

Implementing an HIV and Sexually Transmitted Disease Screening Program in an Emergency Department

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Study objective: We assess the feasibility, effectiveness, and cost of routinely recommended HIV/sexually transmitted disease screening in an urban emergency department (ED).

Methods: From April 2003 to August 2004, patients aged 15 to 54 years were offered rapid HIV testing, and those aged 15 to 25 years were also offered gonorrhea and chlamydia testing (nucleic acid amplification), Monday through Friday, 11 AM to 8 PM. Infected patients were referred for treatment and care. Prevalence, treatment rates, and cost were assessed.

Results: Among 3,030 patients offered HIV testing, 1,447 (47.8%) accepted, 8 (0.6%) tested positive, and 3 (37.5%) were linked to care. Among 791 patients offered sexually transmitted disease testing, 386 (48.8%) accepted, 320 provided urine (82.9%), 48 (15.0%) tested positive, and 42 (87.5%) were treated for gonorrhea or chlamydia. The program cost was \$72,928. Costs per HIV-infected patient identified and linked to care were, respectively, \$9,116 and \$24,309; cost per sexually transmitted disease-infected patient treated was \$1,736. The program cost for HIV/sexually transmitted disease screening was only \$14,340 more than if we screened only for HIV.

Conclusion: Through ED-based HIV/sexually transmitted disease screening, we identified and treated many sexually transmitted disease-infected patients but identified few HIV-infected patients and linked even fewer to care. However, sexually transmitted disease screening can be added to HIV screening at a reasonable cost. [Ann Emerg Med. 2007;49:564-572.]

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SEE EDITORIAL, P. 573.

INTRODUCTION

Background

Of the 925,000 to 1,025,000 persons in the United States living with HIV, approximately one quarter are unaware of their infection.¹ To reduce the number of new infections, the Centers for Disease Control and Prevention (CDC) recently unveiled a strategy that included decreasing the number of HIV-infected persons who are unaware of their infection and linking infected persons to prevention, care, and treatment.^{2,3} Routine HIV screening can potentially identify infected patients before they develop an AIDS-defining illness, decrease continued HIV

transmission, and thus decrease the estimated \$7 billion in annual HIV-related health care costs.⁴

Sexually transmitted diseases such as gonorrhea and chlamydia also pose a large public health problem. If untreated, they can cause pelvic inflammatory disease, which may lead to infertility, chronic pelvic pain, and ectopic pregnancy.⁵ The high prevalence of gonorrhea and chlamydia in the United States accounts for \$10 billion in direct and indirect expenses.⁵

There is national recognition^{6,7} that HIV and sexually transmitted disease prevention efforts should be integrated for many reasons: similar behaviors (ie, sexual activity and drug use) promote sexually transmitted disease and HIV transmission; prevention of one will likely prevent the other;

Editor's Capsule Summary

What is already known on this topic

Early detection of HIV disease and other sexually transmitted diseases is an important means of controlling spread in populations and improving the outcomes of those infected. However, the cost-effectiveness of routine screening for HIV and other sexually transmitted diseases in emergency departments (EDs) is unclear.

What question this study addressed

This study measured the costs and effect of concurrent screening for HIV and sexually transmitted diseases in a single urban ED.

What this study adds to our knowledge

In this ED, slightly less than half of eligible patients consented to HIV or sexually transmitted disease screening. Positive screening rates were less than 1% and 15%, respectively. The program cost more than \$9,000 per identified HIV patient and \$1,736 per treated patient with sexually transmitted disease. The cost of adding sexually transmitted disease screening to HIV screening was relatively low.

How this might change clinical practice

This study may cause advocates of routine ED HIV screening to reconsider their position, given the low yield and high costs in this urban ED.

HIV and sexually transmitted diseases disproportionately affect the same marginalized populations, and infection with one may facilitate transmission of the other.⁸ Although the integration can be challenging, it can maximize the effectiveness of sexually transmitted disease and HIV prevention programs.

Importance

Emergency departments (EDs) can play an important role in reducing the morbidity and transmission of HIV and sexually transmitted diseases for several reasons. First, studies have found high HIV seroprevalence (3.5% to 11.8%)⁹⁻¹¹ and asymptomatic sexually transmitted disease prevalence rates (9.7% to 13.6%)¹²⁻¹⁴ in some inner-city EDs. Second, EDs serve populations that have limited access to health care,¹⁵⁻¹⁷ thus placing responsibility on EDs to provide preventive care.^{18,19} Third, the availability of simple and noninvasive HIV²⁰ and sexually transmitted disease²¹ tests facilitates screening interventions. Fourth, several studies in urban EDs have demonstrated the feasibility and effectiveness of implementing ED-based screening programs for HIV,²²⁻²⁸ although fewer have done so for sexually transmitted diseases.^{29,30}

Goals of This Investigation

Despite the recognition that HIV and sexually transmitted disease prevention programs should be integrated and the evidence that ED-based screening programs are feasible and effective, we are unaware of combined ED-based HIV/sexually transmitted disease screening programs. The purposes of this study were to assess the feasibility and cost of implementing an ED-based HIV/sexually transmitted disease screening program, and evaluate its effectiveness in identifying infected patients and linking them to treatment or care.

