

Determinants of influenza vaccination in hard-to-reach urban populations

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Abstract

Objective. Influenza vaccination rates among disadvantaged minority and hard-to-reach populations are lower than in other groups. We assessed the barriers to influenza vaccination in disadvantaged urban areas.

Methods. We conducted a cross-sectional study, using venue-based sampling, collecting data on residents of eight neighborhoods throughout East Harlem and the Bronx, New York City.

Results. Of 760 total respondents, 461 (61.6%) had received influenza vaccination at some point in their life. In multivariable models, having access to routine medical care, receipt of health or social services, having tested positive for HIV, and current interest in receiving influenza vaccination were significantly associated with having received influenza vaccination in the previous year. Of participants surveyed, 79.6% were interested in receiving an influenza vaccination at the time of survey. Among participants who had never previously received influenza vaccination in the past, 73.4% were interested in being vaccinated; factors significantly associated with an interest in being vaccinated were minority race, lower annual income, history of being homeless, being uninsured/underinsured, and not having access to routine medical care.

Conclusions. Participants who are unconnected to health or social services or government health insurance are less likely to have been vaccinated in the past although these persons are willing to receive vaccine if it were available.

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Introduction

Every year, 10–20% of the American population falls ill with influenza (Couch, 1993), and an estimated 36,000 persons die from influenza-related complications (Thompson et al., 2003). Vaccination is known to reduce morbidity and mortality from respiratory infections that arise secondary to influenza infection (Barker and Mullooly, 1980; Fedson, 1987). Although those age 65 and older have accounted for over 90% of influenza-related

deaths over the past decade (Centers for Disease Control, 2005), influenza has been associated with increased incidence of upper respiratory illness, physician visits, and the number of sick days in healthy adults under 65 years of age. As such, the American College of Preventive Medicine and the CDC's Advisory Committee on Immunization Practices (ACIP) recommends annual vaccination for all persons at high risk for complications from influenza infection without a medical contraindication. This includes adults aged 65 and older as well as those with a variety of very common chronic medical conditions such as diabetes mellitus, asthma, and heart disease. Adults aged 50 to 64 have recently been added to those recommended for flu vaccination because of the significant prevalence of these high-risk conditions in that age group (Centers for Disease Control,

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2005; Bridges et al., 2000; Nichol et al., 1995). The influenza vaccination rate among persons over the age of 65 was recently reported as 66%; this rate was lower among Hispanics (54%) and African-Americans (48%) than among Whites (66%) (Centers for Disease Control, 2005). Several studies have shown, however, that influenza vaccination rates among high-risk elderly persons can be as low as 20%, even in patients in health maintenance organizations (Mullooly et al., 1994; Figaro and Belue, 2005). Rates for younger persons in high-risk groups have been shown to be even lower (Figaro and Belue, 2005).

Minorities tend to have lower influenza vaccination rates than non-minorities, a disparity that exists for all age groups, including the elderly covered by Medicare, and those who are directly targeted by public health interventions (Lashuay et al., 2000; Ostbye et al., 2003; Collins et al., 1999). Although overall rates of vaccination in the elderly have been on the rise in the last decade, the disparities among ethnic groups have persisted: Hispanic elderly are less likely than white elderly to receive influenza vaccination every year and African-American elderly are even less likely (Hargraves, 2001). Differences in vaccination rates between high-risk whites and African-Americans, at any age, persist through all demographic strata, including those related to health care access and perceived health status (Egede and Zheng, 2003; Marin et al., 2002). Inner city elderly, and a large proportion of those living in disadvantaged urban neighborhoods have consistently lower rates of influenza vaccination than those not living in areas of disadvantage, even when race is taken into account (Zimmerman et al., 2003; Nowalk et al., 2004).

Although data are sparse, other hard-to-reach sub-groups such as elderly shut-ins, active injection drug users, sex workers, and undocumented immigrants may be even less likely to receive regular influenza vaccination despite high risk of morbidity and mortality secondary to influenza. A number of the medical conditions for which influenza vaccination is recommended, such as diabetes mellitus, heart disease, and asthma, are also more prevalent in these groups. In addition, low socioeconomic status urban populations are at increased risk of morbidity and mortality when immunization rates are low (Task Force on Community Preventive Services, 2000). Many members of these hard-to-reach groups are at increased risk of morbidity and mortality due to influenza as a result of factors ranging from low socioeconomic status, increased risk of immunocompromise due to lifestyle, and increased incidence and prevalence of high risk comorbidities such as asthma and diabetes.

