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ORIGINAL RESEARCH

Determinants of adherence to influenza vaccination among inner-city adults with persistent asthma

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Abstract

Aims: Despite guideline recommendation, influenza vaccination rates among asthmatic patients remain low. The objective of this study was to identify health beliefs associated with vaccination adherence in asthmatic patients.

Methods: We surveyed 167 adults with persistent asthma undergoing follow-up at a hospital-based clinic. Vaccination beliefs questions were based on the Health Belief Model. Patients who reported receiving influenza immunisation most or every year were considered adherent to vaccination.

Results: Overall, 71% of patients were adherent to influenza vaccination. In multivariate analyses, doctor or nurse recommendation (odds ratio [OR]: 14.71, 95% CI 5.40-40.05), the belief that the vaccine protects against influenza (OR: 7.21, 95% CI 2.25-23.10), and the belief that the vaccine could cause a cold (OR: 0.46, 95% CI 0.19-1.13) were independent predictors of adherence.

Conclusions: Vaccination beliefs and physician recommendation were associated with influenza vaccination adherence among inner-city asthmatics. Future interventions should target these potentially modifiable factors.

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Introduction

Asthma is a common disease with an overall prevalence in the general population of 6-7%.[1,2] Several studies have documented that minority inner-city populations in the United States have disproportionately higher rates of asthma and worse outcomes.[1-4] Patients with asthma are considered to be at risk for complications of influenza. Influenza virus infection can trigger asthma exacerbations and has been associated with increased rates of hospitalisation and higher morbidity.[5,6] Immunisation with an inactivated influenza vaccine is a cost-effective strategy to reduce the impact of influenza, especially for persons at increased risk of influenza-related complications.[7-9] Consequently, current national guidelines recommend vaccination for all adult asthmatics.[10-13] Despite these recommendations, fewer than 50% of adult asthmatics in the United States are routinely vaccinated for influenza.[10,14,15] Increasing rates of influenza vaccination among asthmatics might help to improve asthma control among high-risk populations. Achieving these goals, however, requires a better understanding of the factors influencing vaccination adherence among asthmatics, especially among minority populations who are at the highest risk of poor outcomes but who often have lower rates of vaccination compared to non-minority groups.[16,17]

Several studies have identified predictors of adherence to influenza vaccination in the general adult population.[18-21] Among the most consistently reported factors associated with vaccination adherence were demographic factors, knowledge, and attitudes and beliefs about influenza vaccination.[16,18,19,22,23] However, there have been no studies

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evaluating which factors are correlated with adherence to influenza vaccination in asthmatics. Although there may be some overlap in the predictors of vaccination adherence among patients with and without asthma, some differences are expected as well. Some physicians and asthma patients still believe that vaccination itself can induce exacerbations, a potential barrier for recommending or adhering to the vaccine.[24] Additionally, uncertainty remains about the benefits and effectiveness of influenza vaccination for adult asthmatics amongst physicians and patients.[20]

The purpose of this study was to identify facilitators of, and barriers to, influenza vaccination adherence in inner-city, minority asthmatic patients, a group at high-risk for poor asthma outcomes and with suboptimal rates of immunisation.

Methods

Patient population

We analysed cross-sectional data collected as part of a prospective cohort study of adults with persistent asthma followed at a large hospital-based general internal medicine clinic located in East Harlem, New York City. Study participants were enrolled over a 12-month period, from July 2004 to July 2005. The prospective study consisted of a baseline interview and two follow-up surveys at 1- and 3-months after enrolment. Data regarding influenza vaccination were obtained as part of the 1-month follow-up survey. We screened daily the clinic's computerised registration system to identify all adults with a physician diagnosis of asthma (ICD-9 codes 493, 493.X, and 493.XX). Patients were eligible if they were ≥18 years of age, spoke English or Spanish, and had mild persistent, moderate persistent or severe asthma, defined according to the National Heart, Lung and Blood Institute's Expert Panel on Asthma.[11,25,26] Individuals with a smoking history of ≥10 pack-years, a diagnosis of chronic obstructive lung disease or emphysema, restrictive lung disease, or other chronic respiratory illness, were excluded from the study. Mount Sinai's Institutional Review Board approved the study, and all patients signed informed consent.