MATERIALS AND METHODS

Study Design

Between April 23, 2003, and August 5, 2004, we routinely offered HIV/sexually transmitted disease testing to as many age-eligible patients as possible who came into the ED during study hours, Monday to Friday, 11 AM to 8 PM. The study was approved by the appropriate institutional review boards.

Setting

This study was performed in an urban, nonprofit hospital ED. The ED receives 44,000 visits annually and is classified as a Level I trauma center, certified to treat the most critically injured patients at all times. The patient population is predominantly black or Hispanic and low income; 10% of patients have private health insurance.

The AIDS prevalence rate of the community surrounding the hospital is 409.4 cases per 100,000 persons compared to the city rate of 329.8 and US rate of 144.2.³¹ Similarly, the gonorrhea and chlamydia rates in this community are twice as high as the city rate and 5 to 8 times as high as the national rate.³¹ Additionally, a 2001 targeted HIV testing project found a 3.0% HIV positivity rate among high-risk patients attending this ED.²⁵ Finally, in 2003, 1.0% of the patients who visited the ED had an HIV diagnostic code (the CDC recommends that settings with a prevalence rate $\geq 1\%$ consider routinely offering HIV testing.)³²

Selection of Participants

Eligible ED patients had to meet age criteria and be able to provide informed consent. Patients aged 15 to 54 years were eligible for HIV screening. Patients aged 15 to 25 years were also eligible for gonorrhea and chlamydia screening. The age criteria were selected according to the recommended age ranges for HIV³² and sexually transmitted disease³³ testing.

Patients were ineligible if they were in critical condition, had an unstable psychiatric condition, were under the influence of alcohol or drugs, or were prisoners or detainees. Documented (as noted in the medical record) HIV infection or documented HIV test in the previous 3 months was an additional exclusion criterion for HIV screening. Receipt of sexually transmitted disease testing by Gen-Probe (Gen-Probe, Inc., San Diego, CA) during the ED visit or documented sexually transmitted disease test in the previous 2 weeks was another exclusion criterion for sexually transmitted disease screening.

Intervention

Two study staff members received training on HIV/sexually transmitted disease prevention and counseling and testing at the local health department. They were also trained by the HIV test kit manufacturer to properly conduct and interpret the rapid test results.

Before the initiation of the project, HIV and sexually transmitted disease screening were performed only when clinically indicated. HIV testing was rarely offered to ED patients. Patients with sexually transmitted disease symptoms were generally tested and empirically treated before the return of the test results.

During the study period, study staff approached potentially eligible patients in their examination room to confirm eligibility, explain the study, offer confidential HIV/sexually transmitted disease testing, and ask for consent. Before obtaining consent, the study staff briefly described the rapid test, discussed HIV/sexually transmitted disease transmission and prevention, and assessed the patient's preparedness to receive same-day HIV results.

Whole-blood samples (by fingerstick or venipuncture) obtained from patients who consented to HIV screening were tested using the OraQuick Rapid HIV Antibody Test (Orasure Technologies, Inc., Bethlehem, PA), which provides results in 20 to 40 minutes. Patients who had preliminary positive results were retested in duplicate with OraQuick. Repeatedly reactive tests were considered preliminary HIV positive, and a whole-blood sample was sent to the state's public health laboratory for confirmation by Western blot.* Those patients who tested positive by Western blot were considered to be HIV infected.

During the ED visit, the patient and attending physician received the rapid HIV test result. The result was also entered into the patient's medical record. During discussion of the test result, condoms and pamphlets about HIV and sexually transmitted diseases were provided. Patients with preliminary positive HIV test results were scheduled for an appointment at the hospital's infectious diseases clinic within 2 weeks of the ED visit. The infectious diseases clinic attendance was confirmed using the hospital's medical information system. Study staff attempted to contact by telephone or certified mail those patients who did not keep scheduled appointments. Patients who could not be contacted were referred to the local health department for field investigation.

Urine specimens obtained from patients who consented to sexually transmitted disease screening were tested with the BDProbeTec amplified DNA Assay (Becton Dickinson, Franklin Lakes, NJ) at the state public health laboratory; study staff received test results within 5 working days. All sexually transmitted disease test results were entered into the patient's medical record. Patients who tested positive for either gonorrhea

or chlamydia were notified by telephone or certified mail and referred to a local health department or hospital-affiliated clinic for free sexually transmitted disease treatment. Study staff referred sexually transmitted disease-infected patients whom they were unable to contact to the local health department for field investigation.