One of the goals of Healthy People 2010 is to raise the rate of influenza vaccination in high-risk adults to 60%, and for institutionalized high-risk adults and all those over age 65, to 90% (Department of Health and Human Services, 2000). Attaining these goals, however, has proved a challenge for the US public health system, which has been highlighted by the national influenza vaccine shortage of 2004. In order to address the dearth of data on the topic, we aimed to assess the barriers to immunization among hard-to-reach populations in disadvantaged minority communities. Comparable assessments of personal and structural barriers to preventive health behaviors such as influenza vaccination in this population are scarce. Others

have not looked at populations like this in ways that can differentiate the importance of these barriers and their effects in vaccination rates. In the recently released draft US government “Pandemic Influenza Response and Preparedness Plan,” little attention is paid to the problem of persistently low influenza vaccination rates in disadvantaged populations. The draft encourages state and local government to “identify potential barriers to vaccination of racial and ethnic minority populations and develop strategies to overcome them” (Department of Health and Human Services, 2004). This study is an attempt to do that on a broader scale, to identify the relative contributions of personal factors and structural barriers to influenza vaccination in disadvantaged urban populations.

Methods

Study population

The communities of East Harlem and the Bronx are among the most socioeconomically disadvantaged communities in New York City. These neighborhoods also have high disease morbidity, including some of the highest HIV incidence rates in the city, as well as higher rates of asthma and diabetes mellitus than the general population of the city. Our study was carried out in three neighborhoods in East Harlem and five in the Bronx. These neighborhoods are areas of particular disadvantage across their larger boroughs. Neighborhood boundaries were defined by a process of consultation with East Harlem and Bronx community members as part of a project that will eventually distribute influenza vaccinations to marginalized groups.

Subject recruitment

This project sought to recruit members of hard-to-reach populations, not members of the general population, in each of these eight East Harlem and Bronx neighborhoods of New York City. First, we collaborated with community members to conduct ethnographic assessments on areas within these neighborhoods with high population presence of these groups. Second, we recruited participants using venue-based sampling. Our venues included places frequented by members of our study population (e.g., elderly shut-ins active injection drug users, sex workers, and undocumented immigrants), including drug outreach centers, shooting galleries, places where sex workers solicited, and meeting places for undocumented immigrants to find off-the-books employment. These more specific areas included the sites of previous research by our team using street outreach described elsewhere (Ompad et al., 2004; Diaz et al., 2001a,b). The study was approved by the institutional review board of the New York Academy of Medicine.

Data collection

In February, March and April of 2004, bilingual outreach workers approached participants in each neighborhood and administered a brief survey about participants' vaccination histories and perceived barriers to vaccination. All persons encountered during this enumeration phase were asked to complete the survey. The survey was only administered to those aged 18 or older. Participants were not paid for completing the interview. The survey instrument assessed age, gender, race, marital status, recent and lifetime homelessness, recent and lifetime hunger sources of income, history of medical conditions which would indicate influenza vaccination, history of influenza vaccination, and interest in receiving influenza vaccination. Interest in vaccination was determined by asking, “Are you interested in taking a flu shot?” Recent influenza vaccination was defined as having received a vaccination at any time during from fall of 2003 to spring of 2004. The questions on access to health care addressed insurance and type, regularity and location of access to health care, and receipt of services from government or community agencies. For those reporting more than one type of health insurance, we classified them according

Table 1
Correlates of lifetime influenza vaccination among residents of East Harlem and the Bronx^a

Characteristic	Total sample		Ever had flu vaccine		P value	Adjusted odds ratio (95% CI)
	n	%	n	%		
Age						
18 to 29	192	25.3	107	55.7	0.0001	1.0
30 to 39	195	25.7	106	54.4		0.79 (0.50, 1.25)
40 to 49	186	24.5	114	61.3		0.88 (0.54, 1.44)
50 to 64	127	16.8	95	74.8		1.86 (1.04, 3.31)
65 and older	58	7.7	45	77.6		1.90 (0.82, 4.41)
Gender					0.222	
Male	340	45	201	59.1		
Female	416	55	264	63.5		
Racial/ethnic background					0.9141	
White	27	3.6	17	63.0		
Hispanic or Latino	574	75.9	352	61.3		
African-American	132	17.5	84	63.6		
Other	23	3.0	13	56.5		
Marital status					0.1479	
Single, never married	390	51.7	248	63.6		
Divorced	74	9.8	48	64.9		
Separated	59	7.8	35	59.3		
Widowed	34	4.5	26	76.5		
Married or common law	174	23.1	95	54.6		
Domestic partnership	23	3.1	13	56.5		
Total legal income					<0.0001	
No income	191	25.1	90	47.1		
\$1 to \$4800/year	165	21.7	115	69.7		
\$4801 to \$9600/year	178	23.4	119	66.9		
\$9601/year and up	183	24.1	113	61.7		
Missing	43	5.7	31	72.1		2.05 (0.88, 4.79)
Housing type					0.4802	
Homeless	83	11.2	57	68.7		
Transitional	122	16.4	77	63.1		
Institutional	13	1.8	7	53.8		
Stable	524	70.6	317	60.5		
Ever been homeless					0.0099	
Yes	285	38.5	192	67.4		
No	456	61.5	264	57.9		0.92 (0.61, 1.40)
Ever hungry in past 6 months					0.3104	
Yes	220	29.3	129	58.6		
No	532	70.7	333	62.6		
Health insurance status					<0.0001	
None	235	31.3	102	43.4		
Medicaid	312	41.5	232	74.4		
Medicare	42	5.6	32	76.2		
Private insurance/HMO	76	10.1	40	52.6		
Other	87	11.6	57	65.5		1.91 (1.04, 3.50)
Receives routine medical care					<0.0001	
Yes	529	70.3	367	69.4		
No	224	29.8	97	43.3		0.51 (0.34, 0.76)
Ever received health/social services from government agency					<0.0001	
Yes	454	59.9	314	69.2		
No	304	40.1	153	50.3		0.85 (0.57, 1.26)
Ever received health or social services from a community agency					0.0177	
Yes	269	35.6	181	67.3		
No	487	64.4	285	58.5		1.03 (0.68, 1.66)
Ever injected drugs					0.0604	
Yes	95	12.6	67	70.5		
No	661	87.4	400	60.5		0.88 (0.47, 1.65)
Injected drugs in the past 6 months					0.7835	
Yes	42	5.5	25	59.5		
No	717	94.5	442	61.6		
Ever traded sex					0.1700	
Yes	54	7.2	38	70.4		
No	699	92.8	426	60.9		

