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Distance to Public Test Sites and HIV Testing

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This article examines how proximity to the nearest publicly funded test site affects HIV testing. Using a sample of 5,361 Los Angeles County adults, multinomial logit models estimated simultaneously the likelihood of (1) obtaining an HIV test in the prior 2 years, and (2) testing in a private physician's office, a publicly funded medical clinic, or in a nonmedical setting, such as a bar or bathhouse. Low-income Los Angeles residents rely on publicly funded sites for HIV testing. When public sites are more distant, poor individuals are less likely to use them and less likely to get tested. Distance from public sites does not affect HIV testing among the nonpoor. To encourage HIV testing among the groups where HIV is growing fastest, public health agencies must keep the time and money costs of HIV testing low.

Keywords: *HIV testing; distance; disparities; publicly funded HIV testing; Los Angeles*

An estimated 1.6 million people in the United States have been infected with HIV since the disease was first reported in June 1981. Originally concentrated among men having sex with men (MSM) and injection drug users (IDUs), HIV has moved into the broader community. Women now account for more than a quarter of all new AIDS cases nationally (Centers for Disease Control and Prevention [CDC] 2006a). Infection rates are particularly high among African American women, who

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make up 66 percent of new female AIDS diagnoses, and among Latinas (16 percent) (CDC 2006a). Many of these women are unaware that they are infected with HIV until they develop AIDS.

As HIV/AIDS moves into the general population, it is increasingly important to provide broad coverage of HIV testing sites, especially because one quarter of persons in the United States who are infected with HIV are unaware of their disease status (Glynn and Rhodes 2005). Consequently, they do not benefit from the effective antiretroviral medications developed in the past 10 years that have extended and improved the quality of life of persons living with HIV (PLH). HIV testing benefits society at large as well as PLH. When PLH know their serostatus, most reduce or eliminate their transmission behaviors (Crepaz and Marks 2002; CDC 2000). Furthermore, PLH adhering to antiretroviral medication regimens lower their viral load, which can further reduce HIV transmission (Porco et al. 2004). Increasing the percentage of PLH who know their serostatus is judged one of the most cost-effective ways to decrease HIV transmission internationally (Creese et al. 2002).

Recent analyses of the United States have found universal testing in medical settings to be cost-effective, even in communities where HIV prevalence is low (Paltiel et al. 2006), resulting in calls for "systematic voluntary HIV screening in health care settings" (Sanders et al. 2005). In view of the benefits to PLH and to society of knowing one's serostatus, the CDC has called for incorporating HIV tests as routine medical care for all adults aged 13–64 and for increasing the use of nonmedical settings as testing venues (CDC 2006b, 2003). However, testing in medical settings may fail to reach many of those at highest risk because they do not receive regular medical care. Indeed, male, younger, Latino, poor, nearly poor, or uninsured persons are more likely to report having no usual source of health care (National Center for Health Statistics [NCHS] 2006) and, thus, depend on public care sites.

The rationale for public funding of HIV test sites is to provide free or low-cost HIV testing to lower-income persons, the uninsured, or those without a regular source of care, who might otherwise be deterred from testing because of financial costs (Solanki, Schauffler, and Miller 2000). In addition to financial costs, the cost of travel to a publicly funded test site may affect an individual's decision to obtain an HIV test. Indeed, time and distance costs are stronger predictors of demand for medical care when money costs are low (Coffey 1983).

This article analyzes the role of distance costs on HIV testing decisions by addressing two questions: Are people living farther from the nearest publicly funded HIV testing site less likely to get HIV testing? Is HIV testing behavior of lower-income persons particularly affected by distance to publicly funded sites? In an era of constrained resources, answers to these questions are necessary to help public agencies most productively target their HIV testing activities.

We examine these questions using data from Los Angeles (LA) County, which covers a wide geographic area encompassing urban, suburban, and semirural areas and includes substantial variation in proximity to publicly funded HIV test sites. LA

County also has the second highest cumulative number of AIDS cases in the nation, exceeded only by the City of New York (CDC 2004).

New Contribution

The study is innovative in combining an economic model with the Health Behavior Model to predict both the personal and provider characteristics that affect an individual's decision to obtain an HIV test as well as the choice to use a public provider for that test. Our work contributes to understanding how distance costs affect individuals' decisions to seek medical care for prevention or to identify disease, and which groups are most likely to be affected by distance.

