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## Original Study

# Influenza Vaccination Coverage Among US Nursing Home Nursing Assistants: The Role of Working Conditions

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## A B S T R A C T

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**Objectives:** To estimate influenza vaccination coverage among nursing assistants (NAs) working in US nursing homes, and to identify demographic and occupational predictors of vaccination status among NAs. **Design, setting, and participants:** Cross-sectional analysis of data on 2873 NAs from the 2004 National Nursing Assistant Survey. Multivariable-adjusted vaccination coverage (prevalence) ratios for demographic and occupational characteristics were calculated using Poisson regression. **Measurements:** Outcome variable was NAs' influenza vaccination status, yes or no, based on the question, "During the past 12 months, did you receive a flu shot?"

**Results:** Coverage for all NAs working in US nursing homes was estimated to be 37.1%. NAs 45 or older were more likely to be vaccinated than younger NAs (prevalence ratio [PR] = 1.23, 95% confidence interval [CI]: 1.07–1.41). Significant negative associations with vaccination status were found for NAs who were non-Hispanic blacks (PR = 0.82, 95% CI: 0.70–0.97), disagreed that they were respected/rewarded for their work (PR = 0.85, 95% CI: 0.71–1.00), worked at for-profit facilities (PR = 0.83, 95% CI: 0.72–0.95), and reported receiving fewer than 7 of 15 nonwage job benefits (PR = 0.77, 95% CI: 0.67–0.90).

**Conclusion:** Influenza coverage among nursing home NAs appears to be similar to nationally reported coverage estimates among health care providers in the United States in general. In addition to individual characteristics, occupational characteristics reflective of working conditions are associated with vaccination status among NAs, suggesting that further research into these types of associations may be useful in identifying which institutions may benefit from outreach efforts and types of interventions to increase vaccination coverage.

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Health care personnel (HCP) may acquire influenza from patients.<sup>1</sup> They may also transmit influenza to patients,<sup>1</sup> as they have been shown to have substantial clinical and subclinical rates of infection during influenza seasons<sup>2</sup> and often continue to work while infected.<sup>3</sup> Vaccination of HCP, therefore, is important not only for reducing staff illness and absenteeism,<sup>1,4–6</sup> but also for protection of their patients,<sup>1,7–12</sup> who may be at increased risk for serious illness and complications from influenza.<sup>1,13</sup> However, despite evidence for likely benefit to patients and the vaccine's safety,<sup>1,5,7</sup> influenza vaccination rates among US HCP remain unacceptably

low. Analysis of National Health Interview Survey data indicates influenza vaccination coverage among HCP did not change significantly from 2004 to 2008, averaging only 44.8%,<sup>14</sup> well below the *Healthy People 2010* goal of 60%.<sup>15</sup> Research by the RAND Corporation indicated that, even during the 2009 pandemic influenza A (H1N1), vaccination coverage among HCP was only 37.1% for the 2009 H1N1 monovalent vaccine and 61.9% for seasonal influenza vaccine. Coverage for both seasonal and 2009 H1N1 vaccines was lowest among HCP working in long term care facilities versus hospitals or other locations.<sup>16</sup>

The elderly living in long term care facilities such as nursing homes are at highest risk of serious illness and death from seasonal influenza, especially when underlying chronic conditions are present.<sup>13,17,18</sup> The principal caregivers for this population are approximately 600,000 nursing assistants (NAs) working in the nation's nursing homes.<sup>19</sup> NAs typically have far more contact with residents than other staff members. Indeed, some 90% of hands-on

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resident care is provided by NAs.<sup>20</sup> Working under supervision of nursing or medical staff, they assist residents of nursing facilities with activities of daily living including bathing, eating, dressing, and toileting. They may also perform other direct care tasks such as taking vital signs, changing dressings, skin care, transferring, positioning, and turning.<sup>19,20</sup>

At the same time, NAs, particularly those working in nursing homes, work under physically and emotionally demanding conditions, typically with little training, for low pay and often without respect or support from their supervisors or the public.<sup>20,21</sup> Because past studies have shown that working conditions that detract from HCPs' "quality of work life" are associated with adverse patient safety and occupational health outcomes,<sup>22,23</sup> it is likely that unfavorable working conditions might also be associated with low influenza vaccination coverage among HCP.

Given their close contact with those most vulnerable to influenza complications and their challenging working conditions, we wanted to evaluate whether individual or occupational characteristics of NAs are associated with vaccination status. Toward these ends, we undertook this study with 2 main objectives: to estimate influenza vaccination coverage among NAs working in US nursing homes, and to identify demographic and occupational predictors of vaccination status among NAs.

## Methods

### Data

We analyzed cross-sectional data from the National Nursing Assistant Survey (NNAS). Conducted as a supplement to the National Center for Health Statistics 2004 National Nursing Home Survey, the NNAS is the first nationally representative survey of NAs working in US nursing homes. The survey was administered to a stratified, multistage, probability sample of NAs who had worked at a subsample of 790 National Nursing Home Survey nursing homes. To be eligible for participation in the survey, NAs' job duties had to include assisting residents with activities of daily living and NAs had to work at least 16 hours per week. The NNAS methodology has been fully described elsewhere.<sup>24</sup>

Only respondents who were currently employed as an NA at the time of the interview ( $n = 2897$ ) were considered for this analysis. Twenty-four respondents were further excluded because of missing vaccination status data, resulting in a final, unweighted sample size of 2873.

