007-08	1161	656 57	1.02	0.96 , 1.09
Age				
<30 years	118	49 42	REF	
30-<40 years	638	336 53	1.39	1.05 , 2.04
40-<50 years	1017	579 57	1.48	1.13 , 1.96
≥50 years	597	359 60	1.54	1.16 , 1.84
Race/ethnicity				
Non-Hispanic Black	1357	734 54	REF	
Hispanic	667	400 60	1.07	0.89 , 1.16
Non-Hispanic White & other	346	189 55	1.01	0.96 , 1.19
Education				
< High school	936	520 56	REF	
High school diploma	698	392 56	1.02	0.92 , 1.14
More than high school	764	410 54	1.02	0.91 , 1.14
Annual household income				
≤\$12,000	1148	627 55	REF	
\$12,001-\$24,000	544	327 60	1.07	0.98 , 1.17
\$24,001-\$36,000	276	152 55	0.95	0.83 , 1.08
≥\$36,000	313	174 56	0.97	0.84 , 1.12
Country of Birth				
United States & territories	1837	1009 55	REF	
Other	531	314 59	1.05	0.92 , 1.20
Center				
Bronx	454	277 61	REF	
Brooklyn	490	289 59	1.04	0.91 , 1.19
Washington, D.C.	334	178 53	0.92	0.79 , 1.07
Los Angeles	426	227 53	0.83	0.71 , 0.97
San Francisco	333	163 49	0.82	0.69 , 0.96
Chicago	333	189 57	1.01	0.88 , 1.17
Depressive Symptoms ^d				
No	920	504 55	REF	
Yes	1428	812 57	1.01	0.93 , 1.10
Drug use in last 6 months ^e				
No	1954	1115 57	REF	
Yes	416	208 50	0.95	0.83 , 1.07

Predictors ^a	No. of person-seasons	Vaccinated women		
		n % ^b	aPR ^c	95% CI
Alcohol use in prior 6 months				
Abstainer / Light (<3 drinks/week)	2112	1205 57	REF	
Moderate / Heavy (≥3 drinks/week)	248	117 47	0.90	0.77 , 1.05
Current cigarette smoker				
No	1407	825 59	REF	
Yes	953	497 52	0.90	0.82 , 1.00
Received another vaccination in the prior 6 months ^f				
No	1983	1088 55	REF	
Yes	337	202 60	1.07	0.97 , 1.18
Medical insurance				
Public ^g	1593	883 55	REF	
Private or other	408	236 58	1.05	0.92 , 1.21
None	359	201 56	1.06	0.93 , 1.20
At least one healthcare visit in the prior 6 months				
No	159	59 37	REF	
Yes	2141	1227 57	1.46	1.13 , 1.88
One or more indications for influenza vaccination ^h				
No	1229	674 55	REF	
Yes	1141	649 57	1.00	0.92 , 1.09
Pneumonia in the prior 6 months ⁱ				
No	2257	1254 56	REF	
Yes	113	69 61	1.13	0.96 , 1.34
Mode of HIV transmission				
Intravenous drug use	540	307 57	REF	
Heterosexual contact	997	585 59	0.97	0.87 , 1.09
Transfusion	44	28 64	1.01	0.76 , 1.35
None identified	774	399 52	0.87	0.76 , 1.00
Clinical AIDS diagnosis ^j				
No	1408	0	REF	
Yes	962	538 56	0.98	0.90 , 1.07
CD4+ T-lymphocyte count				
≥200 cells/mm ³	2031	1163 57	REF	
<200 cells/mm ³	329	154 47	0.86	0.97 , 0.99
HIV viral load				
≤80 copies/mL	1282	747 58	REF	
81-9,999 copies/mL	657	345 53	1.03	0.94 , 1.14
≥10,000 copies/mL	411	217 53	1.07	0.94 , 1.22
Taking HAART				
No	810	407 50	REF	
Yes	1560	916 59	1.09	0.99 , 1.21

Abbreviations: 95% CI: 95% confidence interval; AIDS: acquired immunodeficiency virus; aPR: adjusted prevalence ratio; HAART: highly active antiretroviral therapy; HIV: human immunodeficiency virus.

^a Predictors were measured prior to the influenza season (between April 1 and September 30).

^b Denominator is person-seasons.

^c Adjusted for all the predictors in the table.

^d Depressive symptoms is defined as a CESD score ≥ 16 for women not reporting injection drug use and ≥ 23 for women reporting injection drug use.

^e Drug use includes reporting injection or non-injection use of any of the following: marijuana, crack, cocaine, heroine, methadone, amphetamines, methamphetamine, non-prescription methadone or narcotics.

^f Vaccination to prevent the following conditions were classified as having received another vaccination in the prior six months: hepatitis A, hepatitis B, Pneumococcal disease including pneumonia, varicella, tetanus or the human papillomavirus vaccine

^g Public medical insurance includes Medicaid/Medi-CAL (California only), Medicare and Veteran's medical insurance.