The local health department helped train study staff, paid for HIV confirmatory and sexually transmitted disease testing, provided referral sites for free sexually transmitted disease treatment, and assisted with field investigations.

Data Collection and Processing

Using a standardized form, study staff collected (by medical record or patient report) the following information on all patients who visited the ED during study hours: basic demographics, eligibility or reason for ineligibility, and reason for study refusal, if applicable. Medical records, local health department reports, and patient reports were used to document sexually transmitted disease treatment and linkage to HIV care information. Risk factor information was not collected, because screening was routinely recommended and not risk based.

For the cost analysis, an observer collected time-motion data to determine the amount of staff labor time required to conduct HIV/sexually transmitted disease screening. Data were collected from July to August 2004, during which time 107 patients were screened, of whom 81 were approached and 49 consented to HIV/sexually transmitted disease screening. Tasks were designated as HIV-only (collecting whole-blood specimens, conducting the rapid test, running controls, entering test results into medical records, delivering test results, and attempting to contact infected patients who missed their infectious diseases clinic appointment) or sexually transmitted disease-only (obtaining urine specimens, preparing specimens for transportation to the laboratory, delivering positive test results, and referring patients for treatment). Nonspecific tasks included activities such as assessing patient eligibility, approaching patients, offering and discussing HIV/sexually transmitted disease testing, and obtaining informed consent. Time commitments for these activities were multiplied by staff wages of approximately \$18 an hour, including 15% for fringe benefits, to determine labor costs associated with HIV and sexually transmitted disease screening separately. The cost estimate also included test kit costs, specimen processing, educational materials, office supplies, and treatment visit (existing literature estimates were used).^{34,35} A 33% administrative cost estimate was also added to account for clerical work, supervision, and other nonpatient costs.³⁶ We measured the impact of the HIV/sexually transmitted disease screening program against the baseline of no program, thereby assuming that patients would not have been screened in the absence of the program. To estimate the costs of sexually transmitted disease screening alone, we assumed sexually transmitted disease screening would be an addition to HIV screening and calculated only the costs of obtaining and processing sexually transmitted disease specimens. Because we

*Since the writing of the study protocol, the US Food and Drug Administration no longer requires that reactive rapid tests be repeated.

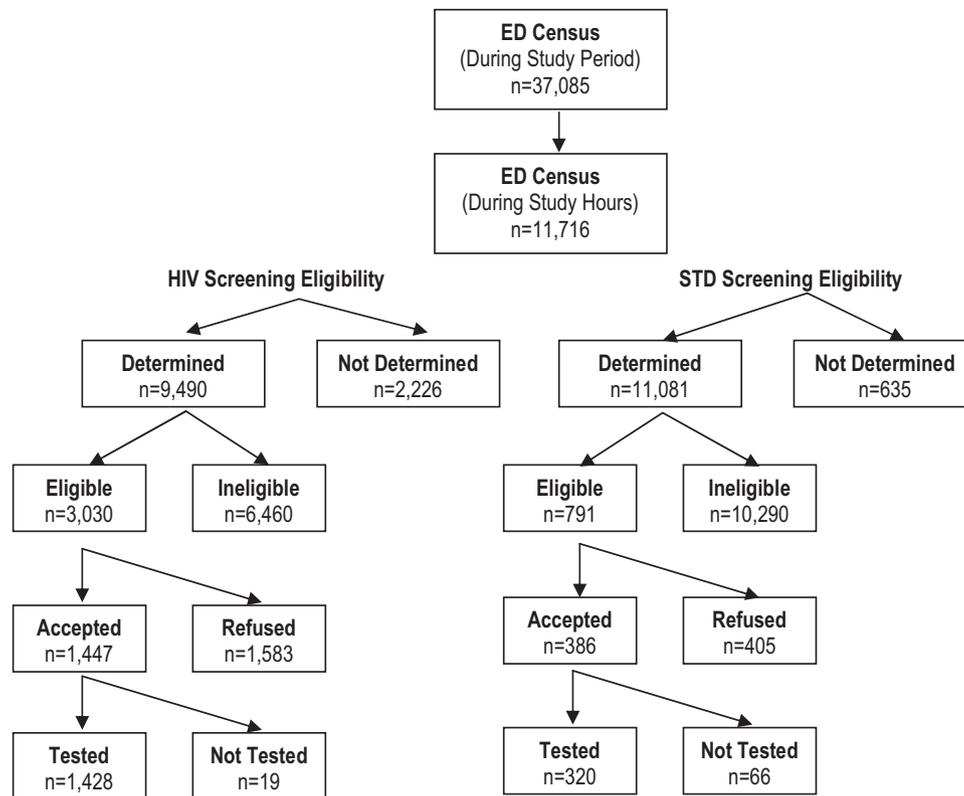


Figure. Eligibility and acceptance rates among patients approached for HIV/sexually transmitted disease screening. *STD*, Sexually transmitted disease.

assumed that the hospital had the capacity to conduct HIV/sexually transmitted disease testing and related services, we did not include startup costs (eg, training and most overhead costs). The cost analysis was conducted from the hospital's perspective; patient and sequelae costs were excluded. Costs were standardized to 2004 dollars.