Table 1 (continued)

Characteristic	Total sample		Ever had flu vaccine		P value	Adjusted odds ratio (95% CI)
	n	%	n	%		
Traded sex in the past 6 months						
Yes	18	2.4	12	66.7	0.6471	
No	740	97.6	454	61.4		
Ever had a hepatitis vaccine						
Yes	350	49.4	255	72.9	<0.0001	
No	359	50.6	179	49.9		
HIV status						
Positive	33	4.5	30	90.9	<0.0001	1.0
Never tested	203	27.8	95	46.8		0.15 (0.04, 0.58)
Negative	494	67.7	323	65.4		0.26 (0.07, 0.97)
Medically indicated to receive flu vaccine						
No	411	54.1	226	55.0	<0.0001	
Yes	349	45.9	242	69.3		1.36 (0.95, 1.95)
Interested in taking flu vaccine						
Yes	576	79.6	375	65.1	0.0012	
No	148	20.4	75	50.7		
Reason why did not want flu shot						
You think the vaccine is not safe	21	16.8	11	52.4	<0.0001	
You do not like injections	28	22.4	12	42.9		
You have a medical reason that conflicts with getting a vaccine	13	10.4	9	69.2		
You are not at high risk	24	19.2	2	8.3		
You already had vaccine this year	19	15.2	18	94.7		
Other	20	16.0	12	60.0		

^a Due to missing values, the numbers in some of the cross tabulations presented in this table may not add up to the total sample size.

to the more generous insurance program. Questions about vaccination included in the survey were (i) history of recent immunizations, (ii) key perceived barriers to obtaining vaccination, (iii) primary reasons for accepting or not accepting vaccination, and (iv) principal health conditions, including morbidity and factors that determine eligibility for influenza vaccination.

Statistical methods

We summarized socio-demographic variables, access to health care, drug-related and sex-related risk behaviors, vaccination history, HIV status, interest in receiving an influenza vaccination, and, if they were not interested in influenza vaccination, their reasons for non-interest. We calculated the total number and proportion of the sample that had ever had an influenza vaccination, and used chi-square tests when comparing vaccination status by covariates to assess significance in the differences between those who had ever had an influenza vaccination and those who had not. We used logistic regression to assess relations between the above characteristics and the likelihood of ever having received an influenza vaccination. All covariates that were significantly associated ($P < 0.1$) with receiving an influenza vaccination in bivariate analysis were included in multivariate models.

We calculated the total number and proportion of the sample that had their influenza vaccination in the past year (Fall 2003 to Spring 2004) or prior to the past year (before Fall 2003), and used chi-square tests when comparing vaccination status by covariates to assess significance in the differences between the two groups. We used logistic regression to assess relations between the covariates of interest and the likelihood of having received an influenza vaccination in the past year. All covariates that were significantly associated ($P < 0.1$) with receiving an influenza vaccination in bivariate analysis were included in multivariate models.

We examined the characteristics of those who were not interested in an influenza vaccination at the time of the survey, and their reasons. We excluded those who did not want the vaccine because they had had it during the current influenza season. We calculated the total number and proportion of this sub-sample who were interested in having an influenza vaccination and those who were not, and used chi-square tests when comparing vaccination status by covariates to assess significance in the differences between the two groups. We

used logistic regression to assess relations between the covariates of interest and the likelihood of wanting influenza vaccination at the time of the survey. Finally, we assessed reasons for not being interested in influenza vaccination among those who had never had an influenza vaccination. We calculated the total number and proportion of the sub-sample who were not interested because they felt the vaccine was not safe, because they hate injections or needles, because they had a medical reason that would conflict with receiving the vaccine, and because they perceived themselves to be at low risk. We used chi square tests to assess significance in the differences among the groups.