This article examines the effect of distance to free, publicly funded HIV testing sites on HIV testing using a nested logit model. Thus, we are able to examine the effect of distance to publicly funded sites on the likelihood of being tested in such a site, in a private medical site, or in a nonmedical setting as well as on the overall probability of an HIV test at any location. This article confirms the importance of time costs, not only in affecting provider choice, but also in the overall demand for medical services.

This article's contribution lies in highlighting the substitutability among various locales for obtaining an HIV test. It also demonstrates that low-income individuals do not have the resources to substitute private providers when publicly funded test sites are more distant. Recognizing that time costs are particularly relevant to low-income individuals is important and has implications for the ability of low-income individuals to access all medical care, not just preventive and screening services. The deterrent effect of distance to public sites on HIV testing by low-income persons means that if public health agencies seek to encourage HIV testing among the groups where HIV is growing fastest, they must keep the time costs as well as the money costs of testing low.

The next section outlines a model of HIV testing choice. We then describe the methods and the results of the estimation. A final section discusses the implications of the findings for policy.

Conceptual Model of HIV Testing Choice

Proximity to medical service providers has been associated with the likelihood of receiving nonacute services including mammography (Brustrom and Hunter 2001), outpatient treatment for back pain (Aakvik, Holmas, and Kjerstad 2003), mental health services (Allard, Tolman, and Rosen 2003; White 1986), primary care (Nemet and Bailey 2000; Fortney et al. 2005), and routine medical checkups (Arcury et al. 2005). Coffey's (1983) study of the demand for female medical care services found time costs affected the choice of a public versus private provider, and to a lesser extent, the decision to have a medical visit at all. Although Coffey includes a measure of the woman's preferred choice of providers in her estimates of the demand for female medical services, none of the articles above estimates simultaneously patients' decisions as to whether to obtain a medical service with their choice among different providers.

HIV testing can occur in a number of different types of settings—a private physician's office or a publicly funded test site, such as a public hospital, community health center, or family planning clinic. Alternatively, testing can occur at a nonmedical location, such as public health outreach testing in a bar or bathhouse.

The choice among testing locations and the decision to obtain an HIV test at all are interrelated and can be considered within a nested choice model where the utility of testing in a particular test site depends on the attributes of the decision maker, *i,* which affect the overall value of HIV testing, as well as on the attributes of the test site alternatives, *j,* as valued by individual *i*. Thus, the utility of test site *j* to individual *i* is $U_{ji} = U(S_{ji}, R_i)$ for all *j* in $J_{i.}$ where U_{ji} is the utility function and S_{ji} is the vector of all relevant characteristics of j as perceived by individual *i.* R_i is the vector of all person-specific attributes. The individual chooses alternative *j* in $J_{i.}$ if and only if

$$U(S_{ji}, R_i) > U(S_{ki}, R_i) \text{ for all } k \text{ in } J_{i.}\ K \neq j.$$

The AIDS Health Belief Scale (AHBS) guides the choice of variables included in the nested logit model. The AHBS posits AIDS-specific measures that correspond to the four components of the Health Belief Model: perceived susceptibility to disease, perceived severity of the disease, perceived benefits of taking a health action and perceived barriers to engaging in a health action (Zagumny and Brady 1998).

The perceived barriers related to the money and time costs of testing in a private doctor's office, a publicly funded clinic, or a nonmedical setting, affect the probability that an individual will obtain an HIV test in a particular location or choose not to test at all. In contrast with private test sites, which generally charge a fee, publicly funded clinics provide free or low-cost care to low-income residents of Los Angeles. Nonmedical settings, often supported by public health outreach, generally provide free or low-cost testing. Although there is little variation in financial costs of testing across publicly funded clinics, the time costs of accessing these services can vary substantially across individuals, depending on the distance between where they live and the test sites' locations. We hypothesize that the closer the publicly funded test site is to the individual's residence, the lower the cost of travel time to access testing and the more likely the individual is to test for HIV in a free, public clinic or other publicly supported test site. Similarly, the lower the cost of travel time to a publicly funded test site, the lower the cost of a substitute for private testing and the lower the likelihood of testing in a private site.