### Variables

Vaccination status was operationalized as a dichotomous variable reflecting respondents' answers—yes or no—to the question "During the past 12 months, did you receive a flu shot?"

Independent variables of interest reflected self-reported demographic and occupational characteristics of NAs. For this analysis, we focused on occupational variables (including job, organizational and facility characteristics) reflective of NAs' working conditions. The variables sex, primary language, job satisfaction, respect, discrimination, facility location, facility size, facility safety equipment, and availability of employer-provided health insurance were analyzed using their original survey categories.

Derived variables were developed either by collapsing numeric survey variables to categorical ones (age group, education, household income, tenure at current job, hourly wage) or based on the values of a combination of original survey variables (race/ethnicity, has health insurance from any source). The NNAS asked respondents whether or not their employers offered 15 different job

benefits, including paid sick leave, vacation days, retirement or pension plan, and so forth. Because our hypothesis was not that any given benefit (except health insurance) would be associated with vaccination status, rather that more benefits are indicative of better working conditions and greater organizational commitment to workers, we combined the dichotomous variables for each benefit into a single ordinal variable reflecting the number of job benefits offered by the employer.

### Analytic Approach

We calculated population-weighted point estimates of vaccination coverage and their design-adjusted 95% confidence intervals for the selected demographic, occupational, and institutional characteristics. Bivariate associations with vaccination status were assessed using Rao-Scott design-adjusted chi-square tests for dichotomous variables (sex, has health insurance from any source, ever discriminated against because of race/ethnicity, facility ownership, facility lacks needed safety equipment, employer-provided health insurance). For multilevel categorical variables (race/ethnicity, primary language, facility location), we used the stratum-adjusted Cochran Mantel-Haenszel test for independence, and for ordinal variables (age group, education, household income, tenure at current job, hourly wage, satisfaction with current job, NAs are respected/rewarded for their work, facility size, number of benefits offered by employer), the stratum-adjusted Cochran Mantel-Haenszel test for trend was used.

We calculated multivariable-adjusted coverage ratios and their design-adjusted 95% confidence intervals using Poisson regression. Variables associated vaccination status with  $P$  less than .10 in the bivariate analyses were included in the regression model with the exception of employer-provided health insurance, which was not entered separately because it is included among the 15 nonwage job benefits offered by the employer. To increase statistical power and for ease of interpretation, ordinal variables (including the number of job benefits offered) were dichotomized before being entered into the model.

All analyses were conducted using SAS-callable SUDAAN 10.0 (RTI International, Research Triangle Park, NC). The complex nature of the survey sample design was accounted for in the calculation of all standard errors.

## Results

Influenza vaccination coverage by demographic characteristics of NAs is presented in Table 1. Coverage for all NAs working in US nursing homes was estimated to be 37.1%, including 36.7% of women and 41.4% of men. The vast majority of NAs were women; however, sex was not significantly associated with vaccination status. Increasing age, on the other hand, was found to be positively associated with vaccination status, with age group coverage ranging from 31.7% among those 16 to 24 and 25 to 34 years old to 75.6% among those 65 years and older.

Overall, both race/ethnicity and NAs' primary language were significantly associated with vaccination status. Among racial/ethnic subpopulations, vaccination coverage was significantly lower for non-Hispanic blacks than for both non-Hispanic whites ( $\text{chi-square}_{df1} = 10.0, P < .01$ ) and Hispanics/Latinos ( $\text{chi-square}_{df1} = 11.0, P < .01$ ). And, compared with the approximately 89% of NAs who reported that their primary language was English, Spanish-speaking NAs were significantly more likely to have been vaccinated ( $\text{chi-square}_{df1} = 6.02, P = .01$ ). The difference in vaccination coverage between English-speaking NAs and those who reported that their primary language was something other than English or Spanish was not significant ( $\text{chi-square}_{df1} = 1.85, P = .17$ ).

**Table 1**  
Sample Characteristics and Influenza Vaccination Coverage among US Nursing Home Nursing Assistants by Demographic Characteristics