Results

Among 760 respondents surveyed, 468 (61.6%) had ever had an influenza vaccination. Table 1 shows the characteristics and bivariate correlates of having ever had an influenza vaccination. Of the 61.6% of this sample who had ever had an influenza vaccination, 51.4% were vaccinated in the last year (Fall 2003–Spring 2004) (data not shown). When asked if they were interested in having an influenza vaccination at the time of the survey, 79.6% of all respondents said they were. Among those who were not interested in receiving an influenza vaccine, 16.8% said it was because they did not think the vaccine was safe, 22.4% said it was because they hate injections, 10.4% said it was because they had a medical contraindication to the influenza vaccination, and 19.2% said it was because they felt they were at low risk. Other reasons for not wanting the vaccine comprised the remaining 30.2% of responses.

Sociodemographic covariates significantly associated with greater likelihood of having ever received an influenza vaccination were older age (77.6% for age group 65 and older, 74.8% for age group 50–64, 61.3% for age group 40–49, 54.4% for age group

Table 2
Correlates of recent influenza vaccination among hard-to-reach residents of East Harlem and the Bronx who have previously received influenza vaccination^a

Characteristic	Total		Last shot this year		P value	Logistic regression model for recent influenza vaccination adjusted odds ratio (95% CI)
	n	%	n	%		
Age						
18 to 29	92	22	40	43.5	0.3897	
30 to 39	94	22.4	48	51.1		
40 to 49	102	24.3	53	52.0		
50 to 64	91	21.7	52	57.1		
65 and older	40	9.6	23	57.5		
Gender						
Male	180	43.2	92	51.1	0.9410	
Female	237	56.8	122	51.5		
Racial/ethnic background						
White	17	4.1	5	29.4	0.289	
Hispanic or Latino	319	76.3	169	53.0		
African-American	69	16.5	36	52.2		
Other	13	3.1	6	46.2		
Marital status						
Single, never married	217	51.9	104	47.9	0.0856	1
Divorced	44	10.5	24	54.5		1.07 (0.51, 2.23)
Separated	32	7.7	18	56.3		1.05 (0.46, 2.40)
Widowed	25	6	17	68.0		1.93 (0.74, 5.00)
Married or common law	88	21.1	42	47.7		0.96 (0.55, 1.67)
Domestic partnership	12	2.9	10	83.3		5.00 (0.95, 26.12)
Total legal income						
No income	76	18.1	35	46.1	0.6863	
\$1 to \$4800/year	110	26.2	58	52.7		
\$4801 to \$9600/year	105	25	57	54.3		
\$9601/year and up	104	24.8	51	49.0		
Missing	25	6	15	60.0		
Housing type						
Homeless	53	12.8	21	39.6	0.3732	
Transitional	70	16.9	31	44.3		
Institutional	7	1.7	4	57.1		
Stable	284	68.6	145	51.1		
Ever been homeless						
Yes	177	43.1	99	55.9	0.088	1
No	234	56.9	111	47.4		0.76 (0.47, 1.23)
Ever hungry in past 6 months						
Yes	121	29.1	60	49.6	0.6277	
No	295	70.9	154	52.2		
Health insurance status						
None	82	19.7	33	40.2	0.0784	1
Medicaid	218	52.4	122	56.0		1.14 (0.61, 2.14)
Medicare	30	7.2	14	46.7		1.07 (0.40, 2.86)
Private insurance/HMO	35	8.4	22	62.9		2.20 (0.88, 5.51)
Other	51	12.3	24	47.1		1.22 (0.54, 2.74)
Receives routine medical care						
Yes	335	80.5	189	56.4	0.0002	1
No	81	19.5	27	33.3		0.48 (0.26, 0.88)
Ever received health/social services from government agency						
Yes	288	68.6	150	52.1	0.6917	
No	132	31.4	66	50.0		
Ever received health/social services from a community agency						
Yes	165	39.5	92	55.8	0.1773	
No	253	60.5	124	49.0		
Injected drugs in the past 6 months						
Yes	22	5.3	18	81.8	0.0033	1
No	397	94.8	197	49.6		0.17 (0.04, 0.80)
Ever traded sex						
Yes	32	7.7	15	46.9	0.6007	
No	385	92.3	199	51.7		

Table 2 (continued)

