Individual- and Neighborhood-Level Characteristics Associated with Support of In-Pharmacy Vaccination among ESAP-Registered Pharmacies: Pharmacists' Role in Reducing Racial/Ethnic Disparities in Influenza Vaccinations in New York City

Natalie D. Crawford, Shannon Blaney, Silvia Amesty,
Alexis V. Rivera, Alezandria K. Turner, Danielle C. Ompad,
and Crystal M. Fuller

ABSTRACT *New York State (NYS) passed legislation authorizing pharmacists to administer immunizations in 2008. Racial/socioeconomic disparities persist in vaccination rates and vaccine-preventable diseases such as influenza. Many NYS pharmacies participate in the Expanded Syringe Access Program (ESAP), which allows provision of non-prescription syringes to help prevent transmission of HIV, and are uniquely positioned to offer vaccination services to low-income communities. To understand individual and neighborhood characteristics of pharmacy staff support for in-pharmacy vaccination, we combined census tract data with baseline pharmacy data from the Pharmacies as Resources Making Links to Community Services (PHARM-Link) study among ESAP-registered pharmacies. The sample consists of 437 pharmacists, non-pharmacist owners, and technicians enrolled from 103 eligible New York City pharmacies. Using multilevel analysis, pharmacy staff who expressed support of in-pharmacy vaccination services were 69% more likely to support in-pharmacy HIV testing services (OR, 1.69; 95% CI 1.39–2.04). While pharmacy staff who worked in neighborhoods with a high percent of minority residents were less likely to express support of in-pharmacy vaccination, those in neighborhoods with a high percent of foreign-born residents were marginally more likely to express support of in-pharmacy vaccination. While educational campaigns around the importance of vaccination access may be needed among some pharmacy staff and minority community residents, we have provided evidence supporting scale-up of vaccination efforts in pharmacies located in foreign-born/immigrant communities which has potential to reduce disparities in vaccination rates and preventable influenza-related mortality.*

KEYWORDS *Vaccination access, Pharmacy services, Pharmacy staff support, Racial/ethnic disparities*

Blaney and Ompad are with the Center for Urban Epidemiologic Studies, New York Academy of Medicine, New York, NY, USA; Crawford, Rivera, Turner, and Fuller are with the Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA; Amesty is with the Department of Population and Family Health, Mailman School of Public Health, Columbia University, New York, NY, USA; Amesty is with the Center for Family and Community Medicine, College of Physicians and Surgeons, Columbia University, New York, NY, USA.

Correspondence: Natalie D. Crawford, Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA. (E-mail: ndc2102@columbia.edu)

This research is supported by the National Institutes on Drug Abuse [R01 DA022144-01].

INTRODUCTION

The Centers for Disease Control and Prevention estimates that 5% to 20% of the US population is infected with the influenza virus every year; there is an average estimate of 36,000 influenza-related deaths and over 200,000 people are hospitalized from influenza-related complications annually.¹ In addition, several studies have shown that disparities in influenza vaccination uptake exist among Black and Hispanic persons aged 65 years and older compared with Whites.²⁻⁴ Influenza vaccination is proven to reduce influenza morbidity and mortality, and while most of the research on influenza focuses on older persons, who account for most of the influenza-related deaths, influenza is also an important health problem for those under age 65 years. The economic burden of influenza due to hospitalizations, morbidity, mortality, and lost earnings from lost days of productivity is very high across all age groups. And since influenza epidemics occur annually, this burden amounts to a dramatic annual reduction in the rate of economic growth.⁵