Characteristic	% of Total*	% Vaccinated (95% CI)	P Value <sup>†</sup>
Total <sup>‡</sup>	100.0	37.1 (34.5–39.7)	—
Sex			
Female	92.3	36.7 (33.9–39.5)	.31
Male	7.7	41.4 (32.9–49.9)	
Age group, y			
16–24	17.0	31.7 (26.4–36.9)	
25–34	23.6	31.7 (27.5–35.9)	
35–44	24.4	36.4 (31.3–41.6)	
45–54	22.4	40.2 (35.0–45.4)	
55–64	10.0	43.8 (36.0–51.5)	<.01
65+	2.6 <sup>§</sup>	75.7 (59.9–91.4)	
Race/Ethnicity			
White, non-Hispanic	47.0	39.6 (36.0–43.2)	
Black, non-Hispanic	37.0	30.7 (26.4–35.1)	
Hispanic/Latino	9.5	44.4 (37.1–51.7)	<.01
Other race	6.5	44.6 (34.7–54.5)	
Education			
Less than high school	29.4	37.4 (33.3–41.6)	
High school diploma	45.8	37.0 (33.3–40.6)	
Some college	19.9	33.7 (28.4–39.1)	.60
College grad	4.9	50.4 (38.4–62.5)	
Household income			
< \$20,000	36.3	33.8 (29.9–37.7)	
\$20,000 – <40,000	40.8	40.2 (36.4–44.0)	.22
\$40,000+	22.9	36.8 (31.6–42.0)	
Primary language			
English	89.0	36.1 (33.4–38.9)	
Spanish	3.9	48.6 (38.5–58.6)	.04
Other	7.1	43.0 (33.0–53.0)	
Has health insurance from any source			
Yes	83.7	37.7 (34.8–40.5)	.22
No	16.3	34.1 (28.8–39.4)	

CI, confidence interval.

\* Population-weighted.

<sup>†</sup> From the chi-square test for independence (nominal variables) or trend (ordinal variables).

<sup>‡</sup> Sample size = 2873.

<sup>§</sup> Because of the small sample size ( $n = 46$ ), the estimate of the proportion of subjects vaccinated for this age group is not assumed to be reliable.

Among the characteristics of NAs' current jobs that we considered, tenure at current job, hourly wage, job satisfaction, feeling respected/rewarded for their work, facility size, facility ownership, availability of employer-provided health insurance, and the number of benefits offered by the employer were significantly associated with vaccination status (Table 2). We noted statistically significant positive trends in vaccination coverage across increasing levels of tenure at current job, hourly wage, job satisfaction, feeling respected/rewarded for work, and the number of benefits offered. There was a significant inverse relationship, however, between vaccination coverage and the number of beds in the nursing home, with coverage decreasing across increasing levels of facility size. NAs who reported that they worked at for-profit facilities were significantly less likely to have been vaccinated than those who worked at government or private not-for-profit facilities, and those who reported that their employer did not offer health benefits were less likely to have been vaccinated than those whose employers did offer health coverage.

Multivariate-adjusted coverage ratios for individual and job characteristics are presented in Table 3. After adjustment for the effect of the 11 variables included in the Poisson regression model, 5 variables remained significantly associated with vaccination status. NAs aged 45 or older were 23% more likely to be vaccinated than those aged 16 to 44 years. Non-Hispanic blacks were 18% less likely than non-Hispanic whites to be vaccinated. Those who

**Table 2**  
Influenza Vaccination Coverage among US Nursing Home Nursing Assistants by Current Job Characteristics

Characteristic	% of Total	% Vaccinated (95% CI)	P Value
Tenure at current job			
<=6 mo	15.3	26.0 (21.2–30.8)	
>6 mo – <1 y	12.3	32.0 (26.1–37.8)	
1 yr – <2 y	13.8	38.5 (31.8–45.3)	
2–5 y	32.2	39.1 (34.5–43.8)	
6–10 y	10.8	40.3 (32.7–48.0)	
11–20 y	10.8	40.3 (33.1–47.5)	
20+ y	4.6	54.5 (42.0–66.9)	<.01
Hourly wage			
<\$6.00	8.4	36.8 (27.3–46.3)	
\$6.00 – <8.00	10.7	26.7 (20.9–32.6)	
\$8.00 – <10.00	32.0	37.2 (33.1–41.3)	
\$10.00 – <12.00	28.7	36.3 (31.6–41.0)	
\$12.00+	20.2	43.6 (37.6–49.6)	.03
Satisfaction with current job			
Extremely dissatisfied	3.7	33.8 (22.6–45.0)	
Somewhat dissatisfied	14.2	35.7 (29.7–41.7)	
Somewhat satisfied	51.6	34.9 (31.2–38.6)	
Extremely satisfied	30.5	41.8 (37.5–46.2)	.03
NAs respected/rewarded for their work			
Strongly disagree	18.3	29.3 (24.0–34.6)	
Somewhat disagree	12.6	33.7 (27.1–40.3)	
Somewhat agree	32.2	38.4 (34.0–42.9)	
Strongly agree	36.9	41.0 (39.7–45.3)	<.01
Ever discriminated against because of race/ethnicity			
Yes	8.1	36.7 (28.0–45.4)	
No	91.9	37.1 (34.4–39.9)	.93
Facility location			
Urban (metropolitan)	75.8	36.4 (33.1–39.7)	
Large rural (micropolitan)	13.2	35.9 (30.7–41.2)	
Small rural (neither)	11.0	43.4 (37.5–49.2)	.10
Facility size			
3–49 beds	5.0	45.4 (38.8–51.9)	
50–99 beds	27.9	39.3 (35.2–43.5)	
100–199 beds	56.3	36.7 (32.9–40.5)	
200+ beds	10.8	29.7 (21.0–38.4)	.01
Facility ownership			
For profit	58.7	32.8 (29.6–36.0)	
All others	41.3	43.2 (39.0–47.3)	<.01
Facility lacks needed safety equipment			
Yes	15.7	32.5 (26.9–38.2)	
No	84.3	38.0 (35.1–40.8)	.08
Health insurance available through employer			
Yes	91.0	38.0 (35.2–40.8)	
No	9.0	28.2 (21.5–34.8)	.01
Number of benefits offered by employer			
0–2	3.7	26.5 (17.7–37.6)	
3–5	22.4	28.8 (24.5–33.5)	
6–8	50.7	39.8 (36.2–43.6)	
9–11	22.7	40.5 (35.3–45.8)	
12–15	0.6	57.1 (28.5–81.7)	<.01