Primary Data Analysis

The data, excluding identifying information, were entered into a password-protected database and analyzed using SAS version 9.1.3. (SAS Institute, Inc., Cary, NC). Each patient visit was analyzed as a unique patient. Patients who tested positive for gonorrhea or chlamydia were considered sexually transmitted disease-infected. Patients were considered HIV-infected if the repeatedly reactive rapid test was confirmed with a positive Western blot result. Consenting, testing, and positivity rates were assessed by demographic characteristics and as a whole.

RESULTS

Characteristics of Study Subjects

Approximately 37,085 patients attended the ED during the study period, of whom 11,716 attended during the study hours. Patients treated during study hours were primarily women (56.0%) and non-Hispanic black (61.7%) or Hispanic (30.8%).

The majority (62.9%) of patients were aged 15 to 54 years (16.6% were aged 15 to 25 years).

Among the 11,716 patients who visited the ED, eligibility for HIV screening was determined for 9,490 (81.0%) patients (Figure). HIV screening eligibility for the remaining 19.0% of patients could not be assessed because the study staff were consulting with other patients or engaged in follow-up activities. For the 9,490 patients for whom eligibility was determined, 3,030 (31.9%) were eligible for HIV testing. Among the 6,460 (68.1%) ineligible patients, the primary reasons were age (67.1%), unstable psychiatric condition (17.0%), documented recent testing (6.3%), and existing (per medical record) HIV infection (2.3%).

Among the 3,030 patients eligible for HIV screening, 1,447 (47.8%) accepted testing, of whom most (1,428) were tested. Non-Hispanic black patients were more likely to accept HIV testing (49.9%) than Hispanic (45.5%) or non-Hispanic white patients (36.2%) (Table 1). Hispanic patients were also more likely to accept testing than non-Hispanic white patients. There appear to be no considerable differences in acceptance rates by sex or age. Of the 1,583 (52.2%) patients who refused an HIV test, 46.5% reported having been tested recently, and 37.4% did not perceive themselves to be at risk for HIV.

Blood samples were obtained from 1,428 (98.7%) of 1,447 patients who accepted HIV testing; 10 tested positive, and 8

Table 1. HIV screening acceptance, testing, and positivity rates among eligible patients.

Characteristics	Consented, No. (%)	Tested, No. (%)	Positivity, No. (%)
All	1447 (47.7)	1428 (98.7)	8 (0.6)
Sex			
Male	498 (48.6)	493 (99.0)	5 (1.0)
Female	949 (47.3)	935 (98.5)	3 (0.3)
Race/ethnicity			
Non-Hispanic white	54 (36.2)	53 (98.1)	0
Non-Hispanic black	966 (49.9)	954 (98.8)	6 (0.6)
Hispanic	412 (45.5)	406 (98.5)	2 (0.5)
Other	15 (39.5)	15 (100.0)	0
Age, y			
15–29	595 (48.9)	583 (98.0)	3 (0.5)
30–39	362 (46.6)	359 (99.1)	3 (0.8)
40–49	370 (47.7)	366 (98.9)	2 (0.6)
50–54	120 (46.0)	120 (100.0)	0

(0.6%; 95% confidence interval [CI] 0.3% to 1.1%) had confirmed positive results by Western blot (Table 1). HIV positivity rates ranged from 0.0% to 1.0% among the various demographic groups and were highest among men (1.0%), non-Hispanic black patients (0.6%), and those aged 30 to 39 years (0.8%). There were no notable differences in HIV positivity by sex, race/ethnicity, or age.

Of the 8 HIV-infected patients, 3 (37.5%) made at least 1 visit to the infectious diseases clinic and received treatment according to clinical guidelines. Among the 5 patients who did not attend the infectious diseases clinic appointment, 1 outright refused linkage to care, 1 provided erroneous contact information, 1 moved out of state, and 1 left the ED against medical advice. These 5 patients were referred to the local health department for field investigation; however, the investigations were closed because of inability to contact the patients.

Among the 11,716 patients who visited the ED, sexually transmitted disease screening eligibility was determined for 11,081 (94.6%), of whom 791 (7.1%) were eligible (Figure). The primary reason for ineligibility was age (95.2%).

