

Trends in Seasonal Influenza Vaccination Disparities between US non-Hispanic whites and Hispanics, 2000-2009

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Background

Every year influenza infections and related comorbidities account for thousands of deaths in the United States. Effective and safe vaccines for seasonal influenza have been developed and promise to substantially reduce the mortality and morbidity burden of influenza viruses. However, millions go unvaccinated every year in the United States. Past research has identified the existence of disparities in seasonal influenza vaccination, with racial/ethnic minorities experiencing lower vaccination rates than non-Hispanic whites (Egede and Zheng 2003; Fiscella 2005; Fiscella et al. 2007; Fiscella et al. 2002; Linn, Guralnik, and Patel 2010; Logan 2009; Zimmerman et al. 2003). While inequalities in vaccination have been observed in the past, they are typically based on single-year observations. To better understand racial/ethnic disparities and trends in those disparities, this study will examine ten consecutive flu seasons in the United States from 2000-2009. Given the increasingly diverse population within the United States – particularly with a rapidly growing Hispanic population – it is important to understand recent trends and disparities in flu vaccination, which will help identify opportunities to improve public health.

Theory

This study evaluates the Fundamental Cause Theory (FCT) as a possible explanation for racial/ethnic disparities in seasonal influenza vaccination. As the name of the theory indicates, FCT posits that social conditions are the “fundamental cause” of disease or disease-related behaviors (Link and Phelan 1995). By fundamental cause, Link and Phelan refer to the social conditions that influence health outcomes and “cannot be eliminated by addressing the mechanisms that appear to link them to disease” (86). Because these social conditions often involve “access to resources that can be used to avoid risks or to minimize the consequences of disease once it occurs” (87), we expect to observe disparities in flu vaccination rates between non-Hispanic whites and Hispanics, because non-Hispanic whites tend to have superior access to resources (e.g., education and health insurance) that maximize their opportunities to receive the vaccine. Therefore, controlling for flexible resources often linked with race/ethnicity should cause these disparities to diminish.

Data

The BRFSS is the longest ongoing telephone-based health surveillance survey in the world (CDC 2008). Throughout the year, surveys are administered in all 50 states (as well as the District of Columbia, Guam, the U.S Virgin Islands and Puerto Rico), gathering information on the health status of non-institutionalized adults over the age of 18. The BRFSS is important because of its ability to “identify emerging health problems, establish and track health objectives, and develop and evaluate public health policies and programs” (CDC 2008). Although the BRFSS is administered by individual states, it is nationally representative and therefore an important means of monitoring population health on a national as well as state level.

Beginning in 2001, the BRFSS included new measures of seasonal influenza vaccination behavior in its core of survey questions. Respondents were asked if they had received a seasonal flu vaccination in the past 12 months. Although this question measured whether respondents had recently received the vaccine, it failed to specify the exact flu season that respondents referred to in their vaccination reports.¹ Given the retrospective nature of the question and the fact that the BRFSS is administered throughout the year, the respondent could report receipt of vaccination for any of the three possible influenza seasons measurable through annual BRFSS data. This limitation means that precise seasonal influenza vaccination estimates are not readily available.

Filtering Respondents by Month of Interview

The 2009 and 2010 waves of the BRFSS were the first to report *when* respondents received the seasonal influenza vaccination. We used data from these recent waves to examine the distribution of reported influenza vaccinations across different flu seasons. To illustrate, the 2009 BRFSS contains influenza vaccination data for the 2007, 2008, and 2009 influenza seasons. Although the majority of respondents from the 2009 BRFSS reported vaccination for the 2008 flu season (77.32%), more than a fifth (22.69%) of respondents reported vaccination for the 2007 or 2009 influenza seasons.

¹ Influenza seasons typically begin during late October or November of a given year and last through the summer of the next year; see CDC 2010 for details.

Given the seasonal nature of influenza epidemics and the regularity at which they occur, it is proposed that by selecting respondents by their month of interview, gains in the ability of the BRFSS to precisely estimate seasonal vaccination rates can be made. The logic used in restricting respondents by month of interview is shown through the following example. If a respondent is interviewed during January of a particular survey year, that individual cannot report receipt of a flu vaccination for the upcoming flu season, which does not begin until later, in the fall of that year. Given this fact and considering that vaccinations for upcoming flu seasons typically begin in the last quarter of the year, respondents interviewed from January through September should generally report receipt of influenza vaccinations for the previous year's flu season.

By restricting respondents in such a manner, a subsample is produced for the 2009 BRFSS where 97.88% of reported flu vaccinations correspond to the 2008 influenza season. A similar finding was made for the 2010 BRFSS. Therefore, we expect that applying this method to previous years of the BRFSS will yield similar gains in accuracy, which permits us and other health researchers to track vaccination trends more accurately in the U.S. population (Burger et al. *forthcoming*). Another advantage is that this method retains more of the original respondents than alternative approaches that have been developed, which preserves as much data as possible for analysis. Given these advantages, all analyses in this study will consider only those respondents interviewed from January through September of any survey year to be representative of the previous year's flu season.