CI, confidence interval.

disagreed that they were respected/rewarded for their work were 15% less likely to be vaccinated than those who agreed that they were. NAs working at for-profit facilities were 17% less likely to be vaccinated than those who worked at government or private not-for-profit facilities. Finally, NAs who reported that their employers offered fewer than 7 (the sample median) of the 15 job benefits considered were 23% less likely to be vaccinated than those whose employers offered 7 or more benefits.

## Discussion

It is generally accepted that vaccination of HCP against influenza can reduce transmission of the virus in health care settings.<sup>1</sup> It is anticipated, therefore, that vaccination of HCP who work with the

**Table 3**  
Adjusted Influenza Vaccination Coverage Ratios for Individual Characteristics of US Nursing Home Nursing Assistants\*

Characteristic	Adjusted Coverage Ratio (95% CI)
Age, y	
16–44	Ref
45+	<b>1.23</b> (1.07–1.41)
Race/Ethnicity	
White, non-Hispanic	Ref
Black, non-Hispanic	<b>0.82</b> (0.70–0.97)
Hispanic/Latino	1.14 (0.91–1.44)
Other race	1.04 (0.80–1.35)
Primary language	
English	Ref
Spanish	1.11 (0.83–1.47)
Other	1.22 (0.94–1.59)
Tenure at current job, y	
<=5 y	0.95 (0.82–1.10)
>5 y	Ref
Hourly wage	
<\$10.00	0.98 (0.85–1.13)
\$10.00+	Ref
Satisfaction with current job	
Satisfied	Ref
Dissatisfied	1.11 (0.93–1.31)
NAs respected/rewarded for their work	
Agree	Ref
Disagree	<b>0.85</b> (0.71–1.00)
Facility size	
3–99 beds	Ref
100+ beds	0.92 (0.80–1.04)
Facility ownership	
For profit	<b>0.83</b> (0.72–0.95)
All others	Ref
Facility lacks needed safety equipment	
Yes	0.89 (0.75–1.06)
No	Ref
Number of benefits offered by employer	
0–6	<b>0.77</b> (0.67–0.90)
7 or more	Ref

CI, confidence interval.

\* Coverage ratios were adjusted for the effect of all other variables in the table. Coverage ratios in bold are statistically significant.

elderly in nursing homes would provide additional, indirect protection for vulnerable residents. This reasoning is supported by a number of studies suggesting that vaccination of HCP in nursing homes protects residents from influenza.<sup>9,10,12,25–27</sup> However, despite having increased to its current level from 10% in 1989, influenza vaccination coverage among all US HCP remain suboptimal, having increased little since 1997.<sup>28</sup>

In this, the first study to address the issue on a national basis, we estimated influenza vaccination coverage among nursing home NAs to be 37.1%. This was slightly lower than contemporary coverage rates among US HCP in general, estimated at 41.9% based on data from the National Health Interview Survey.<sup>29</sup> The fact that coverage among NAs was no better than among HCP generally may be seen as cause for special concern, given their close contact with those most vulnerable to influenza complications and mortality. Staff vaccination is particularly important for the prevention of influenza transmission in nursing home settings because immune response to vaccination is diminished in the elderly,<sup>30,31</sup> and outbreaks resulting in significant morbidity and mortality may occur even in facilities with well-vaccinated populations.<sup>32</sup>

Vaccination of HCP is also associated with reductions in staff illness and absenteeism.<sup>4–6,21</sup> In addition to its obvious importance for their individual well-being, the health of HCP has significance for their patients, coworkers, and communities beyond the prevention of nosocomial transmission of influenza. High levels of staff illness and absenteeism leading to understaffing can result in

increased workload for those who are working, and to decreased quality of resident care.<sup>33,34</sup> Also, NAs are an important potential source of HCP surge capacity for pandemic or other public health emergency response. High levels of NA absenteeism during severe influenza epidemics could mean that critical gaps in communities' emergency response infrastructures go unfilled.