Most cases of influenza are preventable by vaccine; however, despite a surplus of physicians, vaccination coverage in New York State (NYS) is low (75.1%) compared with many states such as Connecticut (88.8%), Massachusetts (85.1%), and North Carolina (81.7%), where pharmacies in combination with physician offices can provide influenza vaccinations.^{6,7} In New York City (NYC), vaccination rates are even lower (73.4%) than state levels. NYS passed legislation in 2008 authorizing pharmacists to administer immunizations, which may increase vaccination coverage in NYC by increasing access for hard-to-reach urban populations that may lack access to healthcare.⁸ NYC pharmacies have demonstrated the ability to reach, and increase healthy behaviors among, hard-to-reach populations. For example, many NYC pharmacies have registered with the Expanded Syringe Access Program (ESAP) that allows pharmacies to sell syringes without a prescription to help prevent transmission of HIV among injection drug users (IDUs). Therefore, increasing influenza vaccination access in NYC pharmacies may increase immunization rates among racial/ethnic minorities and those with lower socioeconomic status, reducing influenza-related morbidity and mortality among these groups.⁹ National data has shown a significant increase in vaccination rates among states where legislation allowing pharmacies to immunize has been implemented compared with states where such legislation does not exist.¹⁰ Lack of insurance and lower access to physician offices has been a barrier for racial/ethnic minorities in low-income neighborhoods for several primary prevention health services in addition to immunization.^{11,12} NYC pharmacies are uniquely positioned to remedy access problems for minorities and low-income communities since they are located on virtually every corner around NYC; they have long, convenient hours of operation and have demonstrated public health interest by participating in ESAP. Since neighborhood context often influences access to health care, health behaviors, and health outcomes, we linked baseline pharmacy staff data from the Pharmacies as Resources Making Links to Community Services (PHARM-Link) study with 2000 US Census tract data to understand individual-level and neighborhood-level characteristics of pharmacy staff support for in-pharmacy vaccination.

METHODS

PHARM-Link methods have also been described elsewhere.¹³

Study Design

PHARM-Link is a community-based, randomized pharmacy-intervention study among ESAP-registered pharmacies in Harlem, Lower Manhattan, the Bronx, Brooklyn, and Queens that expands social services offered to IDUs to include information on safe injection, syringe disposal, and overall health concerns upon purchase of a non-prescription syringe.

Recruitment

Neighborhoods in each area were ethnographically mapped as areas of high drug activity, and ESAP-registered pharmacies within these neighborhoods were visited to confirm that they were still open and actively participating in ESAP. Once a final updated list of pharmacies was obtained, all pharmacies were contacted to determine eligibility (i.e., actively participating in ESAP). Eligible pharmacies had (1) at least one new non-prescription syringe customer in an average month, (2) at least one new customer that becomes a regular customer in an average month, (3) not required additional documentation from customers during syringe transactions, and (4) the willingness to sell syringes to IDUs. Of 325 pharmacies that were screened for study participation, 172 were eligible; 41 did not participate (11 were not interested in the study, 11 needed corporate approval, 9 were impossible to follow-up, and 10 became ineligible before enrollment); and staff in 131 pharmacies (76% pharmacy participation rate) were asked to complete a baseline survey. Of 489 pharmacy staff in these pharmacies, 12 refused (97% pharmacy staff participation rate) thus leaving 477 pharmacy staff (owners, pharmacists, and pharmacy technicians) who completed a baseline survey. All questionnaires were administered by trained interviewers using Computer-Assisted Personal Interviews (CAPI) at the pharmacy. Baseline data collected between January 2008 and March 2009 were combined and used in the present analysis. The PHARM-Link study was approved by the institutional review boards at the New York Academy of Medicine and Columbia University.

Statistical Analysis

In this analysis, we used pharmacy staff baseline data to assess support of in-pharmacy vaccination which was measured using a Likert scale (very supportive, somewhat supportive, not supportive, don't know, and refused) in response to, "How much do you support vaccination services being provided in your pharmacy?" Persons who reported being *very supportive* or *somewhat supportive* were classified as supportive, and those who reported *not supportive* were classified as not supportive. Persons who reported *don't know* and *refused* were excluded from this analysis ($n=4$). It is important to note that support of in-pharmacy vaccination reflects individual attitudes and beliefs of this service rather than actual participation in current vaccination services in their pharmacy. Participants were probed about their level of support even if this service was not feasible in the pharmacy. Therefore, we refer to the reported beliefs and attitudes of in-pharmacy vaccination as *in-pharmacy vaccination support*.

Baseline data was linked to 2000 US Census data to assess whether social predictors influence support of in-pharmacy vaccination. Census tracts were standardized, and those with fewer than three observations in each tract were excluded ($n=27$ tracts), resulting in the exclusion of 28 pharmacies and 40 pharmacy staff observations; 103 pharmacies with 437 pharmacy staff remain in this analysis. Neighborhood variables of interest (neighborhood income, proportion

of minorities in neighborhood, and proportion of foreign-born in neighborhood) included in the analysis were stratified into categories of low and high based on the median cut-point of variable distribution (income median=-0.7, minority median=1.0, foreign-born median=-0.5).