In addition to distance costs, we also include barriers caused by low income, unemployment, lack of insurance, and not having a regular source of care. Those with health insurance face lower out-of-pocket costs for testing in private physicians' offices and, thus, should be more likely than uninsured persons to test in these locations. Higher income and employed individuals also may prefer private offices, which have shorter office waits than do public clinics, thereby reducing the time costs of testing. In addition, individuals with a regular source of care have an established relationship with a medical provider, which lowers the barriers to receiving an HIV test.

Perceived barriers to testing affect both where one gets tested as well as the overall probability of getting an HIV test. In contrast, perceptions of susceptibility, severity, and the benefits of taking a health action should affect the level of demand for testing across all types of locations and not differentially affect demand for one type of testing location over another.

Persons with greater levels of perceived susceptibility are more likely to test for HIV. We hypothesized individuals whose social networks included larger numbers of persons affected by HIV would perceive themselves as more susceptible to HIV. Thus, we hypothesized higher testing rates among African Americans, Latinos, residents of neighborhoods with greater AIDS prevalence, and men who reported having sex with men. We also hypothesized greater perceived susceptibility among those whose behaviors put them at higher risk for contracting HIV. Thus, we expected men and women reporting multiple sex partners and inconsistent or no condom use to exhibit higher HIV test rates. On the other hand, members of groups in which the prevalence of HIV is not high are expected to have low perceived susceptibility. Thus, women, married people, older individuals, and those with higher levels of education were hypothesized to have lower HIV testing rates.

Perceptions of the severity of HIV infection as well as knowledge of the value of treatment may also be more widespread among individuals who are more likely to know personally people living with HIV. For these reasons as well, we expect residents in high AIDS-prevalence neighborhoods as well as MSM, Latinos, and African Americans to be more likely to seek HIV testing.

Method

Data

Data are from a survey of a random probability sample of adults (aged 18 and older) living in LA County between 1999 and 2000. The LA County Department of Health Services designed and funded the survey to obtain data for public health planning purposes on the health status, health behaviors, and use of health services by residents of LA County. Of those contacted by random-digit dialing, 8,354 completed the survey, producing a 55 percent response rate. The survey was given in English, Spanish, Cantonese, Mandarin, Korean, and Vietnamese. Additional details of the survey are found elsewhere (Simon et al. 2001).

The sample used in this analysis included only persons responding to the survey item asking if they had tested for HIV or AIDS in the past 2 years (persons ages 65 and older were not asked this question [*n* = 1,041] and 120 reported to not know or did not respond). Persons having little choice in whether they tested were excluded from the analysis because this article focuses on voluntary HIV testing. Persons excluded were those testing because of a job or an insurance requirement (*n* = 294), because they were donating blood (*n* = 221), or because they were receiving prenatal care (*n* = 452). (California law requires that women receiving prenatal care be offered HIV testing; many choose to test.) Also excluded were those not providing cross-street information necessary to derive distance measures (*n* = 865), for a final sample size of 5,361.

We examined rates of HIV testing among three particular (nonexhaustive) subsamples comprising (1) uninsured respondents (*n* = 1,665), (2) lower-income respondents (those with household incomes at or below twice the federal poverty level (*n* = 2,209), and (3) persons engaging in higher-risk sex behaviors (*n* = 579).