Vaccination coverage patterns among NAs reported here by demographic and job characteristics were consistent with previous findings for all US HCP, including the findings that vaccination coverage among non-Hispanic blacks was significantly lower than among non-Hispanic whites, the positive association of vaccination status with increasing age, and with certain employer characteristics, such as employer-provided health insurance and facility type.<sup>28</sup>

There are numerous reasons why NAs might not get vaccinated, including personal choice as well as access to vaccination. Reasons commonly given by HCP who decline vaccination include doubts about their risk for influenza and the need for vaccination, doubts about vaccine effectiveness, concerns about side effects, inconvenience, general avoidance of medications or preference for homeopathic medications, and dislike of injections.<sup>7</sup> Access to influenza vaccination in particular and to health care in general is, of course, bound to play a role as well. However, 2004 National Nursing Home Survey data reflect that 88% of US nursing homes offer influenza vaccination to their employees for free or at reduced cost and 86% offer the vaccine on site.<sup>35</sup> In addition, 84% of NAs had health coverage from some source and 91% reported that their employer offered health insurance. So, although access is not universal and other barriers to access surely exist, even for those with health insurance, it seems unlikely that differential access alone can offer an adequate explanation of differences in NAs' vaccination coverage.

Our findings that several job or employer-related characteristics—feeling respected for one's work, facility ownership, and employment benefits offered—were associated with vaccination status, even after adjustment for individual-level variables, suggest that certain occupational characteristics may also play a role in vaccination coverage among NAs. Although explicitly elucidating the mechanism (or mechanisms) that might underlie such associations is not possible using the current data, a conceptual model developed by Gershon and colleagues<sup>22</sup> offers a possible explanation: such variables are markers of certain aspects of NAs' general occupational environment whose relationship to vaccination status is mediated by NAs' "quality of work life." Gershon et al's model posits that one's quality of work life—defined as "the sum of perceptions employees have about their experience at work and related to work"<sup>22</sup>—is determined by factors comprising 3 domains: individual characteristics, organizational characteristics, and working conditions, with the working conditions domain further comprising the constructs organizational climate, job characteristics, and work environment. Variables such as feeling respected for one's work and the number of benefits offered by one's employer are reflective of NAs' "working conditions." Working conditions have been shown to be associated with both patient safety and occupational health outcomes in HCP.<sup>22,23</sup> Our findings suggest that occupational characteristics reflective of NAs' working conditions might also be related to vaccination coverage, which influences the health of nursing home residents and NAs alike.

One possible mechanism that might underlie these relationships is that decreased quality of work life undermines workers' belief that their employer has their best interest at heart. This diminished confidence in their employer's concern for their well-being leads to decreased levels of compliance with workplace policies and procedures (eg, infection control practices) and

employer recommendations (eg, getting the influenza vaccine). Indeed, research has shown that, in the industrial setting as well as among HCP, worker perceptions of their employer's commitment to safety (ie, organizational safety climate) are associated with both the adoption and maintenance of safe work practices and the incidence of workplace injuries.<sup>36–39</sup> This process may limit the effectiveness of employers' efforts to increase coverage through, for example, vaccination campaigns, even to the extent that increased efforts, in as much as they are perceived by workers to be associated with the employer, could actually lead to decreased vaccine acceptance.

The significance of the association between vaccination status and facility ownership may also be interpreted in this way, by understanding the ownership variable as a possible proxy for some unmeasured element of working conditions—an indirect assessment of aspects of the organizational, social, or physical environment of NAs' workplaces or of their job characteristics not captured by the other job variables in our analysis. Previous studies have documented a similar relationship between long term care facility ownership and resident vaccination, with residents living in government-owned and nonprofit facilities having higher coverage rates than those living in for-profit facilities.<sup>40,41</sup> Poorer performance by for-profit relative to not-for-profit nursing homes may be attributable to the profit motive. However, the inability of such facilities to exercise discretion in the allocation of resources may also play a role because for-profit nursing homes tend to have lower occupancy, higher Medicaid census, and operate in states with lower Medicaid payments than not-for-profit homes.<sup>42</sup>

The previously documented association between having employer-provided health insurance and vaccination status among HCP<sup>28</sup> has typically been understood in terms of individual access to health care. In our study, actually having health insurance from any source was not associated with vaccination status. The availability of employer-provided insurance, however, was. This suggests that, at least among NAs, this association might also be interpreted in terms of working conditions, with employer-provided insurance being an employer-level marker for a work environment that more effectively fosters either compliance with infection control practices or protective health behaviors in general among employees.

It is perhaps a version of this dynamic—employees' mistrust about their employers' commitment to their well-being—that we see at play in some of the recent debate over mandatory influenza vaccination for HCP.<sup>43–51</sup> Such mandates appear to be effective in achieving high levels of coverage.<sup>52</sup> Yet, HCP and their unions, although not opposing the concept of influenza vaccination, have opposed mandates, arguing that the coercive nature of such policies negatively affects the employee-employer relationship and puts frontline HCP at odds with facility management.<sup>43,53</sup>

The Society for Healthcare Epidemiology of America, in its 2010 position paper endorsing mandatory vaccination of HCP, has responded by arguing that clear communication and a “trusting partnership” between management and workers will address these concerns.<sup>54</sup> The Society for Healthcare Epidemiology of America further suggests that by engaging in “collaborative interaction” with management, HCP unions would be in a position to emphasize the importance of vaccination for protection of workers and patients. However, if unfavorable working conditions negatively affect employee perceptions of their employer's commitment to their well-being, they may have the potential to undermine such partnerships or collaborations.