Descriptive statistics of the population were calculated. Bivariate analyses were performed between descriptive characteristics and to determine fit in the adjusted model. Prevalence ratios were calculated using adjusted logistic regression to assess the strength of association of neighborhood-level indicators independently on support of in-pharmacy vaccination, after adjusting for all significant individual-level predictors ($p<0.05$) and neighborhood-level predictors ($p<0.10$) in the bivariate analysis. Since clustering on the pharmacy level may have influenced the estimates and standard errors, we ran all models accounting for clustering on the pharmacy level and found no significant pharmacy-level effect, and therefore, only assessed random effects at the neighborhood level. All data management procedures were performed in SAS version 9.1, and statistical analyses were carried out with SAS callable SUDAAN which takes into account the variation on the individual and neighborhood levels.¹⁴

RESULTS

Of 103 pharmacies, 24 were located in the Bronx, 16 in Brooklyn, 10 in Queens, 28 in Upper Manhattan (Harlem), and 25 in Lower Manhattan. Of those participating, 54.4% were independently owned, and 45.6% were chain pharmacies. On average, pharmacy staff reported 23.2 ESAP customers/month and 41.1 non-prescription syringes sold in the last week.

There were a total of 437 pharmacy staff: 189 pharmacists, 19 non-pharmacist owners/managers, and 229 pharmacy technicians/clerks. Of these pharmacy staff, 38.7% were male, most were Hispanic (36.1%), followed by Asian/Pacific Islander (19.3%), African American (18.2%), White (13.1%), South Asian/Indian/Pakistani (8.3%), and other race/ethnicity (5.1%). Pharmacy staff worked an average of 9.4 years in pharmacies. Most (86.3%) pharmacy staff supported vaccination being provided inside the pharmacy (Table 1).

Support of in-pharmacy vaccination did not significantly differ by pharmacy location, pharmacy type, staff position, demographics, or perception of neighborhood level of drug activity. Pharmacy staff who reported support of other public health-related pharmacy services, including HIV testing, provision of safe syringe disposal information, and provision of referrals to medical, social, and drug treatment services, were significantly more likely to support in-pharmacy vaccination (Table 2). Since supportive services were highly correlated, we only included support of in-pharmacy HIV testing (which was more reflective of service provision such as vaccination) and support of distribution of medical and social service referrals (which reflected an interest in broad health/social service concerns rather than one service only). In the adjusted multilevel model, we found that persons who supported other services such as HIV testing in the pharmacy (PR, 1.69; 95% CI 1.39–2.04, $p<0.0001$) compared with those who did not support other services in the pharmacy were significantly more likely to support in-pharmacy vaccination (Table 3). Among neighborhood predictors, pharmacies in neighborhoods with a high percent of minority residents were significantly less likely (PR, 0.94; 95% CI, 0.88–1.00, $p=0.0468$) to support in-pharmacy vaccination compared with those with fewer minorities, but interestingly neighborhoods with a high percent of

TABLE 1 Pharmacy staff socio-demographic characteristics and prevalence of vaccination support

	Total population		Vaccination support		
	Number	Percent	Number	Percent	<i>p</i> Value
Socio-demographic characteristics					
Borough					
The Bronx	124	28.4	106	85.5	0.5160
Brooklyn	60	13.7	48	80.0	
Queens	33	7.6	28	84.8	
Upper Manhattan (Harlem)	104	23.8	93	89.4	
Lower Manhattan	116	26.5	102	87.9	
Pharmacy type					
Independent	237	54.2	203	85.7	0.6838
Chain	200	45.8	174	87.0	
Title					
Pharmacist	189	43.2	165	87.3	0.7499
Owner/manager, non-pharmacist	19	4.3	17	89.5	
Technician/clerk	229	52.4	195	85.2	
Gender					
Male	169	38.7	147	87.0	0.8072
Female	267	61.1	229	85.8	
Transgendered	1	0.2	1	100.0	
Race/ethnicity					
African American or Black	79	18.2	64	81.0	0.4276
White	57	13.1	50	87.7	
Hispanic or Latino/a	157	36.1	140	89.2	
Asian or Pacific Islander	84	19.3	70	83.3	
South Asian, Indian, or Pakistani	36	8.3	33	91.7	
Other	22	5.1	18	81.8	
Level of perceived drug activity in pharmacy neighborhood					
High	235	53.9	206	87.7	0.1932
Moderate	107	24.5	95	88.8	
Low	35	8.0	29	82.9	
Don't know	59	13.5	46	78.0	
Neighborhood characteristics					
Household income					
Low	225	51.5	194	86.2	0.9761
High	212	48.5	183	86.3	
Percent minority residents					
Low	216	49.4	193	89.4	0.0642
High	221	50.6	184	83.3	
Percent foreign-born residents					
Low	213	48.7	176	82.6	0.0310
High	224	51.3	201	89.7	
	Median	Range	Mean		
Years worked in pharmacies	6.0	0–52	9.5		0.7581
ESAP customers/month	14.4	4–200	22.0		0.1492
ESAP syringes sold in the last week	23.3	2–600	40.2		0.9226