Among the 791 patients who were eligible for sexually transmitted disease testing, 386 (48.8%) accepted. Men (54.6%) were more likely to consent than women (46.3%), and non-Hispanic black patients (54.6%) were more likely to consent than Hispanic patients (40.6%). There appear to be no real differences in acceptance rates by age (Table 2). The primary reasons for refusal among the 405 (51.2%) patients who declined testing were recent testing (47.0%) and lack of perceived risk (37.0%).

Of 386 patients who accepted sexually transmitted disease testing, 320 (82.9%) patients were tested; most (60) were not tested because they were unable to provide a urine sample. In all, 48 (15.0%; 95% CI 11.5% to 19.3%) patients tested positive for a sexually transmitted disease: 16 (5.0%) for gonorrhea, 38 (11.0%) for chlamydia, and 6 (1.9%) for both. Sexually transmitted disease positivity rates ranged from 0.0%

Table 2. Sexually transmitted disease screening acceptance, testing, and positivity rates among eligible patients.

Characteristics	Consented, No. (%)	Tested, No. (%)	Positivity, No. (%)
All	386 (48.8)	320 (82.9)	48 (15.0)
Sex			
Male	131 (54.6)	112 (85.5)	11 (9.8)
Female	255 (46.3)	208 (81.6)	37 (17.8)
Race/ethnicity			
Non-Hispanic white	8 (34.8)	7 (87.5)	2 (28.6)
Non-Hispanic black	254 (54.6)	210 (82.7)	41 (19.5)
Hispanic	119 (40.6)	101 (84.9)	5 (5.0)
Other	5 (50.0)	2 (40.0)	0
Age, y			
15–19	133 (50.4)	108 (81.2)	22 (20.4)
20–25	253 (48.0)	212 (83.8)	26 (12.3)

to 28.6% among demographic groups (Table 2). Women (17.8%) had a higher rate than men (9.8%), and non-Hispanic black patients (19.5%) had a higher rate than Hispanic patients (5.0%). Also, the rate among those aged 15 to 19 years (20.4%) was higher than among those aged 20 to 25 years (12.3%).

Sexually transmitted disease treatment was confirmed for 42 (87.5%) of the 48 sexually transmitted disease–infected patients. Nine patients were empirically treated by ED providers for sexually transmitted disease symptoms, 7 were treated during their hospital admission, 11 went to a hospital-affiliated clinic, 5 went to the local health department, 5 went to their primary care provider, and 5 went elsewhere.

Program costs were estimated to be \$72,928 (Table 3). The cost per person tested was \$42 (when counting persons who tested for HIV or sexually transmitted disease), the cost per HIV-infected person identified was \$9,116, the cost per HIV-infected person linked to care was \$24,309, and the cost per sexually transmitted disease–infected person treated was \$1,736. The program cost for HIV/sexually transmitted disease screening was only \$14,340 more than if we screened only for HIV (data not shown); if screening were limited to HIV only, the cost per HIV-infected person tested and cost per HIV-infected person linked to care would decrease to \$7,276 and \$19,403, respectively.

LIMITATIONS

Our study has certain limitations. First, we could not completely differentiate screening costs as HIV- or sexually transmitted disease–specific because some costs applied to both (eg, screening and approaching patients); thus, we may have slightly overestimated costs if the program were limited to HIV screening.

Second, we do not know how well the prevalence of undiagnosed HIV or sexually transmitted disease infection among patients who were tested during the study can be generalized to the respective populations of eligible patients who were not tested (because they refused or were never approached). The prevalence of undiagnosed HIV or sexually

Table 3. Cost analysis results: combined HIV and sexually transmitted disease screening.

Category	Measure	No.	Subtotal, \$
Personnel Costs			
	Time, h		
Screening for eligibility	0.04	1,558	1,201
Screened for eligibility, but not approached	0.02	8,198	2,964
Approached and refused testing	0.06	1,988	2,186
Accepted, but not tested	0.27	79	382
Tested: HIV and STD	0.54	269	2,604
Tested: STD only	0.23	51	209
Tested: HIV only	0.32	1,159	6,723
Posttest HIV-negative patient	0.02	1,418	475
Posttest HIV-infected patient	0.24	10	43
Follow-up on STD-infected patients for results and treatment	0.13	48	115
Follow-up on HIV-infected patients who did not keep appointment at infectious diseases clinic	4.00	5	359
Materials			
	Unit cost, \$		
HIV test costs for HIV-negative	14.5	1,428	20,706
HIV test costs HIV-infected	14.5	30	435
HIV test cost HIV-infected: Western blot	32.54	10	325
STD test costs	27.37	320	8,758
STD treatment costs (STD-infected patients)*	23.91	48	1,148
Educational material	—	—	2,000
Office supplies	—	—	4,200
Subtotal			53,685
33% Administrative costs (clerical, supervision and nonpatient costs)			17,716
Total†			72,928

*Assumes patients testing positive for gonorrhea were treated for both chlamydia and gonorrhea; cost includes cost of treatment visit.^{34,35}
†Cost per patient tested for HIV or STD: \$42; cost per HIV-positive patient identified: \$9,116; cost per STD-positive patient identified and treated: \$1,736; cost per HIV-positive patient linked to care: \$24,309.

transmitted disease infection may have differed between those who were tested and those who were not.