The findings in this study are subject to certain limitations. First, the NNAS data are self-reported and subject to recall and social-desirability bias. However, among adults, self-report of influenza vaccination is considered a sensitive and specific source of

information and is generally accepted as evidence of vaccination in clinical practice.<sup>55,56</sup> Second, the NNAS excludes NAs who work in nursing homes but who are employed by temporary staffing agencies rather than the facility itself. The Bureau of Labor Statistics, however, reported that 1.5% of NA jobs were filled by temporary agency personnel in 2004.<sup>57</sup> Additionally, the NNAS overall response rate was 53.4%, and low response rates can result in response bias; however, weighting adjustments attempt to minimize the effects of nonresponse, noncoverage, and undercoverage.<sup>24</sup>

It should also be noted that there was an influenza vaccine shortage in the US during the 2004–2005 influenza season, during which time most of the NNAS telephone interviews were administered,<sup>24</sup> which could have led to lower than usual coverage levels among NAs. However, HCP involved in direct patient care (including NAs) were included in the redefined high-priority groups recommended to receive vaccination during the 2004–2005 season.<sup>58</sup> A subsequent Government Accountability Office report concluded that actions by federal and state governments to mitigate the impact of the shortage, such as revising vaccination recommendations to target high-priority groups and expeditious distribution of vaccine supplies, were largely successful and were able to achieve levels of vaccination coverage approaching past levels for priority groups.<sup>59</sup>

Finally, because facility identifiers are not available in the public use data set, upon which the current analyses are based, we were unable to account for variation in the variance of independent variables at the individual facility level in our model or to include certain variables measured exclusively at the facility level. Many characteristics, including aspects of working conditions relevant to vaccination coverage among nursing home staff, are either applied (in the case of policy, eg, the use of vaccination campaigns) or otherwise operate (eg, as a function of the particular dynamics of a specific management team) primarily at the facility level. An important example of this would be the implementation of particular strategies by individual facilities to increase vaccination coverage, such as providing vaccination on-site or offering the vaccine for free or at reduced cost. Because we cannot determine whether the particular facility at which an individual NA worked used any such strategies, we could not quantify the role they play in vaccination coverage.

## Conclusions

Despite these limitations, the results of our analyses allow us to conclude that influenza vaccination coverage among nursing home NAs in the United States has been similar to that of US HCP in general—which is to say unacceptably low—and that certain job and employer characteristics are independent predictors of vaccination status among NAs, in addition to individual demographic characteristics. We observed that variables reflective of adverse working conditions were negatively associated with vaccination status among NAs. We further suggest that one possible interpretation of this association is that NAs' working conditions can influence health behaviors such as vaccine acceptance. Further research into the association of facility- or employer-level ecological variables with vaccination status is needed to identify opportunities for interventions intended to increase vaccination coverage among NAs through organizational or systems change.

Our findings underscore the importance of current recommendations that health agencies and institutions should work together to increase influenza vaccination levels among nursing home NAs by making vaccination convenient and available and by adopting policies that encourage vaccination. Educational efforts may be effective in reducing attitudinal barriers to vaccination as well.

Additionally, our finding that, in addition to individual characteristics, occupational and organization characteristics—including variables reflective of working conditions—are associated with vaccination status suggests that further research into these types of associations may be useful in identifying potential institution-level organizational change interventions to increase vaccination coverage, including interventions aimed at improving the working conditions of NAs. Future multilevel analyses using linked individual NA data from the NNAS and facility-level data from the National Nursing Home Survey would address the hierarchical structure of the available data, with individual NAs nested within nursing homes, and allow for optimal examination of the effect of nursing home facility characteristics on vaccination coverage among NAs.