Analyses

Using the previously outlined approach of limiting respondents by interview month, we estimated influenza vaccination rates and trends in those rates for non-Hispanic white and Hispanic males and females during the 2000-2009 influenza seasons. Linear regression trend lines were applied to annual gender- and ethnic-specific rates to help summarize trends in seasonal flu vaccination during the 2000-2009 period of observation. We also estimated vaccination rates for non-Hispanic whites and Hispanics by various sociodemographic characteristics (e.g., age and educational attainment) for the 2000-2009 influenza seasons. Difference of proportion tests were used to test if statistically significant differences in seasonal vaccination exist between non-Hispanic whites and Hispanics in these subgroups.

Finally, a series of gender-stratified logistic regression models were estimated to test the proposition set forth by FCT – namely that racial/ethnic disparities in the odds of influenza vaccination will diminish after accounting for flexible resources (i.e., health care insurance, educational attainment, and household income) that are distributed unequally by race/ethnicity in the U.S.

Preliminary Results

In Figure 1, estimated seasonal vaccination rates are presented for non-Hispanic white and Hispanic females (results for males are similar, but not shown here). All four groups examined in this study – Hispanic females, Hispanic males, non-Hispanic white females and non-Hispanic white males – experienced increases in seasonal influenza vaccination rates from 2000-2009. However, rates of increase differed by race/ethnicity and sex. Among females it was observed that vaccination rates among non-Hispanic whites increased from 34.4% (95% C.I., 33.9-35.0) during the 2000 influenza season to 46.4% (95% C.I., 46.0-46.9) during the 2009 influenza season. Among Hispanic females, vaccination rates also increased – from 23.5% (95% C.I., 21.6- 25.5) during the 2000 influenza season to 30.5% (95% C.I., 29.2-31.9) during the 2009 influenza season. Although both groups increased substantially, the relative gain in vaccination rates was higher among non-Hispanic white females (34.9%) than Hispanic females (29.8%). We observed similar discrepancies in trends among males, with non-Hispanic whites experiencing a 25.4% relative increase over the time period compared to just 12.5% among Hispanics

In basic logistic regression models that control for age and survey year (i.e., period of observation), Hispanic females experienced 34.6% ($p = <.001$) lower odds of reporting an influenza vaccination than white females (Model 1 in Table 1). This disparity is considerably wider disparity than the 25.3% lower odds of vaccination reported by Hispanic males (regression results not shown for males). Age appears to have a similar affect for females and males, with the odds of influenza vaccination increasing with age, and a particularly sharp increase at ages 65 and older. These models also affirm that the odds of influenza vaccination have increased over this period of observation.

Introducing healthcare insurance coverage into the logistic regression model causes disparities between white and Hispanic females to narrow considerably (Model 2 in Table 1). We observed similar results for males. In addition, for both males and females, access to health care coverage roughly doubled the odds of reporting an influenza vaccination in the previous year ($p < .001$). Age continues to have a similar effect as in Model 1, with odds of reporting vaccination increasing across all age groups.

In Model 3, education and household income are introduced into the analysis. In this model, the disparities between whites and Hispanics narrowed further (see Table 1 for results among females; results for males not shown). Education had similar effects for males and females, with the odds of vaccination increasing with additional education. Females with ≥ 4 years of college experienced 38.3% higher ($p < .001$) odds of reporting an influenza vaccination than females with less than a high school degree. Among females, a gradient effect was also observed for income; as expected, the odds of reporting a flu vaccine increased with household income. However, contrary to expectations, this gradient effect for household income was not observed among males, suggesting that household income is not a key determinant of this particular health behavior among males. Among females, there was also some slight attenuation in the effect of healthcare coverage, but results for age and period of observation are generally comparable to previous models.

Conclusion

As demonstrated through the analyses, statistically significant differences in vaccination uptake among whites and Hispanics were present in the United States during the 2000-2009 influenza seasons. Consistently, Hispanics exhibited lower rates and odds of influenza vaccination than their white counterparts. Although it was encouraging to find that rates of influenza vaccination increased for each group studied, disparities between whites and Hispanics have unfortunately widened over the past decade. Findings from this study lend support to the proposition set forth by FCT that whites tend to have superior access to flexible resources, which enable them to engage in health-promoting behaviors.

Specifically, the presence of some form of healthcare coverage is very influential in affecting the odds of reporting a seasonal flu vaccination. During the ten-season period of observation, 89.1% (95% C.I., 89.0- 89.2) of whites reported some form of healthcare coverage compared to 66.8% (95% C.I., 66.3-66.7) of Hispanics, highlighting the considerable gap in healthcare coverage between the two groups. This large disparity in healthcare coverage indicates that non-Hispanic whites may be able to marshal more medical resources than Hispanics to obtain influenza vaccinations, supporting the claim of FCT that racial and ethnic minorities may be disadvantaged in the utilization of flexible resources to improve health. Even though flu vaccinations are relatively inexpensive without insurance and available in non-traditional locations (such as shopping centers), the effect of healthcare coverage on the odds of reporting vaccination was relatively stable when controlling for the possible confounding effects of household income and education. Although it is important to recognize that FCT does not explain the entirety of the difference in adjusted odds ratios, healthcare coverage, education, and household income combine to explain 56.9% and 43.9% of the difference in odds ratios between whites and Hispanics for males and females, respectively.