Characteristic	Total		Last shot this year		P value	Logistic regression model for recent influenza vaccination adjusted odds ratio (95% CI)
	n	%	n	%		
Traded sex in the past 6 months						
Yes	9	2.2	4	44.4	0.7451	
No	409	97.9	211	51.6		
Ever had a hepatitis vaccine						
Yes	231	59.1	125	54.1	0.2441	
No	160	40.9	77	48.1		
HIV status						
Positive	27	6.7	24	88.9	<0.0001	1
Never tested	82	20.4	33	40.2		0.13 (0.03, 0.51)
Negative	294	73	152	51.7		0.20 (0.06, 0.71)
Medically indicated to receive flu vaccine						
No	191	44.5	95	49.7	0.5267	
Yes	229	54.5	121	52.8		
Interested in taking flu vaccine						
Yes	339	83.9	185	54.6	0.0172	
No	65	16.1	25	38.5		
If did not want flu vaccine, reason why not						
You think the vaccine is not safe	11	19	4	36.4	0.2735	
You do not like injections	11	19	5	45.5		
You have a medical reason that conflicts with getting a vaccine	8	13.8	1	12.5		
You already had vaccine this year	15	25.9	6	40.0		
Other	11	19	3	27.3		

^a Due to missing values, the numbers in some of the cross tabulations presented in this table may not add up to the total number of participants in this table's subset.

30–39, and 55.7% for age group 18–29; $p = 0.001$), higher total legal annual income (69.7% for those earning \$1–\$4800, 66.9% for those earning \$4801–\$9600, and 61.7% for those earning \$9601 or more vs. 47.1% for those with no income; $P < 0.001$), and having ever been homeless (67.4% vs. 57.9% for those who had never been homeless; $P = 0.01$). Health care access covariates significantly associated with ever having received an influenza vaccination were health insurance status (74.4% for those with Medicaid, 76.2% for those with Medicare, 52.6% for those with private insurance, and 65.5% for those with some other type of insurance vs. 43.4% for those with no insurance; $P < 0.001$), receiving routine medical care (69.4% vs. 43.3% for those who do not; $P < 0.001$), receiving health or social services from a government agency (69.2% vs. 50.3% for those who had not; $P < 0.001$), receiving health or social services from a community agency (67.3% vs. 58.5% for those who had not; $P = 0.018$), and having tested positive for HIV (90.9% vs. 65.4% for those who had tested negative and 46.8% for those who had never been tested; $P < 0.001$). Among vaccination-related covariates, significantly associated with greater likelihood of having ever received an influenza vaccination was being interested in an influenza vaccination at the time of the survey (65.1% vs. 50.7% for those who were not; $P = 0.001$), and reporting a medical condition, except for HIV, which would indicate vaccination (63.9% for those who would be medically indicated for vaccination vs. 55.0% for those who would not; $P < 0.001$).

Table 1 also shows the results of multivariate models of correlates of ever having had an influenza vaccination. In a multivariate logistic regression model, variables that were significantly associated with a greater likelihood of having

ever had the influenza vaccine were: being in the 50–64 age group (adjusted odds ratio (AOR) = 1.86, 95% Confidence Interval (CI) = 1.04–3.31), and receiving Medicaid (AOR = 1.98, 95% CI = 1.25–3.15). Variables significantly associated with a lower likelihood of having ever had an influenza vaccination were not receiving routine medical care (AOR = 0.51, 95% CI = 0.34–0.76) and having never been tested (AOR = 0.15, 95% CI = 0.04–0.58), or tested negative (AOR = 0.26, 95% CI = 0.72–0.97) for HIV. Unadjusted odds ratios are not shown.

Table 2 shows the bivariate correlates for having been vaccinated in the last year among those who have ever had an influenza vaccination (Fall 2003–Spring 2004) or before last year (prior to Fall 2003). The covariates significantly associated with having had an influenza vaccination in the past year were: receiving routine medical care (56.4% vs. 33.3% for those who did not; $P = 0.001$), having ever injected drugs (69.8% vs. 48.2% for those who had never; $P = 0.002$), injecting drugs in the past 6 months (81.8% vs. 49.6% for those who did not; $p = 0.003$), testing positive for HIV (88.9% vs. 40.2% for never been tested and 51.7% for testing negative; $P < 0.001$), and being interested in an influenza vaccination at the time of survey (54.6% vs. 38.5% for those who were not; $P = 0.017$). In the multivariate logistic regression, the variables significantly associated with a lower likelihood of having had an influenza vaccination in the most recent year were not receiving routine medical care (AOR = 0.48, 95% CI = 0.26–0.88), report of no illicit drug injection within the past 6 months (AOR = 0.17, 95% CI = 0.04–0.80), and never being tested or having tested negative for HIV (AOR = 0.13, 95%

Table 3
Correlates of wanting influenza vaccination among hard-to-reach residents of East Harlem and the Bronx who have never previously received a flu vaccination^a