TABLE 2 Support of in-pharmacy services for the total pharmacy staff population and by vaccination support

	Total population		Vaccination support		
	Number	Percent	Number	Percent	<i>p</i> Value
Vaccination					
No	60	13.7	—	—	—
Yes	377	86.3	—	—	—
ESAP					
No	118	27.8	96	81.4	0.0628
Yes	307	72.2	271	88.3	
HIV testing					
No	92	21.1	50	54.3	<.0001
Yes	345	78.9	327	94.8	
Free HIV testing referral					
No	11	2.5	4	36.4	0.0001
Yes	426	97.5	373	87.6	
Safe syringe disposal information					
No	7	1.6	5	71.4	0.2476
Yes	430	98.4	372	86.5	
Safe syringe use information					
No	10	2.3	8	80.0	0.6338
Yes	427	97.7	369	86.4	
Medical and social services referrals					
No	19	4.3	11	57.9	0.0018
Yes	418	95.7	366	87.6	
Drug treatment referrals					
No	22	5.1	13	59.1	0.0012
Yes	413	94.9	362	87.7	
Daily medical/prescription counseling					
No	107	24.5	88	82.2	0.1637
Yes	330	75.5	289	87.6	

TABLE 3 Prevalence ratios (PR) and 95% confidence interval (CI) for in-pharmacy vaccination support for select characteristics

	PR	95% CI		<i>p</i> Value
In-pharmacy HIV testing support				
No	Ref	Ref	Ref	<0.0001
Yes	1.69	1.39	2.04	
Pharmacy medical and social services referrals support				
No	Ref	Ref	Ref	0.1882
Yes	1.14	0.89	1.45	
% Minority residents				
Low	Ref	Ref	Ref	0.0468
High	0.94	0.88	1.00	
% Foreign-born residents				
Low	Ref	Ref	Ref	0.0854
High	1.06	0.99	1.13	

foreign-born residents were marginally more likely to support in-pharmacy vaccination (PR, 1.06; 95%CI 0.99–1.13, $p=0.0854$). Neighborhood income was not an important predictor of support for in-pharmacy vaccination.

DISCUSSION

This study found that pharmacy staff support of in-pharmacy vaccination services was high overall. This is consistent with a previous national finding that pharmacists were willing to counsel and promote vaccines.¹⁵ Specifically, we found that individual pharmacy staff demographics and pharmacy characteristics were not important in predicting vaccination support. Instead, support for in-pharmacy vaccination was associated with support for expansion of other in-pharmacy services including HIV testing. With respect to neighborhood-level characteristics, pharmacy staff who worked in neighborhoods with a higher percentage of foreign-born residents was somewhat more likely to support in-pharmacy vaccination, while staff who worked in neighborhoods with a higher proportion of minorities had a significantly lower likelihood of supporting in-pharmacy vaccination.

In terms of individual- and pharmacy-level characteristics, past research has shown inconsistent results. In a randomly selected national sample of pharmacists, Kamal and Maine (2003) found that staff position was important in predicting immunization administration; owner/manager pharmacists were more likely than chief and staff pharmacists to administer and counsel about adult immunizations.¹⁵ Our data indicated that staff position was not significantly associated with vaccination support, but because our analysis included pharmacy technicians (who cannot administer immunizations under NYS law), we conducted sub-analysis removing pharmacy technicians from the dataset (data not shown), and the association remained unchanged. While technicians likely have no influence on vaccination policy, we included them in the results presented because they are vital to the vaccination delivery process as they are on the front line of the pharmacy and likely influence (1) patient/customer comfort, (2) information patients/customers receive on vaccination, and (3) willingness of the patient/customer to be vaccinated in the pharmacy.