One of the most disturbing gaps in influenza vaccination coverage between whites and Hispanics appears in the ≥ 65 age group. On average, Hispanics ≥ 65 experienced vaccination rates nearly 15% lower than their white counterparts, with the disparity being its widest during the 2009 influenza season. Seasonal influenza vaccination is an important factor in preventing premature mortality, especially among older individuals (Thompson et al. 2004). Given that individuals ≥ 65 experience the highest mortality rates due to the seasonal flu, addressing racial/ethnic vaccination disparities in this age group should be a public health priority.

Tables and Figures

FIGURE 1. Estimated trends in seasonal influenza vaccination rates for White and Hispanic females age ≥ 18 in the United States, 2000-2009 influenza seasons

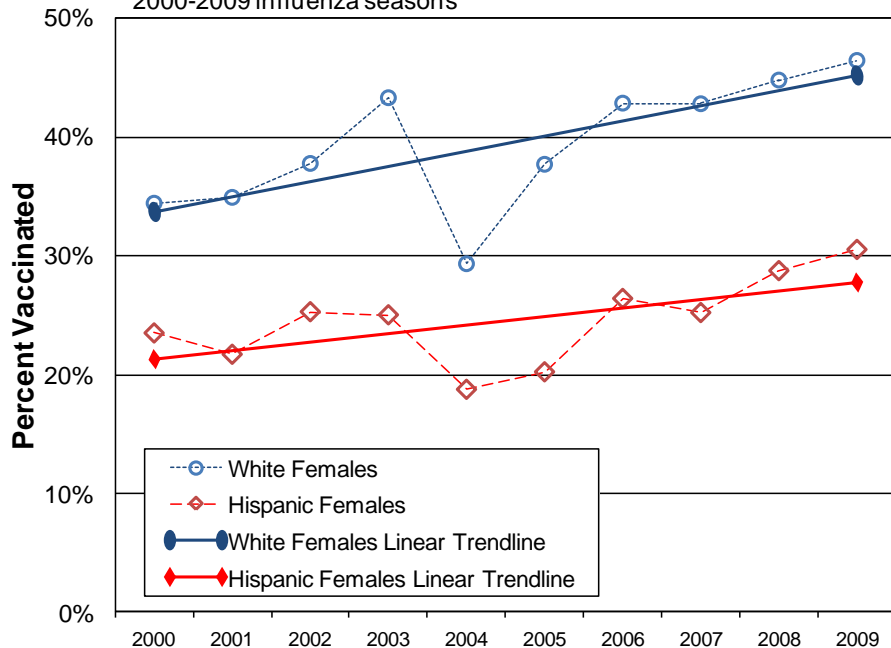


Table 1. Logistic regression estimates of the effect of White and Hispanic race/ethnicity and sociodemographic factors on reported seasonal influenza vaccinations for US Females age ≥ 18 , 2000-2009

Characteristics	Model 1			Model 2			Model 3		
	AOR \ddagger	95% CI \ddagger		AOR	95% CI		AOR	95% CI	
Race/ethnicity									
White	1.000			1.000			1.000		
Hispanic	0.654***	0.635	0.674	.731***	0.709	0.754	0.806***	0.780	0.833
Age									
≥ 65	1.000			1.000			1.000		
55-64	0.373***	0.365	0.380	0.396***	0.388	0.404	0.361***	0.353	0.370
45-54	0.205***	0.201	0.209	0.217***	0.213	0.222	0.193***	0.188	0.198
35-44	0.142***	0.138	0.145	0.151***	0.148	0.155	0.132***	0.128	0.135
25-34	0.124***	0.121	0.127	0.136***	0.133	0.139	0.119***	0.116	0.123
18-24	0.109***	0.105	0.113	0.124***	0.119	0.129	0.117***	0.112	0.123
Healthcare Coverage									
No				1.000			1.000		
Yes				2.126***	2.062	2.192	1.893***	1.829	1.960
Education									
< High School							1.000		
HS or GED							1.028	0.991	1.067
1-3 Years College							1.160***	1.117	1.204
≥ 4 Years College							1.383***	1.331	1.437
Household Income									
\leq \$14,999							1.000		
\$15,000-\$24,999							1.083***	1.046	1.121
\$25,000-\$34,999							1.108***	1.069	1.149
\$35,000-\$49,999							1.103***	1.065	1.143
\$50,000-\$74,999							1.123***	1.084	1.164
\geq \$75,000							1.249***	1.204	1.295
Period									
2000-2009	1.057***	1.055	1.060	1.058***	1.055	1.061	1.057***	1.054	1.060
Valid n. \S	1,325,609			1,323,345			1,123,506		

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

\ddagger AOR, adjusted odds ratio; CI, confidence interval.

\S Unweighted sample size.

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