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## RESEARCH

# Relationship between pharmacist density and adult influenza vaccination after controlling for individual and neighborhood effects

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## ABSTRACT

**Objectives:** Since 2009, all 50 states have passed legislation to allow pharmacists to administer influenza vaccinations. Pharmacies have become the second most common place for influenza vaccination, after a doctor's office. The aim of this study was to provide nationally representative results on the relationship between pharmacist density and influenza vaccination after controlling for both individual- and county-level characteristics.

**Design:** Retrospective data analysis with the use of merged individual data from the 2008–2012 Behavioral Risk Factor Surveillance System (BRFSS) and county data from the 2010 Area Health Resources Files. Sample-weighted multivariate logistic models were estimated to predict influenza vaccinations with the use of number of pharmacists per 1000 population as the key predictor.

**Setting and participants:** BRFSS is a telephone-based national survey across 50 states. A nationally representative sample of 1,696,119 adults 18 years of age and older were included in this analysis.

**Results:** The number of pharmacists per 1000 population was associated with higher odds of influenza vaccination (adjusted odds ratio [AOR] 1.13, 95% confidence interval [CI] 1.11–1.15) and was significant for non-Hispanic whites (AOR 1.06, 95% CI 1.04–1.08) and Hispanics (AOR 1.35, 95% CI 1.24–1.48). It varied across county types and employment status. The largest effects were found in urban counties (AOR 1.16, 95% CI 1.11–1.21) and among the self-employed (AOR 1.18, 95% CI 1.10–1.26), homemakers (AOR 1.18, 95% CI 1.10–1.26), and the retired (AOR 1.18, 95% CI 1.14–1.22).

**Conclusion:** Pharmacists play an important role in influenza vaccination and are an important alternative to traditional settings such as doctors' offices and health clinics. Future research is needed to investigate reasons and barriers behind their different effects in different regions and population groups. By covering in-pharmacy vaccinations in health plans and removing other barriers, pharmacists can help to alleviate the shortage of other health care providers and help increase vaccination rates.

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In the United States, millions of people are sickened by influenza every year. The Centers for Disease Control and Prevention (CDC) estimate that influenza-related complications cause more than 200,000 people to be hospitalized every year<sup>1</sup> and from 3000 to 49,000 deaths during each influenza season.<sup>2</sup> Influenza vaccination is highly cost-effective in preventing influenza and its related medical conditions.<sup>3–6</sup> For example, 1 study<sup>3</sup> estimated that approximately 275,000 quality-adjusted life-years could be saved if people 50 years of age and older all received annual influenza vaccination. A recent study<sup>5</sup> based on U.S. adults 50 years of age and older calculated considerable medical and indirect annual costs of

**Key Points****Background:**

- Influenza vaccination is highly cost-effective in preventing influenza and can save billions of dollars in direct medical costs and indirect societal costs.
- Despite its effectiveness, influenza vaccination rates are far below the Healthy People 2020 targets, with significant disparities across racial and ethnic groups.
- Pharmacists are playing an increasingly important role in influenza vaccination owing to their experience, convenient locations, flexible hours, and deep connections with local residents.

**Findings:**

- This study found that local pharmacist density is significantly and positively associated with influenza vaccination. The largest effect was among the Hispanic population.
- The results suggest that pharmacies and pharmacists are an important nontraditional setting to provide influenza vaccination. They can help address the recent shortage in primary care physicians and other traditional health care providers.
- Including free in-pharmacy influenza vaccination in private health insurance programs could improve vaccination rates, based on inferences from this and earlier studies. However, future studies are needed to investigate the causality relationship, because the findings in this study are mainly associations.

\$16.0 billion due to preventable influenza cases. Because of influenza vaccination's cost-effectiveness and influenza's serious health and cost consequences, the Advisory Committee on Immunization Practices has consistently recommended annual influenza vaccination in the United States for everyone 6 months of age and older.<sup>7</sup>

During the 2014-2015 influenza season, the coverage rate was 66.7% among adults 65 years of age and older, and 36.7% among adults 18 to 64 years of age,<sup>8</sup> both of which were far below the Healthy People 2020 targets of 90% and 80%, respectively, for the 2 age groups.<sup>9</sup> There also remain large racial and ethnic disparities. Among adults 18 years of age and older, 46.7% of non-Hispanic whites were vaccinated, compared with 38.7% of non-Hispanic blacks, 35.0% of Hispanics, and 41.3% of other non-Hispanic races during the 2014-2015 influenza season.<sup>8</sup> These disparities remained stable from other seasons.

Explaining the low influenza vaccination rate and disparities is of great interest to health researchers, not only because of the need for increasing vaccination coverage in particular, but also because of the need for designing sound public health policies to promote preventive care in general. Pharmacists and pharmacies are playing an increasingly important role in administering and promoting immunization owing to their convenient locations, flexible hours, and connections with local residents.<sup>10-15</sup> A pharmacy is located within 5 miles of

most Americans,<sup>15</sup> and many are serving medically underserved areas.<sup>16</sup> Many pharmacists administer vaccinations during evenings, weekends, and holiday hours when traditional settings are likely to be unavailable.<sup>10</sup> In the past decade, ever more people are using nonmedical settings, such as pharmacies in a store, to get vaccinated instead of traditional settings such as doctor's offices, hospitals, health centers, and clinics.<sup>17,18</sup> After a doctor's office, a pharmacy is the most common place for influenza vaccination.<sup>17,18</sup>

Despite pharmacists' increasing importance in health care, there are few studies to quantify their impact on influenza vaccination at the national level. Most studies on this topic are regional case studies.<sup>11-13,15,16,19</sup> Because of small sample sizes and specific regional characteristics, their findings may not be generalizable to the national level. Four national-level studies examined the growth of in-pharmacy influenza vaccination based on data from large retail clinics<sup>20</sup> or the Behavioral Risk Factor Surveillance System (BRFSS).<sup>14,21,22</sup> Rather than using pharmacist density, they compared the vaccination rates in states that passed pharmacy-based immunization statute versus states that did not.<sup>14,21,22</sup> Some of the earlier studies did not control for either individual or neighborhood factors. Furthermore, the relationship between local pharmacist density and influenza vaccination can differ depending on subsamples according to race and ethnicity, county types, and employment status.

**Objectives**

The objective of the present study was to examine, with the use of nationally representative databases, whether higher pharmacist density was associated with increased likelihood of adult influenza vaccination. Pharmacist density was measured by the number of pharmacists per 1000 population in a county. This study controlled for both individual and community factors simultaneously. This approach helped control for the effects of other factors and estimate a "cleaner" effect of pharmacists on influenza vaccination.<sup>23</sup> We hypothesized that local pharmacist density would be positively and significantly associated with individual influenza vaccination. We further hypothesized that the magnitude of the association would vary by racial and ethnic group, county type, and employment status.

**Methods***Data*

Data in this study were collected from 2 sources, both of which are publicly available. Individual attributes and influenza vaccination status were collected from the 2008-2012 BRFSS, which was collected by CDC through telephone surveys since 1984, making it the largest continuously conducted health survey system in the world. Each year, BRFSS collects information from more than 400,000 noninstitutionalized adults across all 50 states and the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. Its main purpose is to monitor health-related risk behaviors, chronic health conditions, and the use of preventive services. Similarly to other studies in this area,<sup>21,22,24</sup> we focused on influenza vaccination among adults 18 years of age and older in our analysis.

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