Variables

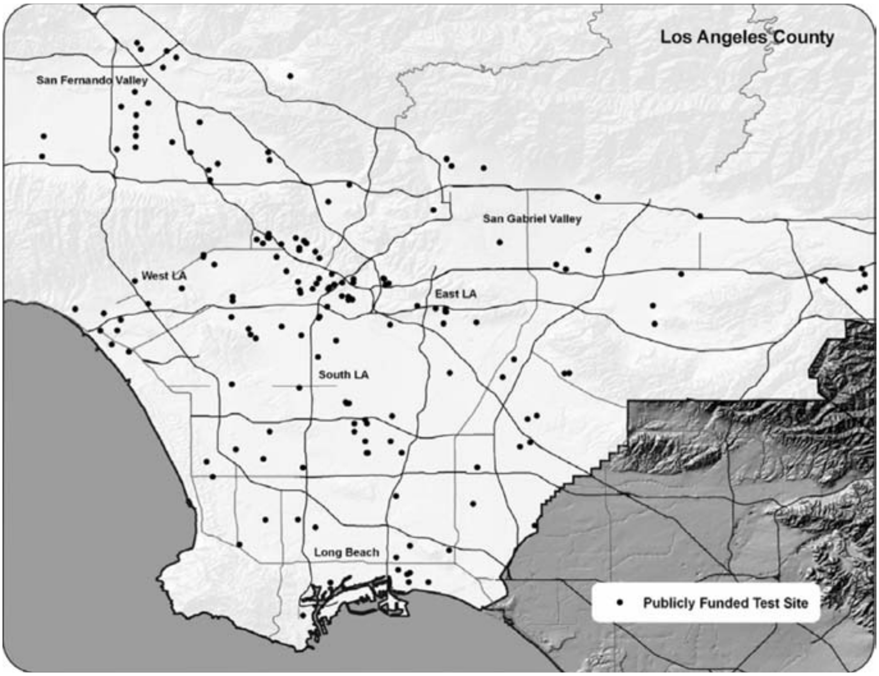
The dependent variables were testing or not testing in the prior 2 years and testing in (1) a publicly funded site (public hospitals and clinics, community, nonprofit, or family planning clinics); (2) a private physician's office or medical laboratory, or (3) a nonmedical setting, such as special testing by public health providers in a bar, bathhouse, shopping mall, or home.

The main independent variable of interest was the proximity of an individual's residence to the nearest publicly funded test site, measured in terms of miles or travel time. We used data on publicly funded test sites in LA County compiled by AIDS Project LA (2004), Grusky et al. (2004), and the Office of AIDS Programs and Planning and HIV Epidemiology of the LA County Department of Health Services (OAPP 2004). ArcGIS software was used to calculate the distance in miles between the intersection closest to a respondent's residence and the nearest publicly funded test site. This software also estimated the time required to travel to the nearest test site via automobile and public transportation. However, the survey data lacked information on access to private automobiles, so we used data from the 2000 Census on the percentage of persons in each zip code who owned automobiles to create a weighted average of public versus private transport for each respondent's expected travel time.

Figure 1 shows the location of all publicly funded HIV test sites in Los Angeles County. As indicated in the figure, West Hollywood and Hollywood, neighborhoods found between the West LA and East LA labels on the map, contain many HIV test sites. However, relatively few sites are located in the predominately low-income areas of East LA and South LA.

Low income was defined as reported income that was under twice the federal poverty level. Respondents who had neither public nor private health insurance were coded as uninsured. Higher-risk sexual behavior was defined as having more than one sex partner and not always using condoms during the past year. Table 1 presents means and standard deviations of all independent variables.

Figure 1
Location of Publicly Funded HIV Testing Sites within Los Angeles County



Empirical Strategy

The first analysis presented is a logit regression of the probability of having had an HIV test in the prior 2 years. We also estimate nested logit models because it is important to consider the test/no test decision simultaneously with the decision about where to be tested. Empirically, we consider the probability of testing in each of three venues: publicly funded test sites, private physician offices, and nonmedical settings, as follows:

$$\Pr(\text{public}) = \text{pr (any test)[pr (public} \mid \text{any test)]}$$
$$\Pr(\text{private}) = \text{pr (any test)[pr (private} \mid \text{any test)]}$$
$$\Pr(\text{nonmedical}) = \text{pr (any test)[pr (nonmedical} \mid \text{any test)]}$$

We used a nested, multinomial logit model to estimate simultaneously the likelihood of receiving any test and the location of the test (StataCorp 2005). Testing in

Table 1
Weighted Sample Description of a Random Sample of Persons in Los Angeles County

Variable	Weighted % or Mean (standard deviation)
Distance to public test site (miles)	1.53 (1.59)
AIDS prevalence/10,000 in zip code	17.23 (26.63)
Time to public test site (minutes)	5.02 (5.62)
Higher-risk sexual behaviors (%)	13
Lower income (%)	42
Insurance status	
Private (%)	61
Public (%)	6
None (%)	33
Has regular source of medical care (%)	74
Gay/bisexual (%)	4
Married or living with someone as if married (%)	43
Female (%)	47
Age (years)	39
College educated (%)	25
Race/Ethnicity	
White (%)	42
Latino (%)	31
African American (%)	11
Asian/Pacific Islander (%)	12
Other (%)	4
Employed (%)	72