^h Indicated if currently pregnant, or have any of the following: diabetes mellitus, kidney disease, congestive heart failure, asthma or received chemotherapy.

ⁱ Excludes *Pneumocystis (carinii) jiroveci* pneumonia.

^j Clinical AIDS was classified as a prior report of clinical diagnosis defined by the 1993 Centers for Disease Control and Prevention surveillance definition, excluding CD4 count < 200 cells/mm³.

Table 3

Influenza vaccination and illness belief predictors, and other significant predictors, of influenza vaccination in n=1,161 HIV-infected participants in the Women's Interagency HIV Study (WIHS), 2007-08 influenza season, United States

Predictors ^a	No. of person-seasons	Immunized women n % ^b	PR	95% CI	aPR ^c	95% CI
At least one healthcare visit in the prior 6 months						
No	77	28 36	REF		REF	
Yes	1023	564 55	1.60	1.17, 2.18	1.34	1.00, 1.79
CD4+ T-lymphocyte count						
≥200 cells/mm ³	997	585 59	REF		REF	
<200 cells/mm ³	157	67 43	0.71	0.58, 0.87	0.77	0.63, 0.94
Vaccinated in the previous (2006-07) season						
No	471	171 36	REF		REF	
Yes	690	485 70	1.86	1.63, 2.13	1.66	1.44, 1.91
The flu shot protects me						
Disagree	274	115 42	REF		REF	
Neither agree or disagree	179	97 54	1.29	1.05, 1.58	1.26	1.03, 1.54
Agree	705	442 63	1.54	1.32, 1.81	1.38	1.18, 1.61
Flu is not a serious disease						
Disagree	860	508 59	REF		REF	
Neither agree or disagree	109	55 50	0.89	0.73, 1.08	0.98	0.80, 1.20
Agree	189	91 48	0.78	0.66, 0.92	0.85	0.72, 1.01
I am not at high risk for getting the flu						
Disagree	794	471 59	REF		REF	
Neither agree or disagree	129	59 46	0.79	0.65, 0.97	0.90	0.74, 1.10
Agree	235	124 53	0.86	0.74, 0.99	0.97	0.84, 1.12
The flu shot made me sick						
Disagree	732	436 60	REF		REF	
Neither agree or disagree	103	54 52	0.85	0.68, 1.05	0.99	0.80, 1.22
Agree	322	134 42	0.89	0.78, 1.01	0.99	0.87, 1.12

Predictors ^a	No. of person-seasons	Immunized women n % ^b	PR	95% CI	aPR ^c	95% CI
I do not like to be study by needles in a healthcare setting						
Disagree	466	267 57	REF		REF	
Neither agree or disagree	175	97 55	0.96	0.82 , 1.13	1.00	0.86 , 1.16
Agree	517	290 56	1.01	0.90 , 1.13	1.04	0.93 , 1.16
I had a discussion with my healthcare professional about the flu shot						
No	823	444 54	REF		REF	
Yes	337	211 63	1.16	1.04 , 1.29	1.08	0.97 , 1.20
I know where to get a free flu shot						
No	270	159 59	REF		REF	
Yes	890	496 56	0.97	0.86 , 1.10	0.94	0.84 , 1.06

Abbreviations: 95% CI: 95% confidence interval; AIDS: acquired immunodeficiency virus; aPR: adjusted prevalence ratio; HIV: human immunodeficiency virus; PR: crude prevalence ratio.

^a Predictors were measured prior to the influenza season (between April 1 and September 30).

^b Denominator is person-seasons.

^c Adjusted for age, race/ethnicity, education, annual household income, country of birth, center, depressive symptoms (defined as a CESD score ≥ 16 for women not reporting injection drug use and ≥ 23 for women reporting injection drug use), drug (including injection or non-injection use of any of the following: marijuana, crack, cocaine, heroin, methadone, amphetamines, non-prescription methadone or narcotics) and alcohol use in the prior 6 months, current cigarette smoking, receiving any other vaccination in the prior 6 months, medical insurance type (public medical insurance including Medicaid/Medi-CAL (California only), Medicare and Veteran's medical insurance, private or other), having an indication for influenza vaccination other than HIV (i.e. currently pregnant or have any of the following: diabetes mellitus, kidney disease, congestive heart failure, asthma or received chemotherapy), pneumonia (excluding *Pneumocystis (carinii) jiroveci* pneumonia) in the prior 6 months, mode of HIV transmission, clinical AIDS diagnosis (classified as a prior report of a clinical diagnosis defined by the 1993 Centers for Disease Control and Prevention surveillance definition, excluding CD4 count < 200 cells/mm³), HIV viral load, and taking highly-active antiretroviral therapy.