Characteristic	Interested in flu vaccine		Not interested in flu vaccine		P value	Unadjusted odds ratio 95% CI
	n	%	n	%		
Age						
18 to 29	56	70.9	23	29.1	0.2011	1
30 to 39	68	81.9	15	18.1		1.86 (0.89, 3.90)
40 to 49	45	66.2	23	33.8		0.80 (0.40, 1.62)
50 to 64	24	77.4	7	22.6		1.41 (0.53, 3.72)
65 and older	7	63.6	4	36.4		0.72 (0.19, 2.69)
Gender						
Male	106	79.1	28	20.9	0.04	1
Female	94	68.1	44	31.9		0.56 (0.32, 0.97)
Racial/ethnic background						
White	2	22.2	7	77.8	0.0003	1
Hispanic or Latino	167	79.1	44	20.9		13.27 (2.66, 66.12)
African-American	26	61.9	16	38.1		5.68 (1.05, 30.80)
Other	6	66.7	3	33.3		6.99 (0.86, 56.83)
Marital status						
Single, never married	98	74.2	34	25.8	0.5186	1
Divorced	16	66.7	8	33.3		0.69 (0.27, 1.77)
Separated	14	60.9	9	39.1		0.54 (0.21, 1.36)
Widowed	5	71.4	2	28.6		0.87 (0.16, 4.68)
Married or common law	59	79.7	15	20.3		1.37 (0.69, 2.72)
Domestic partnership	8	80.0	2	20.0		1.39 (0.28, 6.86)
Total legal income						
No income	78	81.3	18	18.8	0.0342	1
\$1 to \$4800/year	38	79.2	10	20.8		0.88 (0.37, 2.08)
\$4801 to \$9600/year	40	70.2	17	29.8		0.54 (0.25, 1.17)
\$9601/year and up	37	59.7	25	40.3		0.34 (0.17, 0.70)
Missing	8	80.0	2	20.0		0.92 (0.18, 4.72)
Housing type						
Homeless	22	84.6	4	15.4	0.4467	1
Transitional	31	77.5	9	22.5		0.63 (0.17, 2.29)
Institutional	4	66.7	2	33.3		0.36 (0.05, 2.70)
Stable	138	71.1	56	28.9		0.45 (0.15, 1.36)
Ever been homeless						
Yes	72	82.8	15	17.2	0.0191	1
No	124	69.3	55	30.7		0.47 (0.25, 0.89)
Ever hungry in past 6 months						
Yes	69	80.2	17	19.8	0.1006	1
No	131	70.8	54	29.2		0.60 (0.32, 1.11)
Health insurance status						
None	104	81.3	24	18.8	0.0033	1
Medicaid	55	72.4	21	27.6		0.60 (0.31, 1.18)
Medicare	7	70.0	3	30.0		0.54 (0.13, 2.24)
Private insurance/HMO	15	46.9	17	53.1		0.20 (0.09, 0.46)
Other	18	75.0	6	25.0		0.69 (0.25, 1.93)
Receives routine medical care						
Yes	99	67.8	47	32.2	0.0259	1
No	99	79.8	25	20.2		1.88 (1.07, 3.29)
Ever received health/social services from government agency						
Yes	88	68.8	40	31.3	0.0921	1
No	112	77.8	32	22.2		1.59 (0.93, 2.74)
Ever received health or social services from a community agency						
Yes	67	79.8	17	20.2	0.1138	1
No	132	70.6	55	29.4		0.61 (0.33, 1.13)
Ever injected drugs						
Yes	22	81.5	5	18.5	0.3332	1
No	177	72.8	66	27.2		0.61 (0.22, 1.68)

Table 3 (continued)

Characteristic	Interested in flu vaccine		Not interested in flu vaccine		P value	Unadjusted odds ratio 95% CI
	n	%	n	%		
Injected drugs in the past 6 months						
Yes	14	82.4	3	17.6	0.5721	1
No	187	73.0	69	27.0		0.58 (0.16, 2.08)
Ever traded sex						
Yes	13	81.3	3	18.8	0.571	1
No	185	72.8	69	27.2		0.62 (0.17, 2.24)
Traded sex in the past 6 months						
Yes	5	83.3	1	16.7	1	1
No	196	73.4	71	26.6		0.55 (0.06, 4.81)
Ever had a hepatitis vaccine						
Yes	61	70.1	26	29.9	0.3316	1
No	131	75.7	42	24.3		1.33 (0.75, 2.36)
HIV status						
Positive	2	66.7	1	33.3		1
Never tested	84	81.6	19	18.4	0.0701	2.21 (0.19, 25.66)
Negative	108	68.8	49	31.2		1.10 (0.10, 12.44)

^a Due to missing values, the numbers in some of the cross tabulations presented in this table may not add up to the total number of participants in this table's subset.

CI = 0.03–0.51 and AOR = 0.20, 95% CI = 0.06–0.71, respectively). Unadjusted odds ratios are not shown.

Table 3 shows the correlates of interest in receiving an influenza vaccination at the time of the survey among those who have never had an influenza vaccination ($N = 273$). Significant covariates were: being a racial minority (79.1% for Hispanics/Latinos, 61.9% for African-Americans, and 66.7% Other vs. 22.2% for Whites; $P = 0.001$), having lower annual income (81.3% of those with no income, 79.2% of those earning \$1–\$4800, 70.2% of those earning \$4801–\$9600, and 59.7% for those earning \$9601 or more; $P = 0.034$), having ever been homeless (82.8% vs. 69.3% of those who had not; $P = 0.012$), having no health insurance or government insurance (81.3% for those with no insurance, 72.4% for those with Medicaid, and 70.0% for those with Medicare vs. 46.9% for those with private insurance; $P = 0.003$), and not receiving routine medical care (79.8% vs. 69.8% for those who did; $P = 0.026$).

