

Association of State Laws and Healthcare Workers' Influenza Vaccination Rates

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Abstract: State laws are being used to increase healthcare worker (HCW) influenza vaccine uptake. Approximately 40% of states have enacted such laws but their effectiveness has been infrequently studied. Data sources for this study were the 2000-2011 U.S. National Health Interview Survey Adult Sample File and a summary of U.S. state HCW influenza vaccination laws. Hierarchical linear modeling was used for two time periods: 1) 2000-2005 (before enactment of many state laws) and 2) 2006-2011 (a time of increased enactment of state HCW influenza vaccination legislation). During 2000-2005, two states had HCW influenza vaccination laws and HCW influenza vaccination rates averaged 22.5%. In 2006-2011, 19 states had such laws and vaccination rates averaged 50.9% ($p < 0.001$). The likelihood of HCW vaccination increased with the scope and breadth, measured by a law score. Although laws varied widely in scope and applicability, states with HCW influenza vaccination laws reported higher HCW vaccination rates.

Keywords: State law ■ healthcare workers ■ influenza vaccination ■ hierarchical linear modeling

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BACKGROUND

The Advisory Committee on Immunization Practices (ACIP) has long recommended annual influenza vaccination for all healthcare workers (HCW) to reduce the spread of influenza, and decrease staff illness and absenteeism,¹ and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) requires that all accredited institutions offer influenza vaccination to staff.² Previously stagnant, HCW influenza vaccination rates have been gradually increasing over the past several seasons (49% in 2008-2009 to 66.9% in 2012-2013).^{3,4}

These improvements may be attributed to identification of HCW influenza vaccination as an important goal for improved public health and safety⁵ as well as considerable research into methods to increase rates using a variety of techniques. These techniques include free influenza vaccine offered at the worksite, education, publicity, incentives, mobile carts, feedback, reporting vaccination rates to administrators, signed declinations and mandates.⁶⁻¹² Most of these studies have concentrated primarily on facility- or health system-wide interventions and results have ranged from no change in rates to nearly 100% vaccine uptake. The roles of state laws on HCW influenza vaccination rates have been infrequently studied. This article examines the relationship between state laws regulating HCW influenza vaccination (as of March 2012) and state level HCW influenza immunization rates, with particular focus on differences in rates between 2000-2005 and 2006-2011. These dates were chosen because they represent time periods before and after JCAHO implemented the recommendation that all hospitals offer influenza vaccine free of charge and the approximate time when the number of states with laws regulating HCW influenza vaccination began to escalate.

METHODS

Data Sources

Primary data included the National Health Interview Survey (NHIS) 2000-2011 public use sample adult files. To merge the NHIS data with state law data, state identifiers were necessary. State identifier is a restricted variable in the NHIS data, therefore, the data were accessed through the National Center for Health Statistics Research Data Center.

The NHIS is a cross-sectional household interview survey conducted annually by the U.S. Census Bureau for the NCHS, which collects self-reported data on the health of the civilian non-institutionalized population of the US. NHIS data are collected through a complex sample design involving stratification, clustering, and multistage

sampling; hence sampling units and person weights were maintained. Key variables extracted from the NHIS data included influenza immunization status and occupation as a HCW. Respondents who were 18 years and older with NHIS occupation codes 29 - 34 were identified as HCWs, which included the following job descriptions: health diagnosing and treating practitioners, health technologists and technicians, other healthcare practitioners and technical occupations, nursing, psychiatric, and home health aides, occupational and physical therapist assistants and aides, and other healthcare support occupations.

State laws regarding HCW influenza vaccination were gathered from a summary of state laws conducted by the CDC and by Stewart and Cox^{13,14} who reported that 15 had laws pertaining to HCWs in long-term care (LTC) facilities while nine had laws pertaining to HCWs in acute care hospitals. Only Alabama and New Hampshire had mandatory HCW vaccination laws. From this summary, information about the elements of each state law regarding HCW influenza vaccination were extracted. Scores were assigned to components as follows: 1) presence of any HCW influenza vaccination law = 25 points; 2) applicable to acute care hospitals or long term care facilities = 5 points each; 3) requirement that the employer offer influenza vaccine, assume the cost, or respond to noncompliance = 10 points each; 4) requirement that employers educate HCWs, document, or report vaccinations = 5 points each; 5) requirement that unvaccinated HCWs formally decline, be vaccinated, or provide documentation of vaccination = 10 points each, for a maximum of 110 possible points.

Analytical Approach

Sample sizes for HCWs in a single year were too small for analysis in some states which necessitated combining data into two groups: the years 2000 to 2005 and 2006 to 2011. The weights for annual NHIS surveys were adjusted to account for these six year periods.¹⁵

SAS release 9.3 and SAS callable SUDAAN release 10.01 software (SAS Institute Inc., Cary, NC, USA) were used to account for complex survey design. To account for the clustering of HCWs within states, two-level hierarchical linear modeling (HLM) was used to examine the relationship between state law and HCW influenza vaccination rates.

Two variables were included in HLM analyses: the dependent variable was vaccination status (yes vs. no) and the independent variables were used in each of the three models: law score, law pertained to LTC facilities (yes vs. no) or law pertained to acute care facilities (yes vs. no). The HLM analysis was conducted using HLM 7 (Scientific Software International, Inc., Lincolnwood, IL).