## References

- Centers for Disease Control and Prevention. Influenza vaccination of health-care personnel: Recommendations of the Healthcare Infection Control Practices Advisory Committee (HICPAC) and the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep* 2006;55:1–16.
- Elder AG, O'Donnell B, McCrudden EAB, et al. Incidence and recall of influenza in a cohort of Glasgow healthcare workers during the 1993–4 epidemic: results of serum testing and questionnaire. *BMJ* 1996;33:1241–1242.
- Weingarten S, Riedinger M, Bolton LB, et al. Barriers to influenza vaccination acceptance: a survey of physicians and nurses. *Am J Infect Control* 1989;17:202–207.
- Nichol KL, Lind A, Margolis KL, et al. The effectiveness of vaccination against influenza in healthy, working adults. *N Engl J Med* 1995;333(14):889–893.
- Wilde JA, McMillan JA, Serwint J, et al. Effectiveness of influenza vaccine in health care professionals. A randomized trial. *JAMA* 1999;281:908–913.
- Saxen H, Virtanen M. Randomized, placebo-controlled double blind study on the efficacy of influenza immunization on absenteeism of health care workers. *Pediatr Infect Dis J* 1999;18:779–783.
- Centers for Disease Control and Prevention. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2009. *MMWR Morb Mortal Wkly Rep* 2009;58:1–52.
- Hayward AC, Harling R, Wetten S, et al. Effectiveness of an influenza vaccine programme for care home staff to prevent death, morbidity, and health service use among residents: cluster randomized controlled trial. *BMJ* 2006;333:1241–1246.
- Carman WF, Elder AG, Wallace LA, et al. Effects of influenza vaccination of health-care workers on mortality of elderly people in long term care: a randomized controlled trial. *Lancet* 2000;355:93–97.
- Potter J, Stott DJ, Roberts MA, et al. Influenza vaccination of health care workers in long-term-care hospitals reduces the mortality of elderly patients. *J Infect Dis* 1997;175:1–6.
- van den Dool C, Bonten MJ, Hak E, Wallinga J. Modeling the effects of influenza vaccination of healthcare workers in hospital departments. *Vaccine* 2009;27:6261–6267.
- van den Dool C, Bonten MJ, Hak E, et al. The effects of influenza vaccination of healthcare workers in nursing homes: insights from a mathematical model. *PLoS Med* 2008;5:e200.
- Thompson WW, Shay DK, Weintraub E, et al. Mortality associated with influenza and respiratory syncytial virus in the United States. *JAMA* 2003;289:179–186.
- Caban-Martinez AJ, Lee DJ, Davila EP, et al. Sustained low influenza vaccination rates in US healthcare workers. *Prev Med* 2010;50:210–212.
- US Department of Health and Human Services. *Healthy People 2010* (conference ed, in 2 vols). Washington, DC: US Department of Health and Human Services. Available at: [http://www.healthypeople.gov/2010/Document/html/uih/uih\\_1.htm](http://www.healthypeople.gov/2010/Document/html/uih/uih_1.htm); 2000. Accessed January 21, 2011.
- Centers for Disease Control and Prevention. Final Estimates for 2009–10 Seasonal Influenza and Influenza A (H1N1) 2009 Monovalent Vaccination Coverage – United States, August 2009 through May, 2010. Atlanta, GA: Centers for Disease Control and Prevention. Available at: [http://www.cdc.gov/flu/professionals/vaccination/coverage\\_0910estimates.htm](http://www.cdc.gov/flu/professionals/vaccination/coverage_0910estimates.htm); 2010. Accessed January 21, 2011.
- Fune L, Shua-Haim JR, Ross JS, Frank E. Infectious disease among residents of nursing homes. *Ann Longterm Care* 1999;7:410–417.
- Muder RR. Pneumonia in residents of long-term care facilities: Epidemiology, etiology, management, and prevention. *Am J Med* 1998;105:319–330.
- Bureau of Labor Statistics. *Occupational Outlook Handbook, 2008–09 Edition: Nursing, Psychiatric, and Home Health Aides*. Washington, DC: US Department of Labor, BLS. Available at: <http://www.bls.gov/oco/ocos165.htm>; 2007. Accessed January 21, 2011.
- Galloro V. Staffing outlook grim: High turnover expected to continue in skilled nursing, assisted living. *Mod Healthc* 2001;31:64.
- Parsons SK, Simmons WP, Penn K, Furlough M. Determinants of satisfaction and turnover among nursing assistants: The results of a statewide survey. *J Gerontol Nurs* 2003;29:51–58.
- Gershon RM, Stone PW, Zeltser M, et al. Organizational climate and nurse health outcomes in the United States: A systematic review. *Ind Health* 2007;45:622–636.
- Stone P, Gershon R. Nurse work environments and occupational safety in intensive care units. *Policy Polit Nurs Pract* 2006;7:240–247.
- National Center for Health Statistics. An introduction to the National Nursing Assistant Survey. *Vital Health Stat* 2007;1:1–54.
- Morens DM, Rash VM. Lessons from a nursing home outbreak of influenza A. *Infect Control Hosp Epidemiol* 1995;16:275–280.
- Jordan R, Wake B, Hawker J, et al. Influenza vaccination of health care workers (HCW) to reduce influenza-related outcomes in high risk patients: a systematic review of clinical and cost-effectiveness. Birmingham, West Midlands, UK: WMHTAC. Vol. 88, West Midlands Health Technology Assessment Collaboration (WMHTAC), 2004.
- Shugarman LR, Hales C, Setodji CM, Bardenheier B, Lynn J. The influence of staff and resident immunization rates on influenza-like illness outbreaks in nursing homes. *J Am Med Dir Assoc* 2006;7:562–567.
- Walker FJ, Singleton JA, Lu P, et al. Influenza vaccination of health-care workers in the United States, 1989–2002. *Infect Control Hosp Epidemiol* 2006;27:257–265.
- Centers for Disease Control and Prevention. Prevention and control of influenza recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep* 2006;55:1–42.
- McIlhaney JE. The unmet need in the elderly: Designing new influenza vaccines for older adults. *Vaccine* 2005;23:S1–S25.
- Goodwin K, Viboud C, Simonsen L. Antibody response to influenza vaccination in the elderly: A quantitative review. *Vaccine* 2006;24:1159–1169.
- Coles FB, Balzano GJ, Morse DL. An outbreak of influenza A (H3N2) in a well immunized nursing home population. *J Am Geriatr Soc* 1989;40:589–592.
- Kane RL, Shamiyan T, Mueller C, et al. Nurse staffing and quality of patient care. *Evid Rep Technol Assess (Full Rep)* 2007;151:1–115.
- Hugonnet S, Chevrolet JC, Pittet D. The effect of workload on infection risk in critically ill patients. *Crit Care Med* 2007;35:76–81.
- Centers for Disease Control and Prevention. National Nursing Home Survey, 2004 Facility Tables: Table 23. Percentage of nursing homes with strategies to encourage employee influenza vaccinations, by selected facility characteristics: United States, 2004. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Health Statistics. Available at: <http://www.cdc.gov/nchs/data/nhnsd/nursinghomefacilities2006.pdf#23>; 2010. Accessed January 21, 2011.
- Zohar D. Safety climate in industrial organizations: Theoretical and applied implications. *J Appl Psychol* 1980;65:96–102.
- Diaz RS, Cabrera DD. Safety climate and attitude as evaluation measures of organizational safety. *Accid Anal Prev* 1997;29:643–650.
- Cohen A, Smith M, Cohen HH. Safety program practices in high versus low accident rate companies—an interim report (USD-HHS No 75–185). Cincinnati (OH): NIOSH; 1975.
- Gershon R, Karkashian C, Grosch J, et al. Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *Am J Infect Control* 2000;28:211–221.
- Bardenheier BH, Wortley P, Ahmed F, Hales C, Shefer A. Influenza immunization coverage among residents of long-term care facilities certified by CMS, 2005–2006: The newest MDS quality indicator. *J Am Med Dir Assoc* 2010;11:59–69.
- Bardenheier B, Shefer A, Mckibben L, et al. Characteristics of long-term care facility residents associated with receipt of influenza and pneumococcal vaccinations. *Infect Control Hosp Epidemiol* 2004;25:946–954.
- Decker F. Nursing home performance in resident care in the United States: Is it only a matter of for-profit versus not-for-profit? *Health Econ Policy Law* 2008;3:115–140.
- Lugo NR. Will carrots or sticks raise influenza immunization rates of health care personnel? *Am J Infect Control* 2007;35:1–6.
- van den Hoven MA, Verweij M. Should we promote influenza vaccination of health care workers in nursing homes? Some ethical arguments in favour of immunization. *Age Ageing* 2003;32:487–489.
- Anikeeva O, Braunack-Mayer A, Rogers W. Requiring influenza vaccination for healthcare workers. *Am J Public Health* 2009;99:24–29.
- Helms CM, Polgreen PM. Should influenza immunisation be mandatory for healthcare workers? Yes. *BMJ* 2008;337:a2142.
- Isaacs D, Leask J. Should influenza immunisation be mandatory for healthcare workers? No. *BMJ* 2008;337:a2140.
- Steckel CM. Mandatory influenza immunization for healthcare workers—an ethical discussion. *AAOHN J* 2007;55:34–39.
- Stewart AM. Mandatory vaccination of healthcare workers. *N Engl J Med* 2009;361:2015–2017.
- Tilburt JC, Mueller PS, Ottenberg AL, et al. Facing the challenges of influenza in healthcare settings: The ethical rationale for mandatory seasonal influenza vaccination and its implications for future pandemics. *Vaccine* 2008;26:D27–D30.
- van Delden JJ, Ashcroft R, Dawson A, et al. The ethics of mandatory vaccination against influenza for healthcare workers. *Vaccine* 2008;26:5562–5566.