Note: $N = 5{,}361$. Excludes persons ages 65 and older because they were not asked this question ($n = 1{,}041$), those reporting to not know or not responding ($n = 120$), those having little choice in whether or not they tested ($n = 977$), those not providing cross street information necessary to derive distance measures ($n = 865$).

public clinics was used as the reference category against which the likelihoods of testing in private medical facilities and nonmedical facilities were compared. The Hausman and Small–Hsiao tests were consistent with independence among the outcomes (Hausman 1978). All regressions were weighted to adjust for differential rates of survey participation across demographic groups (see Simon et al. 2001). Huber–White sandwich estimators adjusted the standard errors.

This article seeks to examine the causal effect of distance on the likelihood of testing for HIV. It is possible that testing rates of persons living closer to publicly funded test sites are higher, not because the time costs of obtaining a test are lower for them, but because public health agencies seek to fund more HIV test sites in areas where the risk of HIV infection is high. Given that those at higher risk are predicted to be more likely to test, it would be problematic to interpret the relationship between testing choice and distance as causal. We control for the endogeneity of the

Table 2
Weighted Prevalence of HIV Testing

	% Testing	# of Testers	% Testers at Private MD Office	% Testers at Publicly Funded Sites	% Testers at Nonmedical Sites
Whole sample $N = 5{,}361$	37.5	2,010	52.4	29.2	18.4
Lower-income subset $n = 2{,}209$	30.7	678	38.0	47.9	14.1
Uninsured subset $n = 1{,}665$	25.5	425	32.1	51.0	16.6
Higher-risk subset $n = 579$	55.8	323	57.6	23.3	19.1

testing site location in two ways. First, models included a measure of AIDS prevalence for each person's residential zip code to control for the greater perceived risk of persons living in areas with higher rates of AIDS and the placement of testing sites in high AIDS-prevalence neighborhoods. Second, we compared the effect of distance on the testing decisions of low-income and high-income persons because the services of publicly funded clinics are directed at low-income persons. If the relationship between distance to test sites and testing reflects the placement of test sites in higher-risk areas, the relationship between distance and testing should exist for both low-income and high-income people. However, if the causality runs from distance to public sites to the testing decision, we would expect to see the effect of distance only among low-income individuals.

Results

Table 1 shows that about 42 percent of the sample are white and non-Latino, 31 percent are Latino, 11 percent are African American, and 16 percent are Asian/Pacific Islander or other ethnicities. About one third reported being uninsured, 42 percent had income less than twice the federal poverty level, and 13 percent reported engaging in higher-risk sex behaviors.

Table 2 presents the overall probability of testing for the entire LA sample and for the low-income, uninsured, and higher-risk subsets. The last three columns show the distribution of testing locations for those who tested. More than one third of the entire sample (37.5 percent) had tested for HIV in the past 2 years. As hypothesized, HIV testing rates were above the LA average (55.8 percent) among individuals at higher risk for contracting HIV ($p < .0001$). Test rates were lower among poorer (30.7 percent) and uninsured (25.5 percent) persons ($p < .0001$). About half of the lower-income (47.9 percent) or uninsured (51.0 percent) persons who received tests

Table 3
Logit Model of HIV Testing as a Function of Distance to the Nearest Publicly Funded Test Site

	Test vs. No Test (N = 5,361)	
	Coefficient	SE
Distance (miles)	− .0833***	.024
AIDS prevalence in zip code	.0004	.001
Latino	.3100***	.072
African American	.9233***	.092
Female	.0562	.062
Higher-risk sexual behaviors	.6824***	.111
Gay/bisexual man	.6376***	.166
Have a regular source of care	.3479***	.076
Age	−.0305***	.003
Lower income	−.0157	.073
Any college education	−.0009	.068
Uninsured	−.2976***	.073
Employed	−.3217**	.065
Married	−.2630***	.065
Constant	.6039	.160
Prob > F	.000	

Note: SE = Standard Error.
** $p < .05$. *** $p < .01$.

did so in publicly funded clinics, while only 23.3 percent of testers with higher-risk sex behaviors tested at public clinics.