Third, for this analysis we treated each patient visit as a unique patient. Some patients were probably screened or refused testing more than once. Hence, the actual consent rate is probably higher than the one we calculated. However, because patients were ineligible if they were recently tested, we have few repeated testers. For instance, only 39 patients were tested twice for HIV during the study period, and they all had negative test results, so this would not significantly affect the HIV positivity rate.

Finally, our patient population may not be representative of other ED populations. In fact, institution-specific factors, such as the proportion of infected patients who are aware of their infection and linkages to HIV care and sexually transmitted disease treatment, may influence the effectiveness of screening at individual sites.

DISCUSSION

Although other studies have shown the feasibility of implementing ED-based HIV²²⁻²⁸ or sexually transmitted disease^{29,30} screening, our study demonstrates that a combined HIV and sexually transmitted disease screening program is also feasible and can be conducted at a slightly higher cost than HIV screening only. However, through screening, we identified only a small number of patients with undiagnosed HIV infection and linked even fewer to care.

Implementing this screening program was feasible for several reasons. First, hiring additional staff to conduct the screening, testing, and referrals prevented overburdening the ED medical staff or hindering the fast pace of the ED. Second, the screening program was well accepted by ED patients. Our HIV (47.7%) and sexually transmitted disease (48.8%) consent rates were comparable to those of other ED-based HIV^{22,24,26,27} or sexually transmitted disease screening projects.^{29,30} Using simple and noninvasive HIV and sexually transmitted disease tests may have contributed to their acceptability. Finally, the local health department helped subsidize the cost of HIV and sexually transmitted disease testing and assisted with follow-up efforts. In all, we attempted to remove the most common barriers (ie, time, cost, follow-up) to implementing an ED-based HIV/sexually transmitted disease screening program.

Unfortunately, we could not routinely offer testing to all eligible patients. ED patients were not screened during nonstudy hours or when study staff was unavailable. Increasing the number of patients screened may be possible by hiring additional staff to offer screening during more hours of the day or by encouraging existing ED staff to offer screening as a routine part of patient care. The latter may not be feasible, given the time currently required for screening, counseling, consenting, and testing (Table 3). However, eliminating requirements for separate, HIV-specific written consent and pretest counseling, as recommended by some clinicians and public health professionals,³⁷⁻³⁹ would make HIV screening and testing easier for ED staff.

Although we anticipated identifying a lower proportion (0.6%) of HIV-infected patients through routine screening than what we found through our previous targeted (high-risk or symptomatic patients)²⁵ screening approach, the positivity rate was lower than expected, given the high AIDS incidence and prevalence rates in the communities surrounding the ED.^{31,40}

In contrast, through sexually transmitted disease screening we identified a significant number (48) and proportion (15.2%) of infected patients and successfully linked most of them to treatment (87.5%). The positivity rates for chlamydia and gonorrhea in this ED were comparable to or slightly higher than those found among patients of similar ages in other urban EDs.^{14,30,41}

Our cost analysis results can be compared with those of other HIV screening studies in similar settings. Walensky et al²⁷ calculated a cost per test, cost per infected patient tested, and cost per person linked to care of \$103, \$5,266, and \$6,026

(2004 dollars), respectively, for an HIV testing program that used oral fluid (nonrapid) testing in urban urgent care centers, with a 2.0% seropositivity rate. In another study of rapid HIV testing in an urban ED, the cost per person tested and cost per positive identified was \$51 and \$1,581 (adjusted to 2004 dollars), with a 3.2% seropositivity rate.²⁴ Although our cost per person tested is within or below the range of other studies, our lower seropositivity rate (0.6%) resulted in a substantially higher cost per infected person identified. Our substantially higher cost per HIV-infected person linked to care (\$24,309) is due to the low rate of linkage to care and indicates a key area for improvement; in fact, in a model-based study, Walensky et al²⁷ demonstrated that limited screening resources should focus on linkage to care. A limitation of our cost analysis was that it was conducted from the perspective of the hospital offering testing rather than the societal perspective. As such, we did not incorporate certain costs (eg, lifetime treatment costs for HIV) or benefits (reductions in sequelae of chlamydia and gonorrhea) of screening. Also, many studies have shown reductions in risk behavior among persons who learn they are HIV infected, which we did not assess.^{42,43} HIV infections averted as a consequence of disease recognition and subsequent risk reduction would at least partially offset the net societal cost of ED screening. An additional limitation is that we based our cost estimates on the actual time spent on the screening activities. Depending on patient volume, some EDs might find it difficult to devote the required time to screening activities without hiring additional staff. A given ED might find labor costs for testing to be higher if additional staff were not fully used for other productive activities when not conducting the screening program.