Table 4 shows the correlates of the reasons respondents gave for why they were not interested in receiving an influenza vaccination, among those who were not interested in one at time of the survey ($N = 113$). Participants who had ever had an influenza vaccination were more likely to say that the vaccine is not safe (24.4%) and that they hate injections (26.7%) as the reason for their disinterest in a vaccination at the time of interview. Among those who had never had an influenza vaccination, the most likely reasons for lack of interest were that they were at low risk (34.4%), and, similar to the previous group, that they disliked injections (25.0; $P = 0.001$).

Discussion

Among residents of eight disadvantaged neighborhoods in East Harlem and the Bronx, New York City, we found that 62% had received one influenza vaccination at least once in their lifetime. We found that persons who were less likely to have ever

had an influenza vaccination were younger, had lower income, did not have health insurance, had no access to routine medical care, and were not receiving other health or social services. Determinants of receiving a recent influenza vaccination included having routine access to medical care, injection drug use, and HIV-positive serostatus. We found that those who wanted the vaccine at the time of the survey were more likely to be racial minorities, to have a lower annual income, to have a history of homelessness, and to lack a source of routine medical care.

Our findings are congruent with studies that have found that persons who are vaccinated are older, are more likely to have a higher rate of access to medical care, and have a higher number of annual physician visits (Nowalk et al., 2004; Wilson et al., 2002; Pena-Rey et al., 2004; Petersen et al., 1999; Nichol et al., 1992; Chapman and Coups, 1999; Carter et al., 1986). It is possible that this is the result of a greater likelihood, with age, of receiving care for chronic illness and being prioritized by caregivers for receipt of vaccine. We observed a lower likelihood of vaccination among those with no access to routine medical care. This observation contrasts with studies that suggest that lack of access to routine medical care is not a barrier to vaccination (Santibanez et al., 2002; Frank et al., 1985). However, most previous studies were conducted in elderly populations; this is in contrast to our sample in which fewer than 8% of respondents were over age 65. Other work provides corroborating evidence that health care providers of hard-to-reach populations may be in a unique position to deliver vaccines to these groups. Seventy-one percent of participants in one study of intravenous drug-users said they would have accepted a vaccine if asked (Seal et al., 2000). Other studies confirm that the recommendation of a health professional is the greatest single determinant of whether people, from a variety of backgrounds, are vaccinated (Duclos and Hatcher, 1993; Nowalk et al., 2004; Lashuay et al., 2000; Chapman and Coups, 1999; Wilson et al., 2002; Figaro and Belue, 2005). Given that 70.3% of

Table 4
Correlates of reasons^a for not wanting influenza vaccination at the time of survey among residents of East Harlem and the Bronx^{b,c}

Characteristic	Not interested, not safe		Not interested, hate injections		Not interested, medical reason		Not interested, low risk		P value
	n	%	n	%	n	%	n	%	
Age									
18 to 29	8	23.5	11	32.4	1	2.9	7	20.6	0.4385
30 to 39	3	13.0	5	21.7	3	13.0	5	21.7	
40 to 49	9	25.0	7	19.4	6	16.7	10	27.8	
50 to 64	2	14.3	2	14.3	4	28.6	2	14.3	
65 and older	1	16.7	3	50.0	0	0.0	1	16.7	
Gender									
Male	7	18.9	6	16.2	6	16.2	9	24.3	0.4918
Female	16	21.1	22	28.9	8	10.5	16	21.1	
Racial/ethnic background									
Hispanic or Latino	16	21.9	18	24.7	12	16.4	13	17.8	0.2189
African-American	4	14.8	9	33.3	2	7.4	7	25.9	
White	1	12.5	0	0.0	0	0.0	4	50.0	
Other	0	0.0	1	50.0	0	0.0	1	50.0	
Total legal income									
No income	5	21.7	6	26.1	2	8.7	7	30.4	0.169
\$1 to \$4800/year	5	27.8	5	27.8	3	16.7	0	0.0	
\$4801 to \$9600/year	6	22.2	5	18.5	4	14.8	8	29.6	
\$9601/year and up	7	17.5	8	20.0	5	12.5	10	25.0	
Missing	0	0.0	4	80.0	0	0.0	0	0.0	
Ever been homeless									
Yes	9	28.1	7	21.9	3	9.4	4	12.5	0.3493
No	14	17.9	20	25.6	11	14.1	20	25.6	
Ever hungry in past 6 months									
Yes	5	20.0	5	20.0	4	16.0	6	24.0	0.8263
No	18	20.9	23	26.7	9	10.5	19	22.1	
Health insurance status									
None	8	25.0	8	25.0	5	15.6	7	21.9	0.2313
Medicaid	9	23.1	9	23.1	4	10.3	7	17.9	
Medicare	0	0.0	0	0.0	3	50.0	1	16.7	
Private insurance/HMO	4	18.2	8	36.4	1	4.5	5	22.7	
Other	2	15.4	3	23.1	1	7.7	4	30.8	
Ever had a flu vaccine									
Yes	11	24.4	12	26.7	9	20.0	2	4.4	0.0011
No	10	15.6	16	25.0	4	6.3	22	34.4	
Do not know	2	100.0	0	0.0	0	0.0	0	0.0	
When received last flu vaccine									
Never received one	10	15.6	16	25.0	4	6.3	22	34.4	0.0029
This year (Fall, 2003–Spring, 2004)	4	25.0	5	31.3	1	6.3	2	12.5	
Before this year (pre-Fall 03)	7	30.4	6	26.1	7	30.4	0	0.0	
HIV status									
Never tested	5	20.8	7	29.2	2	8.3	7	29.2	0.6829
Positive	0	0.0	1	50.0	1	50.0	0	0.0	
Negative	18	21.4	19	22.6	11	13.1	16	19.0	