Table 3 presents estimated non-nested logit results of the effect of the explanatory variables on the overall probability of obtaining an HIV test. As predicted, the measures reflecting greater barriers (distance from a publicly funded clinic, not having insurance) are significantly negatively related to overall testing rates, while factors that reduce the barriers to testing, including having a regular source of care, are positively related to testing. Several factors that increase perceived susceptibility significantly increase test rates. These include Latino or black ethnicity, risky sexual behavior, and MSM. Consistent with the hypotheses, measures of low susceptibility, such as being married or being older, have a negative relationship with testing rates. In this formulation, neither the prevalence rate of AIDS in the zip code nor having low income had a significant negative effect on the testing decision.

Table 4
Multinomial Logit Model of HIV Testing as a Function of Distance to the Nearest Publicly Funded Test Site

	Test vs. No Test (N = 5,361)		Private vs. Public (n = 1,504)		Other vs. Public Site (n = 1,504)	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Distance (miles)	–.0801**	.035	–.0081	.064	–.0648	.107
AIDS prevalence in zip code	.0006	.002	–.0077***	.002	–.0070**	.003
Latino	.2044	.130	–.5594***	.165	–.3697	.237
African American	1.050***	.118	–.1938	.195	–.1993	.268
Female	.0078	.126	–.1537	.145	–.3911*	.202
Higher-risk sexual behaviors	1.0234***	.157	.3136	.213	–.2132	.312
Gay/bisexual man	.872***	.216	.0978	.377	.4349	.386
Have a regular source of care	.4263***	.158	.7053***	.172	–.0786	.223
Age	–.0173**	.007	.0197***	.007	.0238***	.009
Lower income	–.1575	.202	–1.0845***	.164	–.4381*	.240
Any college education	.0323	.106	.3444**	.160	–.0140	.218
Uninsured	–.4245***	.151	–.8107***	.162	–.4490**	.215
Employed	–.2050**	.086	.1924	.155	.1012	.204
Married	–.6207***	.119	–.0236	.160	–.31591	.233
IV1	–.3715	.290				
IV2	.2933	.776				
Constant	–.0859	.401	.4455	.367	–.4520	.450
Prob > F	.000		.000		.000	

Note: SE = standard error; IV = inclusion variable.
* $p < .10$. ** $p < .05$. *** $p < .01$.

The nested logit model, which accounts for the choice of testing sites simultaneously with the decision to be tested, is presented in table 4. The first two columns examine the overall decision to test rather than not to test. The next two columns of table 4 relate to the probability of receiving an HIV test in a private doctor's office rather than a publicly funded test site, given that a test was obtained. The final two columns relate to the probability of using a nonmedical source for an HIV test, given that a test was obtained.

The results show that among the general population, those living at a greater distance from a publicly funded HIV test site are less likely to obtain an HIV test at all, controlling for the effects of income, insurance, gender, ethnicity, and other factors. AIDS prevalence in their zip code had no statistically significant effect on the probability of obtaining a test, but was negatively related to the probability of obtaining a test in a private medical office or a nonmedical site. The uninsured had significantly lower odds of obtaining an HIV test from any source, compared with the insured. When they did get tested, the uninsured were less likely to obtain the test in a private doctor's office rather than a public site. Lower-income individuals also were less likely than persons with higher incomes to receive HIV tests in private doctors' offices than at public sites or other locations, but, overall, their testing rate did not differ significantly from that of higher-income individuals. The fact that the uninsured and lower-income persons are more likely to obtain HIV tests at publicly funded sites rather than private offices reflects that both groups have constrained resources. Persons with higher-risk sex behaviors had higher overall HIV testing rates than those without this risk factor, but their rates were not concentrated in one venue—they are greater users of all three types of sites, as expected.

African Americans, single people, and gay/bisexual men are also more likely to test overall, but their higher testing rates were not the result of preferring one type of test site (public versus private versus nonmedical) over another. Persons with a regular source of health care are more likely to test than those without, and the insured are more likely to test than the uninsured. Both of these groups are more likely to test in private offices rather than publicly funded clinics. Although college-educated individuals are no more likely to get an HIV test than those with less schooling, when they do test, they visit private medical offices.