Data collection and measurements

Trained research staff conducted interviewer-administered surveys in English or Spanish. During the baseline interview, we collected sociodemographic information, access to care data, asthma history, asthma medications, comorbidities, and data on tobacco and alcohol use. Patients treated with inhaled corticosteroids and/or leukotriene inhibitors were classified as receiving asthma controller medications.

Questions regarding vaccination beliefs were based on the Health Beliefs Model, one of the most widely used frameworks for understanding health behaviour.[27] According to the model, an individual's decisions to undertake a health behaviour to avoid a disease is influenced by the perception of personal susceptibility to the condition, the seriousness of consequences if the disease is contracted, the individual's evaluation of the potential benefits of the behaviour in question, and the perceived barriers to taking a specific course of action. In addition, the presence of internal or external stimuli, or cues to action, is proposed to activate the protective health behavior. Using validated questions from prior studies assessing predictors of influenza vaccination in the general population,[20,28,29] we developed a questionnaire which included items measuring the major domains of the Health Belief Model. The study survey included two items assessing perceived susceptibility to influenza – one influenza specific, and the other evaluating general health perception.[28,29] Additionally, the survey included two items for seriousness (including risk and severity of asthma exacerbations due to influenza infection), four items measuring potential benefits (such as decreased risk for influenza infection and asthma exacerbations), four items for barriers (including risk of developing a cold or influenza infection due to vaccination, pain, fever, or discomfort), and three items for cues to action (nurse- or doctor-explained risks and benefits and whether they recommended vaccination). Most items assessing the different domains of the Health Belief Model were measured on a 4-point Likert scale ('not at all', 'possibly', 'probably', and 'definitely'). The survey also included open-ended questions assessing the main reasons for receiving or not receiving influenza vaccination and whether patients had other concerns or issues about influenza or the influenza vaccine.

The outcome of interest for the study is the frequency of self-reported adherence to influenza vaccination. Vaccination adherence was ascertained by the question: "How often would you say you get the flu vaccine?" Possible answers to this question included 'never', 'once', 'a few times', 'mostly every year', and 'every year'. Patients who reported receiving the influenza vaccine 'mostly every year' or 'every year' were classified as adherent to vaccination; all others were considered non-adherents.

The study questionnaire was translated into Spanish by medical translators from the same cultural background as the study participants. The Spanish and English versions were then reviewed by bilingual individuals fluent in local Spanish dialects to check the consistency of the items. The final survey was piloted in a group of 20 patients using cognitive methods to test the clarity and comprehension of the instrument.

Statistical analysis

Means ± SDs are presented for normal data. The prevalence of adherence to influenza vaccination is reported with 95% confidence intervals based on the binomial distribution. We used chi-square, Wilcoxon rank sum, and pooled t test (as appropriate) to examine the association between the patient's

baseline characteristics or vaccination beliefs and self-reported adherence to influenza vaccination.

To identify beliefs independently associated with adherence to influenza vaccination (vaccination 'mostly every year' or 'every year'), a multiple logistic regression model was developed adjusting for age, sex, and asthma severity. Vaccination beliefs were grouped into the domains specified by the Health Belief Model and assessed for colinearity. The best candidate belief for each domain was carried forward into the multivariate model. The criteria used to select these variables were based on the distribution of patients' responses and the results of the correlation and the univariate analysis. Multivariate models were built manually, using a forward strategy. The decision to remove variables from the models was determined based on the result of the likelihood ratio test (criteria 0.05). The final model was evaluated using the Hosmer-Lemeshow test and the c-statistic. Odds ratios are presented with 95% confidence intervals. All analyses used two-tailed significance levels of $p<0.05$ and were conducted with SPSS statistical software (SPSS Inc; Chicago, IL).