Kamal and Maine also found that independent pharmacists were more likely to report administering immunizations compared with chain pharmacists.¹⁵ Our study found no difference between chain and independent pharmacists' support, which could be due to the larger proportion of independent pharmacies in our sample. Using random digit dial surveys to evaluate the ESAP program, we found that independent pharmacies accounted for between 28% and 43% of pharmacies in NYC between 2000 and 2003. This finding could also signify increased comfort and fewer concerns regarding infrastructure, immunization ability, training, and liability, which are more cumbersome on a corporate level compared to an individual pharmacy owner. It is likely that chain pharmacies have gained experience with in-pharmacy vaccination since NYS legislation authorizing in-pharmacy vaccination was passed relatively late in the vaccinating pharmacist movement, which became nationally recognized in 1996.¹⁶

With respect to neighborhood demographics, there has been a lack of research examining neighborhood-level characteristics and prevention services, particularly those occurring in pharmacy settings. Although past research has found higher individual household income to be a predictor of in-pharmacy vaccination usage,¹⁷ our results indicate no effect of neighborhood-level socioeconomic (SES) character-

istics on pharmacy staff support of in-pharmacy vaccination. More research is needed to explore the impact of in-pharmacy vaccinations in low-SES neighborhoods, particularly neighborhoods with high unemployment and low insurance coverage where a significant proportion of the population may not be able to afford to take days off from work due to illness. Our results also identified a potential structural barrier to implementation of in-pharmacy vaccination services, namely, pharmacies within neighborhoods with a higher proportion of minorities demonstrated marginally lower support. The greater likelihood of vaccination support in neighborhoods with a higher proportion of foreign-born residents could be seen as a contradiction in the results (since in NYC, most foreign residents are minorities). However, this could partially be due to the fact that island-born Puerto Ricans are not considered as foreign-born in the US Census. It is also important to note that this difference could highlight increased use of pharmacies as a dependable source for healthcare advice in communities with a higher percentage of foreign-born persons. This may be especially true if these communities also have undocumented residents who do not have insurance or access to healthcare. Additionally, many foreign-born persons may migrate from countries where they are accustomed to pharmacies playing a more involved role in the community and providing basic healthcare services and advice. This information is particularly important as NYC pharmacies gear up to become vaccination access points, and lower support in minority neighborhoods may translate into a “missed opportunity” to help reduce disparities in vaccination and influenza morbidity and mortality. At the same time, identification of public health-minded pharmacists who do support on-site vaccination could still increase access to vaccination and other primary prevention services in minority neighborhoods where persons are more likely to be un- or under-insured and lack healthcare access. In any event, educational awareness campaigns will need to be implemented among both pharmacists and minority residents so that they can understand the importance of increasing vaccination access through pharmacies to reduce disparities in vaccination rates and preventable influenza-related mortality among minorities. Additional research is also warranted among pharmacy staff to help identify barriers to support for in pharmacy vaccination in minority neighborhoods (e.g., social-, structural-, and physical-related barriers) not measured in this study.

While our findings are indeed suggestive of future public health practice and research, several biases may affect the results of this study. Specifically, non-response bias may have resulted in an overestimate of support since ~30% of pharmacies who declined the survey may have been less public health-minded. Additionally, we excluded 28 pharmacies (because of too few observations per census tract) which could have resulted in selection bias. We examined pharmacy- and individual-level characteristics among the pharmacies excluded compared with those included in this analysis and found no differences and therefore, do not expect this type of selection bias to impact our results.

It is also important to note that this study assessed support among ESAP-registered pharmacies which could potentially result in an overestimate of support since these pharmacies may be more supportive of vaccination services (than non-ESAP-registered pharmacies) given their current participation in ESAP, a public health prevention program. However, it is important to note that ESAP registration does not necessarily translate into more public health-minded pharmacists as demonstrated by our earlier research indicating over 40% of ESAP-registered pharmacists did not support ESAP.¹⁸ Nevertheless, it is important to identify

pharmacies that have been successful with other public health programs when additional primary prevention services such as vaccination are being established. Finally, the relationship between neighborhood characteristics and in-pharmacy vaccination support may be over- or underestimated as the Census data collected may not represent the current neighborhood composition and SES level of some of the changing neighborhoods in NYC. Previous research has indicated that any bias related to changes in neighborhood SES over a 10-year period is minimal at best.¹⁹