Older respondents are somewhat less likely to test, but when they do, they also rely on private offices or nonmedical settings. Women are equally as likely as men to obtain an HIV test, but are less likely to be tested in a nonmedical setting. The nested model shows that Latinos have overall HIV testing rates that do not differ from those of Anglos, but they are less likely to receive their test in a private office.

Table 5 adds the interaction of low income and distance to public test sites to the specification in table 4. These results indicate that the effect of distance is attributable to lower-income individuals. The main effect of distance is no longer significantly different from zero. That is, distance to publicly funded test sites is a barrier to testing only for low-income individuals who live farther from publicly funded test sites. However, lower-income individuals who do test remain significantly less likely to do so in private medical offices ($p < .000$). The finding of a differential effect on the poor also supports the causal interpretation of the effect of distance on HIV testing.

The pattern of results was generally the same when time was used as a distance measure instead of miles, although statistical significance was somewhat lower, perhaps reflecting the greater measurement error in estimating the time costs.

The effect for poor persons of distance from publicly funded test sites is demonstrated clearly in the raw data as well as in the predictions from the multivariate models. Table 6 shows that, on average, 31.7 percent of poor individuals who lived 3 or fewer miles from a publicly funded test site tested, compared with 16.3 percent of those who lived more than 3 miles away. A similar halving of the testing

Table 5
Multinomial Logit Model of HIV Testing as a Function of Distance to the Nearest Publicly Funded Test Site and Interactions with Low Income

	Test vs. No Test (N = 5,361)		Private vs. Public (n = 1,504)		Other vs. Public Site (n = 1,504)	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Distance (miles)	.0084	.034	.0557	.110	.0115	.143
Distance*Poor	−.2363***	.079	−.1366	.153	−.1604	.246
AIDS prevalence in zip code	.0007	.002	−.0077***	.002	−.0069**	.003
Latino	.2164*	.128	−.5528***	.165	−.3647	.237
African American	1.0901***	.118	−.1904	.194	−.1951	.268
Female	.0779	.126	−.1464	.145	−.3833*	.202
Higher-risk sexual behaviors	1.1236***	.159	.3183	.213	−.2066	.312
Gay/bisexual man	.8277***	.223	.1166	.374	.4557	.384
Have a regular source of care	.5465***	.161	.7036***	.173	−.0810	.223
Age	−.0204***	.007	.0195***	.007	.0235***	.009
Lower income	.0879	.190	−.9108***	.256	−.2288	.343
Any college education	.1070	.108	.3538**	.160	−.0042	.216
Uninsured	−.4415***	.151	−.8121***	.162	−.4531**	.214
Employed	−.1887**	.086	.1908	.155	.0962	.204
Married	−.5475***	.118	−.0217	.161	−.3157	.232
IV1	−.6146**	.294				
IV2	.9493	.795				
Constant	−.1117	.373	.3488	.389	−.5617	.461
Prob > F	.000		.000		.000	

Note: SE = standard error; IV = inclusion variable.
* $p < .10$. ** $p < .05$. *** $p < .01$.

probability is found among people lacking insurance, whose testing probability falls from .266 to .130. In contrast, 54 percent of persons with risky behavior who lived close to public test sites tested for HIV, a rate that was similar to the 58 percent of those who tested living at a greater distance.

Using the equations in Table 5 to predict testing behavior for the population with characteristics of the low-income individuals in our sample confirms the findings with regard to distance. The predictions show a .32 probability of testing for poor people who live 1 mile from a publicly funded test site and a probability of .17 for those living 5 miles from a public test site. We predict that 26 percent of uninsured individuals living within 1 mile of a public test site would test. This rate falls to 18 percent for the uninsured who live at a distance of 5 miles from a publicly

Table 6
Probability of HIV Test within a 2-Year Period for Low-income Uninsured, and High-risk Individuals by Distance from Nearest Publicly Funded Test Site

	Low Income	Uninsured	Higher Risk
Means by distance from public site			
3 miles or less	.317	.266	.538
More than 3 miles	.163	.130	.575
Predicted from table 4			
1 mile	.319	.263	.471
5 miles	.171	.176	.478

funded site. As in the simple means, the testing rates for individuals with higher-risk sexual behaviors are not sensitive to distance from public sites.