Results

Between June 2004 and July 2005, 677 patients with ICD-9 codes for asthma were identified from the clinic's computerised appointment schedule system and assessed for study eligibility. Of these, 477 were excluded due to: no history of asthma (126 patients, 19%); mild intermittent asthma (119, 18%); history of smoking >10 pack-years (88 patients, 13%); other chronic lung disease (63 patients, 9%); cognitive impairment (20 patients, 3%); and other reasons (61, 9%). Of the remaining 200 eligible patients, 185 (93%) were enrolled into the study. Among these, 18 patients (10%) did not complete the first follow-up survey, thus leaving a cohort of 167 asthmatic patients (90% completion rate). Interviews were conducted in Spanish for 22% of the patients.

The patients had a mean age of 48.5±13.3 years. Consistent with the epidemiology of inner-city asthma, most subjects were Hispanic (59%) or Black (31%) women, with only 5% White. Most patients were insured by Medicaid (87%) and 67% reported an annual income <$15,000 per year. Overall, 71% (95% CI: 63-77%) of patients reported being adherent to influenza vaccination (vaccinated 'mostly every year' or 'every year').

As shown in Table 1, baseline sociodemographic characteristics and asthma history were not significantly related to vaccination adherence except for the finding that adherents were generally older. Non-adherents were somewhat more likely to be insured by Medicaid but the difference did not reach statistical significance. Vaccination

Table 1. Baseline patient characteristics according to frequency of influenza vaccination adherence.

Characteristic		Adherents (n=116)	Non-adherents (n=49)	p-value
Age (yrs) mean±SD		50.5±13.2	43.7±12.2	<0.001
Female		88	84	0.46
Race/ethnicity (%)	Hispanic	55	69	0.29
	African American	35	23	
	White	5	6	
	Other	5	2	
High school education (%)		38	41	0.75
Income <$15,000 (%)		72	68	0.61
Insurance (%)	Medicaid	63	76	0.09
	Medicare	27	10	
	Private/HMO	9	14	
	No insurance	1	0	
Asthma history				
Age of asthma onset <18 years		44	45	0.88
Ever intubated		13	4	0.10
Required steroids in the past year (%)		49	37	0.14
Admissions in past year (mean±SD)		1.16±3.25	0.43±0.66	0.28
Outpatient visits past year (mean±SD)		2.03±3.55	1.14±1.47	0.29
Comorbid conditions				
Atopy (%)		41	39	0.82
Gastroesophageal reflux disease (%)		38	37	0.87
Diabetes mellitus (%)		25	24	0.99
Congestive heart failure (%)		4	8	0.31

Table 2. Beliefs about influenza vaccine by reported vaccination adherence status.

Vaccination belief	Total (n=187)	Adherents (n=116)	Non-adherents (n=49)	p-value
Perceived susceptibility				
General health (%)				
Excellent/Very good/Good	60	59	60	0.93
Fair/Poor	40	41	40	
Worried that the influenza could worsen asthma (%)				
Definitely/Probably	72	73	71	0.85
Not all all/Possibly	28	27	29	
Perceived seriousness				
How sick you can became due to influenza (%)				
Somewhat/Very	83	83	82	0.83
Not at all/A little	17	17	18	
Influenza can make asthma worse (%)				
Definitely/Probably	77	80	70	0.15
Not all all/Possibly	23	20	31	
Perceived benefits				
Influenza vaccine protects from getting influenza (%)				
Definitely/Probably	39	77	33	<0.01
Not all all/Possibly	61	27	67	
Influenza vaccine protects from an asthma attack (%)				
Definitely/Probably	32	40	14	<0.01
Not all all/Possibly	68	60	86	
Influenza vaccine can protect family (%)				
Definitely/Probably	40	46	26	0.02
Not all all/Possibly	60	54	74	
Influenza vaccine protects from dying (%)				
Definitely/Probably	33	36	24	0.14
Not all all/Possibly	67	64	76	
Perceived barriers				
Influenza vaccine can cause influenza (%)				
Definitely/Probably	33	29	43	0.08
Not all all/Possibly	67	71	57	
Influenza vaccine can cause a cold (%)				
Definitely/Probably	32	26	45	0.01
Not all all/Possibly	68	74	55	
Influenza vaccine can hurt (%)				
Definitely/Probably	29	25	41	0.04
Not all all/Possibly	71	75	59	
Influenza vaccine can cause a fever (%)				
Definitely/Probably	27	23	39	0.04
Not all all/Possibly	73	77	61	
Cues to action				
Doctor or nurse recommended (%)				
Yes	75	89	43	<0.01
No	25	11	57	
Doctor or nurse explained risks of the influenza vaccine (%)				
Yes	59	64	47	0.04
No	41	36	53	
Doctor or nurse explained benefits of the influenza vaccine (%)				
Yes	78	86	59	<0.01
No	22	14	41	