Sexually transmitted disease screening can be combined with HIV screening at a reasonable cost. Considering only the additional sexually transmitted disease screening-associated costs (\$14,340), the cost per case of chlamydia or gonorrhea treated (\$299) was comparable to or lower than reported for other similar chlamydia or gonorrhea standalone screening programs (\$300 to \$1400); the cost per person screened (\$45) was within the range reported previously (\$23 to \$53).⁴⁴⁻⁴⁶ Recent studies demonstrated that, in EDs with high sexually transmitted disease prevalence among young women (7% to 24%), screening all young women was more cost-effective than other approaches.⁴⁴⁻⁴⁶ Compared to that of those studies, our results show that adding sexually transmitted disease screening to HIV screening is less costly compared with sexually transmitted disease screening alone. Furthermore, sexually transmitted disease screening and treatment provide health benefits beyond those of HIV screening, including a reduction in HIV incidence and transmission.⁴⁷ However, the cost of screening for both HIV and sexually transmitted diseases is influenced by the prevalence rates of the populations screened; lower prevalence rates increase the cost per case detected.

Future ED-based HIV/sexually transmitted disease screening programs should consider several factors before implementation.

First, although rapid HIV testing increases result notification, preliminary positive results require a return visit for confirmatory test results and linkage to care. In our study, confirmatory test results were provided at the scheduled infectious diseases clinic appointment. Only 5 (including the 2 false-positive patients) of the 10 patients who received a preliminary positive test result attended their scheduled infectious diseases appointment and thus received their Western blot results. Therefore, only 3 of the 8 confirmed positive patients were successfully linked to care. There are a number of ways to increase linkage to care. One strategy would be for patients with preliminary positive test results to meet with HIV case managers or social workers before they leave the ED; if patients receive assistance with some of their social issues (eg, homelessness, drug use) they may be more inclined to tend to their health issues.^{48,49} In one ED-based HIV screening program, 80% linkage to care was attained by walking patients directly to the infectious diseases clinic on receipt of their positive test result.²⁸ Finally, offering a modest financial incentive to attend a clinic appointment may be effective. For instance, one study that offered a monetary incentive reported an increase (from 8% to 23%) in the proportion of ED patients who completed HIV counseling and testing after being referred from the ED.⁵⁰

Second, despite the high sensitivity and specificity rate of the rapid HIV test, some false-positive results should be anticipated in low-prevalence settings. Such screening tests must be followed by further diagnostic testing to confirm the presence of the disease. Therefore, positive rapid test results were reported as “preliminary positive” to the patients, and they were told that a follow-up confirmatory test was needed. The small risk of giving some patients a “preliminary positive” test result is outweighed by the public health good in identifying and treating HIV-infected patients.

Third, collaboration with the local health department in implementing testing can help sustain an ED-based screening program. One ED^{28,39} successfully implemented and sustained a targeted HIV screening program with the support of local health department and Ryan White funding. Similarly, our local health department subsidized all costs related to sexually transmitted disease and HIV confirmatory testing, assisted with follow-up, and was a source of free sexually transmitted disease treatment.

In conclusion, with appropriate funding and collaboration with the local health department, HIV/sexually transmitted disease screening was feasible in this ED. Although routine, voluntary sexually transmitted disease screening identified and treated many patients in this ED, screening for HIV was less successful. According to resources and the results of this project, we are continuing to screen for sexually transmitted diseases, with the collaboration of the local health department; we are also exploring opportunities to implement more targeted HIV screening. The decision to implement HIV and sexually transmitted disease screening for any ED should consider the

resources available (from its institution or local health department), the prevalence of undiagnosed infections in the population to be screened, and the strategies for linking infected patients to treatment and care.

