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RESEARCH

The impact of pharmacy-based immunization services on the likelihood of immunization in the United States

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ABSTRACT

Objectives: A major policy to increase immunization rates against infectious diseases in the United States has included pharmacy-based immunization services. We aimed to determine the impact of pharmacy-based immunization services on the likelihood of adult influenza and pneumococcal immunization.

Design: National individual-level immunization data were merged with pharmacy-level data on the availability of immunization services for 8466 pharmacies from a national pharmacy chain. County-level variation in availability of vaccines from 2006 to 2010 was used to characterize exposure to immunization services. We used a longitudinal logistic regression model to estimate the impact of pharmacy-based immunization services on the outcomes of interest. **Setting and participants:** We conducted the main analysis in the U.S. adult population. We conducted subgroup analyses of high-risk populations, including people 65 years of age or older.

Outcome measures: Odds of being immunized for influenza or pneumococcal disease after exposure to the service compared with before the service while controlling for existing trends in immunization rate growth and other confounders.

Results: Each additional year of exposure to pharmacy-based immunization services was associated with a 1.023 (CI 1.012–1.034) greater odds of reporting an influenza immunization and a 1.016 (CI 1.006–1.027) greater odds of reporting a pneumococcal immunization. Five years after national implementation, we estimate that 6.2 million additional influenza immunizations and 3.5 million additional pneumococcal immunizations are attributable to pharmacy-delivered immunization services each year. Subgroup analyses further indicate that the policy increased the odds of immunization for both diseases over time among adults 65 years of age or older (influenza odds ratio [OR] 1.025, CI 1.013–1.038; and pneumococcal OR 1.026, CI 1.010–1.042).

Conclusion: Pharmacy-based immunization services increased the likelihood of immunization for influenza and pneumococcal diseases, resulting in millions of additional immunizations in the United States.

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Before widespread immunization, vaccine-preventable diseases were responsible for hundreds of millions of deaths globally.¹ Despite strong scientific evidence of benefits, fewer than half of the United States population are immunized for influenza annually.^{2–4} Some vaccine-preventable diseases are on the rise in the United States, further suggesting that

immunization coverage is inadequate.⁵ Vulnerable populations, such as infants, the elderly, and those with chronic medical conditions, are at particularly high risk of death and hospitalization.^{2,6} Immunization rates for vaccine-preventable diseases remain suboptimal.^{7,8}

Increasing vaccination rates could save lives and prevent some of the economic burden of vaccine-preventable diseases.⁸ Recent annual estimates suggest that influenza causes up to 430,000 hospital admissions and 49,000 deaths and that pneumococcal infection cause up to 445,000 hospitalizations and 22,000 deaths in the United States.^{9,10} In 2015, unimmunized individuals in the United States caused an estimated \$7.1 billion in preventable health care costs, largely driven by

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Key Points**Background:**

- Immunization services have expanded to pharmacies in an attempt to improve national immunization rates across the United States.
- Previous studies to determine the impact of these services have used dates of immunization policy laws passing in each state but did not account for the lag in implementation due to training the workforce in some states.
- In addition, previous studies did not examine pneumococcal immunization impacts of the policy.

Findings:

- A significant increase in United States immunization rate was attributable to pharmacy-based delivery.
- The policy improved the odds of immunization for both pneumococcal and influenza disease.
- We found that an estimated 6.2 million additional influenza immunizations and 3.5 million additional pneumococcal immunizations are delivered annually because of their availability at pharmacies.

influenza (\$5.9 billion) and pneumococcal (\$1.9 billion) infections. Influenza vaccination is recommended annually for most healthy individuals but is particularly important for high-risk groups such as individuals with diabetes or heart disease.¹¹ The pneumococcal polysaccharide immunization is recommended once to twice in the lifetimes of adults with certain risk factors and once in adults 65 years of age or older.¹¹

In an effort to increase adult vaccination rates, many states have been expanding immunization authority to nontraditional settings, including pharmacies, since the early 1990s. Early immunization service models included delivery of immunizations at pharmacies by nurses or other professionals. However, the pharmacist work force has been increasingly trained to provide the service since the late 1990s. In 2015, more than 280,000 pharmacists were trained to deliver immunizations across the United States, and all states currently allow pharmacists to deliver immunizations.¹² Research suggests that pharmacies could increase immunization delivery and awareness because of extended hours of operation, convenient locations, and ease of access.¹³ Others suggest that pharmacists act as advocates in their neighborhoods to motivate people to be immunized as well as facilitators hosting other professionals such as nurses to increase access to immunization.¹⁴ In addition, pharmacy-based immunization services are cost-effective for patients and health plans compared with delivery at a physician's office.¹⁵ However, debate remains about whether the policy merely shifted immunization services away from other providers or if it actually improved uptake beyond the existing trends in immunization growth.

A study of retail-setting immunization rates has shown that a growing number of patients receive immunization in

retail settings.¹⁶ However, uncertainty remains about whether the new avenue for care delivery shifted care from traditional mediums or if it improved the overall population-level immunization rates. Previous evaluations of the pharmacy immunization policy have suggested an increase in the rate of influenza immunizations but did not account for the variable roll-out of the policy within and across states.^{13,17} These studies measured implementation of the policy at the state-level based on legislative dates. We believe this measure is imprecise, because many pharmacies did not adopt the policy immediately and many pharmacists needed additional training to deliver immunizations. In addition, some pharmacies provided immunization services in advance of these laws through use of other provider types. The differential pharmacy uptake led to heterogeneous adoption of the service across counties and states. The number of immunizing pharmacists grew from approximately 3000 immunizers in 1999 to more than 150,000 immunizers in 2011.^{18,19} By 2004, 43 states had passed laws allowing pharmacists to deliver immunization, but only 15,000 pharmacists were trained to deliver immunizations.^{20,21} Uptake of immunization services by national drugstores was one major driver of the subsequent increase.^{21,22} We examined the association between the widespread diffusion of pharmacy-based immunization services and the odds of being immunized for influenza and pneumococcal among American adults.

Methods*Study design*

We used a quasiexperimental longitudinal design to identify causal effects of the pharmacy-based immunization services on odds of past-year vaccination immunization. There is substantial variation in the availability of immunization services from pharmacies because of variation in both passage of state laws allowing the practice and diffusion of training of pharmacists to deliver immunization.²³ The heterogeneity in adoption over time provided a unique opportunity for a natural experiment. We used variation in the availability of immunization services within states and across time. The main outcomes were a binary indicator for self-reported pneumococcal and influenza immunization status. The treatment of interest was an interaction between a county-level policy variable and time (change in trend) while controlling for known covariates of getting immunized.

Data

We used survey data from 5 survey waves (2006–2010) of the nationally representative Behavioral Risk Factor Surveillance System (BRFSS). For this survey, the U.S. Centers for Disease Control and Prevention (CDC) completes telephone surveys with more than 400,000 United States adult residents every year.²⁴ BRFSS data include information about health-related risk behaviors, preventive service utilization (including immunizations), chronic health conditions, and demographic and socioeconomic characteristics.²⁴ We used

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