Table 3. Multivariate predictors of adherence to influenza vaccination

Variable	Odds ratio	95% CI	p-value
Doctor or nurse recommendation	14.71	5.40-40.05	<0.001
Belief that influenza vaccine protects from asthma attack	7.21	2.25-23.10	0.001
Belief that influenza vaccine can cause a cold	0.46	0.19-1.13	0.09

CI denotes confidence interval

The model was adjusted for age, gender, and asthma severity

rates were not associated with any of the comorbid conditions assessed in the survey. There was a trend towards patients with more severe asthma (as measured by history of intubation, steroid use, or hospitalisations) being more adherent to influenza vaccination.

Several vaccination beliefs were predictive of vaccination adherence on univariate analyses (Table 2). Most items measuring perceived benefits of influenza vaccination and perceived barriers were associated with vaccination adherence. For example, the belief that vaccination can protect from getting influenza or from an asthma attack were more commonly reported among asthmatics who adhere to vaccination 'mostly every year' or 'every year' compared to non-adherents (p<0.01 for both comparisons). Similarly, the belief that influenza vaccination can protect family members was also associated with vaccination adherence (p=0.02). Nearly all the negative beliefs (barriers) towards vaccination were significantly associated with adherence. Fear that vaccination can cause a cold, fever, or hurt, were more prevalent among non-adherents to vaccination (p<0.05 for all comparisons). Patients who thought that the vaccine can cause influenza infection were somewhat more likely to be non-adherent (p=0.08). Physician or nurse recommendation was associated with increased rates of adherence (89% vs. 43%, p<0.01). Finally, neither perceived susceptibility nor perceived seriousness items were associated with vaccination adherence in this population.

In multivariate analysis, we found that doctor or nurse recommendation was associated with much greater odds of vaccination adherence (OR: 14.71, 95% CI 5.40-40.05, p<0.001) and the belief that vaccination protects from asthma attacks (OR: 7.21, 95% CI 2.25-23.10, p=0.001) was also an independent predictor of adherence to influenza vaccination after adjusting for age, gender, and asthma severity (Table 3). The belief that influenza vaccinate can cause a cold was borderline associated with vaccination adherence (OR: 0.46, 95% CI 0.19-1.13, p=0.09).

Discussion

In this study of a consecutive cohort of high-risk inner-city adults with asthma, we found that several beliefs were associated with influenza vaccination adherence. The most important predictor on multivariate analysis was physician or nurse recommendation. The belief that the influenza vaccine can protect from an asthma attack was also a strong independent predictor of adherence according to the multivariate model. Future interventions to improve vaccination rates among asthmatics should address these potentially modifiable predictors of vaccination adherence.