Discussion

Overall, 37.5 percent of Los Angeles residents had obtained an HIV test in the prior 2 years. This rate is consistent with testing rates found in other studies of the general population (Kaiser Family Foundation 2006), especially considering that 42 percent of the sample is either African American or Latino, two groups that are more likely to test than non-Hispanic whites. Mean testing rates among the poor and uninsured in Los Angeles are lower than in the general population. When poor and uninsured persons do test for HIV, about half do so in a publicly funded test site. Thus, the location of public test sites has the potential to affect the identification of HIV among these increasingly vulnerable groups.

A model of HIV testing that did not account for the interaction between poverty status and distance to test sites showed a negative effect of distance from publicly funded sites and HIV testing. The interacted model in table 5 showed that this effect was attributable to the effect of distance on the poor. Lower-income LA residents living farther from the nearest publicly funded sites were significantly less likely to obtain an HIV test in a 2-year period. When low-cost or free test sites were less conveniently located, poor individuals went without tests entirely instead of testing elsewhere. HIV testing among the nonpoor was not affected by distance to publicly funded sites. Poorer persons often may be unable to afford testing at nonpublicly funded locations, or they may be without automobiles and the time to use public transportation to access more distant public test sites.

Our results demonstrate the importance of considering the time costs of accessing health care services, particularly when the money cost is low. These results imply that it is important to locate HIV test sites in low-income residential areas. To increase testing in poorer neighborhoods, public health departments should consider funding a larger number of smaller testing sites to minimize average distance costs. They could also consider locating testing sites in settings used by large numbers of lower-income people, such as grocery stores or shopping malls. This may be particularly important to encourage testing by poor women, since our results indicate that when they do get tested, they are less likely to get their test in nonmedical settings where public health outreach traditionally occurs. Testing in gay bars and bathhouses, a solution that often works for gay/bisexual men, is not a feasible alternative for many poor individuals, particularly women, who would be unlikely to visit these venues.

A limitation of this study is that the definition of "higher risk for HIV" is based only on sexual transmission and does not measure risk from injection drug use (IDU). We do not believe this is a serious omission because IDU was the exclusive source of infection for only 5.1 percent of persons living with AIDS in LA (Los Angeles County Department of Health Services [LACDHS] 2004). Another 7 percent of LA cases were among MSM who also reported IDU (LACDHS 2004). However, it may limit the generalizability of these results to other locations in the United States, such as New York, which have much higher percentages of IDUs among their HIV population. However, the results do apply directly to those at risk for HIV through sexual transmission, a group that accounts for 80 percent of all HIV/AIDS diagnoses in the United States in the 2001–2004 period (84 percent if one includes those who were MSM as well as IDU) (CDC 2005). Additionally, our results apply to the nondrug-using partners of IDUs, and thus should be of interest even in states where IDU use is high.

Despite weighting to correct for nonresponse, it is likely that some LA residents, such as the homeless, are underrepresented, thereby limiting the generalizability of these results to housed persons with telephones. Any bias attributable to the nonhomeless not having a telephone is likely to be small, since 98.2 percent of housing units in LA had telephone service (U. S. Census 2005). It is possible that some respondents underreported higher-risk sex behaviors. However, this would bias the effect of distance on testing only in the unlikely case that underreporting correlated with distance from publicly funded clinics.

Locating HIV testing sites so they are more accessible to low-income persons can be a powerful and feasible policy tool to increase HIV testing, particularly as HIV spreads into lower-income communities. In addition to reducing time and transportation costs, having HIV testing centers in one's neighborhood may also have an informational value. Many of the test sites in LA display prominent signage that indicates the availability of HIV testing (Grusky et al. 2004). These signs may remind individuals of the value of testing as well as provide specific knowledge about where to get tested.

Areas where AIDS prevalence is high signal locations where residents are at greater risk for HIV. However, public test sites should not be concentrated solely in areas where AIDS rates are already high, but should include lower-prevalence, lower-income areas as well. This is because our results show that greater distance to publicly funded test sites discourages poorer persons from testing.

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