52. Talbot TR, Dellit TH, Hebden J, et al. Factors associated with increased healthcare worker influenza vaccination rates: Results of a national survey of university hospitals and medical centers. *Infect Control Hosp Epidemiol* 2010; 31:456–462.
53. American College of Occupational and Environmental Medicine (ACOEM) guidance statement: Seasonal influenza prevention in health care workers. Elk Grove Village, IL: ACOEM. Available at: <http://www.acoem.org/guidelines.aspx?idp5362>; 2010. Accessed January 21, 2011.
54. Talbot TR, Babcock H, Caplan AL, et al. Revised SHEA position paper: Influenza vaccination of health care personnel. *Infect Control Hosp Epidemiol* 2010;31: 987–995.
55. MacDonald R, Baken L, Nelson A, et al. Validation of self-report of influenza and pneumococcal vaccination status in elderly outpatients. *Am J Prev Med* 1999; 17:173–177.
56. Food and Drug Administration. Influenza virus vaccine 2009–2010 season. Washington, DC: Food and Drug Administration. Available at: <http://www.fda.gov/cber/flu/flu2009.htm>; 2009. Accessed January 21, 2011.
57. Bureau of Labor Statistics. Occupational Employment and Wages, May 2004 Bulletin 2575. Occupations in the Temporary Help Services Industry. Washington, DC: US Department of Labor, BLS. Available at: <http://www.bls.gov/oes/2004/may/temp.pdf>; 2005. Accessed January 21, 2011.
58. Centers for Disease Control and Prevention. Updated interim influenza vaccination recommendations—2004–2005 influenza season. *Morb Mortal Wkly Rep* 2004;53:1183.
59. Government Accountability Office. Influenza Vaccine Shortages in 2004–2005 Underscore Need for Better Preparation. Washington, DC: GAO. Available at: <http://www.gao.gov/new.items/d05984.pdf>; 2005. Accessed January 21, 2011.