RESULTS

Selected Descriptive Statistics of Health Care Workers in the United States

The overall influenza vaccination rate for HCWs in 2000-2005 (weighted N=15,971,315) was 22.5% and in 2006-2011 (weighted N=14,983,857) was 50.9% ($P<0.001$; data not shown). Only Maine and New Hampshire had laws regarding influenza vaccination of HCWs during 2000-2005 while 19 states enacted such laws during 2006-2011 (Alabama, Arkansas, California, Illinois, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New York, North Carolina, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, and Virginia). Table 1 summarizes the distribution of states' law score by range and period. Law scores indicating the presence and comprehensiveness of state laws increased from 2000-2005 to 2006-2011 and in the latter period ranged from 0 to 90.

Table 2 presents the results from the HLM. The overall variance was statistically significant at $p < 0.001$ for influenza vaccination status, indicating that significant variation exists across states in HCW influenza immunization rates and supporting the use of HLM over traditional logistic regression for this analysis. In each of the three models that represent different outcomes, the variable related to state law was found to be significantly associated with increased odds of HCW vaccination. The presence of a state law regarding HCWs in LTC facilities increased the odds of vaccination by 84% while the presence of a state law regarding HCWs in acute care facilities increased the odds of vaccination by 73%. Every one point increase in the law score resulted in a 1% increase in the likelihood of vaccination (see Figure 1).

Table 1. Distribution of Law Scores by Range and Time Period

Law Score	2000-2005 n of states	2006-2011 n of states
0	46	31
1 - 40	0	2
41 - 60	1	3
61 - 80	0	10
81 - 110	1	4
Total states	48	50

Note: Due to small sample size, Alaska and Wyoming were excluded in 2000-2005 and the District of Columbia was excluded in both periods.

Table 2. Results of 2-Level Hierarchical Linear Modeling for Effect of State Law on Health Care Worker (HCW) Influenza Vaccination Rates

	Law applies to HCW in long term care facilities		Law applies to HCWs in acute care hospitals		Total law score	
	Odds Ratio (95%CI)	p-value	Odds Ratio (95%CI)	p-value	Odds Ratio (95%CI)	p-value
Intercept	0.57 (0.48, 0.68)	<0.001	0.59 (0.50, 0.70)	<0.001	0.55 (0.41, 0.65)	<0.001
Law applies to HCWs in LTC	1.84 (1.35, 2.52)	<0.001				
Law applies to HCWs in acute care hospitals			1.73 (1.15, 2.59)	0.009		
Total law score					1.01 (1.006, 1.013)*	<0.001

LTC = long term care facilities; HCW = health care worker.

*Each 1 point increase in law score is associated with a 1.01 increase in the odds of vaccination.

DISCUSSION

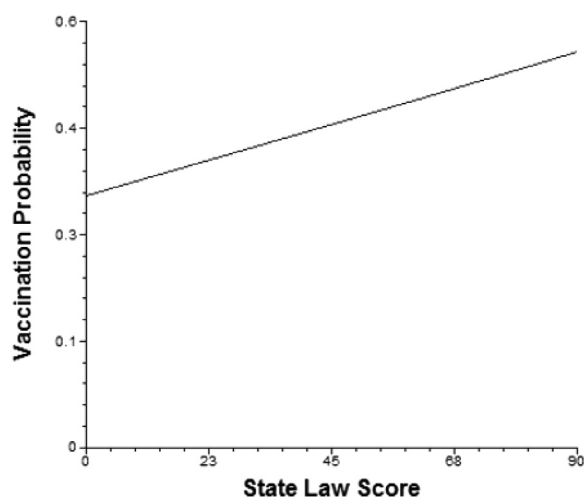
Previous research has demonstrated a clear and marked effect of individual hospital policies on HCW influenza vaccination rates in acute care facilities.^{16,17} In a direct comparison of hospital policy and state law based on national survey data, state laws were ineffective in the presence of hospital policies mandating vaccination.¹⁸ Few studies have examined the direct effect of state law on HCW influenza vaccination rates. In a recent study using 2009-2010 data, from the Behavioral Risk Factor Surveillance System influenza supplemental survey, Lu et al. reported higher influenza vaccination rates among HCWs in six of eight states with legislative requirements to offer

or ensure HCW vaccination against influenza.¹⁹ In the current study, examining the comprehensiveness and target population of state laws, vaccination rates were moderately improved in states with such laws. The level of this effect may be due to variability in the specificity of the laws' language including, allowances for personal, medical or other refusals, the types of HCWs to which the law applies, reporting requirements, level and type of repercussions for not adhering; date of the law's implementation; level of enforcement; or combining data over several years. More research to determine the effects of these factors is indicated.

This analysis was limited by small sample size of HCW in some states, which we sought to overcome by combining data for two six-year periods during which time, HCW influenza vaccination rates were gradually increasing. The weighted average HCW vaccination rate over these time periods is lower than recent national reports of rates as high as 63% over all settings and 82.5% among hospital-based HCWs.⁴ An additional limitation is the fact that NHIS data are self-reported and thus subject to over reporting; however, the sensitivity of influenza vaccination compared with medical records is high (e.g., 98%).²⁰

CONCLUSION

Despite a growing number of states with HCW influenza vaccination laws, few state laws mandate vaccination, hence lack the more powerful impact of individual facility policies requiring HCW vaccination. However, state law may be a viable option for improving HCW vaccine uptake especially in states where the health care environment is not conducive to individual facility-based mandates.

Figure 1. Association of state law score and predicted vaccination probability

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