Despite the potential biases, this analysis presents important information for understanding how increasing access to vaccination through pharmacies may marginally improve disparities in vaccination among foreign-born communities, but may not be fully achieved in US-born racial/ethnic minority communities due to marginally lower levels of support for vaccination services in these communities. These data suggest that initiatives that increase knowledge about lower vaccination rates and increased influenza-related mortality are needed among pharmacy staff and residents working in minority neighborhoods to help boost interest in-pharmacy vaccination in these specific communities. In addition, further research addressing social and structural barriers unique to pharmacies in low-income, minority neighborhoods that may also help explain lower support levels (e.g., physical barriers such as Plexiglass dividers separating staff from patients) is warranted. We believe that in-pharmacy vaccination can significantly increase vaccination rates in NYC and reduce racial/ethnic disparities in vaccination uptake, influenza morbidity, and mortality as access to vaccination increases through the use of pharmacies.

REFERENCES

1. Centers for Disease Control and Prevention. Seasonal influenza: The disease. 2009.
2. Chen JY, Diamant A, Pourat N, Kagawa-Singer M. Racial/ethnic disparities in the use of preventive services among the elderly. *Am J Prev Med*. 2005; 29(5): 388–395.
3. Hebert PL, Frick KD, Kane RL, McBean AM. The causes of racial and ethnic differences in influenza vaccination rates among elderly Medicare beneficiaries. *Health Serv Res*. 2005; 40(2): 517–537.
4. Marin MG, Johanson WG Jr, Salas-Lopez D. Influenza vaccination among minority populations in the United States. *Prev Med*. 2002; 34(2): 235–241.
5. Molinari NA, Ortega-Sanchez IR, Messonnier ML, et al. The annual impact of seasonal influenza in the US: measuring disease burden and costs. *Vaccine*. 2007; 25(27): 5086–5096.
6. Centers for Disease Control and Prevention. National, state, and local area vaccination coverage among children aged 19–35 months—United States, 2007. *MMWR Morb Mortal Wkly Rep*. 2008; 57(35): 961–966.
7. Immunization Action Coalition. States authorizing pharmacists to vaccinate. Saint Paul, MN. 2009.
8. Bryant WK, Ompad DC, Sisco S, et al. Determinants of influenza vaccination in hard-to-reach urban populations. *Prev Med*. 2006; 43(1): 60–70.
9. Vlahov D, Coady MH, Ompad DC, Galea S. Strategies for improving influenza immunization rates among hard-to-reach populations. *J Urban Health*. 2007; 84(4): 615–631.
10. Steyer TE, Ragucci KR, Pearson WS, Mainous AG 3rd. The role of pharmacists in the delivery of influenza vaccinations. *Vaccine*. 2004; 22(8): 1001–1006.
11. Grabenstein JD. Overcoming immunization disparities based on ethnicity. *Pharm Pract Manag Q*. 2001; 20(3): 23–30.
12. Smedley B, Stith A, Nelson A. Editors. *Unequal treatment: Confronting racial/ethnic disparities in health care*. Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care, Board on Health Sciences Policy, Institute of Medicine. Washington, D.C.; 2002.

13. Rivera AV, Blaney S, Crawford ND, et al. Individual- and neighborhood-level factors associated with nonprescription counseling in pharmacies participating in the New York State Expanded Syringe Access Program. *J Am Pharm Assoc.* 2010; 50(5): 580–587.
14. *SUDAAN Example Manual, Release 9.0 Research* [computer program]. Triangle Park, NC: Research Triangle Institute; 2004.
15. Kamal KM, Madhavan SS, Maine LL. Pharmacy and immunization services: pharmacists' participation and impact. *J Am Pharm Assoc.* 2003; 43(4): 470–482.
16. Hogue MD, Grabenstein JD, Foster SL, Rothholz MC. Pharmacist involvement with immunizations: a decade of professional advancement. *J Am Pharm Assoc.* 2006; 46(2): 168–179. quiz 179–182.
17. Ndiaye SM, Madhavan S, Washington ML, et al. The use of pharmacy immunization services in rural communities. *Public Health.* 2003; 117(2): 88–97.
18. Coffin PO, Ahern J, Dorris S, Stevenson L, Fuller C, Vlahov D. More pharmacists in high-risk neighborhoods of New York City support selling syringes to injection drug users. *J Am Pharm Assoc (Wash).* 2002; 42(6 Suppl 2): S62–S67.
19. Geronimus AT, Bound J. Use of census-based aggregate variables to proxy for socioeconomic group: evidence from national samples. *Am J Epidemiol.* 1998; 148(5): 475–486.