^a Participants could only select one reason why they did not want a flu vaccine.

^b Due to missing values, the numbers in some of the cross tabulations presented in this table may not add up to the total number of participants in this table's subset.

^c Percentages presented are row percents.

the population studied reported routine access to medical care, this venue for increasing influenza vaccination should be underscored.

Our findings concur with those who have found that the unvaccinated, and those who do not want a vaccination, often think they are at low risk, particularly those at high risk of morbidity and mortality due to influenza (Santibanez et al., 2002; Seal et al., 2000; Centers for Disease Control, 1997). Our findings also agree with previous observations that persons who believe that the influenza vaccination is not safe are more likely never to have been vaccinated, or at least not to have been vaccinated in the past 12 months

(Figaro and Belue, 2005; Wilson et al., 2002). Congruent with previous work, we found that mistrust of the health care system or providers of government or community services was not a substantial barrier to immunization (Santibanez et al., 2002). Most participants believed these groups have their best interests in mind. One factor not assessed by our study that could be a barrier to vaccination was whether respondents were ambulatory and able to get to the point of vaccine delivery. This is a possible avenue for future research, particularly for members of this population who are elderly or disabled.

Our data suggest that one key method to increase influenza vaccination rates in disadvantaged urban populations is through affiliation with health and social services. Innovative studies that have linked influenza vaccine delivery with less traditional services have shown promise in delivering vaccine to hard-to-reach populations. Some pilot projects have shown success in vaccinating hard-to-reach populations through harm reduction sites, emergency rooms, and other venues (Grau et al., 2002; Stancliff et al., 2000; Slobodkin et al., 1998; Solomon et al., 1991). Changing attitudes about side effects of influenza vaccination has been shown to improve vaccination rates, as has offering different forms of vaccine administration, such as a nasal spray, to those who dislike injections (Buchner et al., 1985). Some studies have shown that African-Americans who were able to access primary care received preventive services at rates equal to or greater than white patients, including immunizations (Williams et al., 2001; Wright et al., 2000).

Our results must be interpreted with caution. Because we relied on self-reported data, we have no way of confirming if the reports of receiving influenza vaccination, or other variables, were accurate. Also, it is possible that these results are not generalizable to other hard-to-reach populations in the city, with differing demographic compositions, or to cities other than New York City. Our study considered reasons for not wanting an influenza vaccination; however, we did not consider reasons why persons may want influenza vaccination. Since no one really knows the true make-up of this hard-to-reach population, it is difficult to say if our sample was representative of that population. It is also difficult to say if those who agreed to participate in our survey differed from those who refused. However, based on our conclusions, and the validation of our methods in other studies (Diaz et al., 2001a,b), we feel our results stand. Another possible limitation of our study is the relatively low number of white subjects ($N = 27$, 3.6%). Because of this, one must be careful in drawing conclusions about minority subjects relative to whites.

Low vaccination rates may be attributable to poor communication to populations of risk regarding both the risks of influenza, and the side effects of the vaccination. In one study of the elderly, half received all their health information from their physician and half from books, television, the Internet, and other media, suggesting an important role for dissemination vaccination-related information through less traditional outlets (Santibanez et al., 2002).

Our findings suggest that connecting members of hard-to-reach populations to government or community social services may be one way to greatly improve influenza vaccination rates. The fact that more than three quarters of survey respondents were interested in receiving influenza vaccine at the time of survey, whether connected to social services or not, indicates it may be possible to conduct well-received influenza vaccination campaigns in this population. A high reported rate of routine access to medical care among the population studied implies that health care providers may be the best route to increasing influenza vaccination in this group. Our findings suggest that there is an unmet need for influenza vaccine particularly among those persons who have been homeless, uninsured, and receive little or no income.

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