As predicted by the Health Belief Model, cues to action – such as physician or nurse recommendation – were strongly associated with patient adherence to vaccination; 89% of patients who reported physician or nurse recommendation were adherent to vaccination. This finding is consistent with the results of other studies assessing predictors of influenza vaccination in non-asthmatic patients.[18,20,21] Furthermore, physician recommendation has been associated with increased use of other preventative measures such as smoking cessation,[30,31] and colon cancer and mammography screening,[32,33] suggesting that this may be an important target for interventions designed to improve influenza vaccination rates among asthmatic patients. Patient reminders – such as postcards or educational materials in the doctor's office – may offer a way to inform patients about influenza vaccination and to deliver the message that their doctor recommends immunisation. Additionally, healthcare providers should promote adult immunisation by increasing awareness of vaccine availability, safety, and effectiveness and by recommending and offering vaccines to all adults with asthma. Providers often miss opportunities to immunise adults during routine contacts in offices, clinics, and hospitals.[34] Education of healthcare providers should therefore emphasise increasing awareness of not only vaccine recommendations but also the provider's role in promoting adult immunisation in general and for asthmatic patients in particular.

Perceived risk of contracting a cold or influenza from the vaccine was common among the respondents and significantly associated with lower rates of adherence. Previous studies in non-asthmatic patients have also reported

that fear of adverse reactions,[20,28,35,36] concerns that vaccination may actually cause disease,[19,36] and fear or pain from injection or needles[20,35,37] may lead to patients declining influenza vaccination. Misinformation about potential side effects of vaccination may partially explain these findings. Although serious adverse events to vaccination are rare and limited to fever and mild, local reactions at the injection site,[38] media attention to rare adverse events might increase public awareness of their occurrence and may decrease receptivity to vaccination.[19] Educational efforts may help to clarify common misconceptions about potential side effects of influenza vaccination which might lead to increased acceptance of the vaccine among asthmatics.

Similarly to Fiebach *et al*, we did not find a significant association between vaccination adherence and perceptions of susceptibility to influenza or its potential severity.[20] Others have found significant association between these beliefs and vaccination acceptance in the general population, as predicted by the Health Belief Model.[19,39-41] These conflicting findings may be due to differences in the age distribution and socioeconomic composition of the study populations or to the fact that our study focused solely on patients with asthma.

The findings of this study should be interpreted with some caution. We used self-report data to ascertain influenza vaccination adherence among study participants. Self-reports may be subject to error. Studies evaluating the sensitivity of patient self-report compared to medical record review for influenza vaccination ranges from 92 to 100% and the specificity from 60 to 98%.[42-45] Additionally, self-reported immunisation data has been used in several similar studies including national surveys such as the Medicare Current Beneficiary Survey and the Behavioral Risk Factor Surveillance Survey. Because patients may receive influenza vaccination at a different clinic or health care centre, patient reports were deemed the best source for this data.

The primary outcome of the study was self-reported past influenza vaccination behavior, rather than future intention to receive influenza vaccination or whether the patient was vaccinated during the last influenza season. As vaccination beliefs could have changed over time, current beliefs may not reflect the actual reasons for patients' adherence to influenza vaccination in the past. This issue may be particularly important given the highly publicised shortage of influenza vaccine during the 2004-2005 influenza season. Zimmerman *et al* showed that shortage of influenza vaccine in 2000-2001 resulted in a small increase in concerns about influenza vaccine, with concerns about getting sick from the vaccine and side effects most frequently reported.[46] However, only 1% of patients in our cohort reported that vaccine shortage was a major concern or an important reason for not receiving the influenza vaccine that season. Finally, this was a modest sized cohort of patients who were enrolled at a single institution. This may limit the generalisability of our findings as well as limiting our statistical power to detect weak associations or to test possible interaction between predictors. However, inner-city patients have the highest utilisation rates and the greatest need for interventions to improve their outcomes.

In summary, this study showed that healthcare provider recommendation and perceived benefits of vaccination are important predictors of influenza vaccination adherence among asthmatic patients. The data generated can be useful for the design of future interventions to improve vaccination rates among asthmatics, a group of patients who are at higher risk of complication from influenza infection.

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Conflict of interest declaration

There were no existing or potential conflicts of interest for the authors in the preparation of this paper.

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