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REFERENCES

- Glynn M, Rhodes P. Estimated HIV prevalence in the United States at the end of 2003. Presented at: 2005 National HIV Prevention Conference; June 12-15, 2005; Atlanta, GA. Abstract T1-B1101.
- Janssen RS, Holtgrave DR, Valdiserri RO, et al. The serostatus approach to fighting the HIV epidemic: prevention strategies for infected individuals. *Am J Public Health*. 2001;91:1019-1024.
- Centers for Disease Control and Prevention. Advancing HIV prevention: new strategies for a changing epidemic: United States, 2003. *MMWR Morb Mortal Wkly Rep*. 2003;52:329-332.
- Bozette SA, Joyce G, McCaffrey DF, et al. Expenditures for the care of HIV-infected patients in the era of highly active antiretroviral therapy. *N Engl J Med*. 2001;344:817-823.
- Institute of Medicine. *The Hidden Epidemic: Confronting Sexually Transmitted Disease: Committee on Prevention and Control of Sexually Transmitted Disease*. Washington, DC: National Academy Press; 1997.
- US Department of Health and Human Services. HHS creates unified HIV/AIDS and STD advisory committee to strengthen prevention and treatment efforts. Available at: <http://hhs.gov/news/press/2002pres/20021114.html>. Accessed April 13, 2005.
- Wohlfeiler D, and the HIV/STD Workgroup. STD/HIV prevention integration: Washington: National Alliance of State and Territorial AIDS Directors and National Coalition of STD Directors: 2002. Available at: <http://www.ncsddc.org/docs/STDHIVIssuePaperFinal.pdf>. Accessed October 23, 2006.
- Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. *Sex Transm Infect*. 1999;75:3-17.
- Schoenbaum EE, Webber MP. The underrecognition of HIV infection in women in an inner-city emergency room. *Am J Public Health*. 1993;83:363-368.
- Kelen GD, Hexter DA, Hansen KA, et al. Trends in human immunodeficiency virus (HIV) infection among a patient population of an inner-city emergency department: implications for emergency department-based screening programs for HIV infection. *Clin Infect Dis*. 1995;21:867-875.
- Goggin MA, Davidson AJ, Cabrill SV, et al. The extent of undiagnosed HIV infection among emergency department patients: results of a blinded seroprevalence survey and a pilot HIV testing program. *J Emerg Med*. 2000;19:13-19.
- Embling ML, Monroe KW, Oh MK, et al. Opportunistic urine ligase chain reaction for sexually transmitted diseases in adolescents seeking care in an urban emergency department. *Ann Emerg Med*. 2000;36:28-32.
- Todd CS, Haase C, Stoner BP. Emergency department screening for asymptomatic sexually transmitted infections. *Am J Public Health*. 2001;91:461-466.
- Mehta SD, Rothman RE, Kelen GD, et al. Unsuspected gonorrhea and chlamydia in patients of an urban adult emergency department. *Sex Transm Dis*. 2001;28:33-39.
- Stern RS, Weissman JS, Epstein AM. The emergency department as a pathway to admission for poor and high-cost patients. *JAMA*. 1991;266:2238-2243.
- Pane GA, Farmer MC, Salness KA. Health care access problems of medically indigent emergency department walk-in patients. *Ann Emerg Med*. 1991;20:730-733.
- Sun BC, Burnstin HR, Brennan TA. Predictors and outcomes of frequent emergency department users. *Acad Emerg Med*. 2003; 10:320-328.
- Wilson SR, Mitchell C, Bradbury DR, et al. Testing for HIV: current practices in the academic ED. *Am J Emerg Med*. 1999;17: 354-356.
- FCB Healthcare. Formative research results: HIV prevention in care for health care professionals. Available at: <http://www.fcb.com>. Accessed November 1, 2005.
- Centers for Disease Control and Prevention. Notice to readers: approval of a new rapid test for HIV antibody: United States, 2001. *MMWR Morb Mortal Wkly Rep*. 2002;51:1051-1052.
- Centers for Disease Control and Prevention. Screening tests to detect *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections 2002. *MMWR Morb Mortal Wkly Rep*. 2002;51:7-8.
- Centers for Disease Control and Prevention. Routinely recommended HIV testing in an urban urgent-care clinic. *MMWR Morb Mortal Wkly Rep*. 2001;50:538-541.
- Kelen GD, Hexter DA, Hansen KN, et al. Feasibility of an emergency department-based, risk-targeted voluntary HIV screening program. *Ann Emerg Med*. 1996;27:687-692.
- Kelen GD, Shanan JB, Quinn TC. Emergency department-based HIV screening and counseling: experience with rapid and standard serologic testing. *Ann Emerg Med*. 1999;33:147-155.

25. Glick NR, Silva A, Zun L, et al. HIV testing in a resource-poor urban emergency department. *AIDS Educ Prev*. 2004;16:126-136.
26. Kendrick SR, Kroc KA, Couture E, et al. Comparison of point-of-care rapid HIV testing in three clinical venues. *AIDS*. 2004;18:2208-2210.
27. Walensky RP, Losina E, Malatesta L, et al. Effective HIV case identification through routine HIV screening at urgent care centers in Massachusetts. *Am J Public Health*. 2005;95:71-73.
28. Lyons MS, Lindsell CJ, Ledyard HK, et al. Emergency department HIV testing and counseling: an ongoing experience in a low-prevalence area. *Ann Emerg Med*. 2005;46:22-28.
29. Monroe KW, Weiss HL, Jones M, et al. Acceptability of urine screening for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in adolescents at an urban emergency department. *Sex Transm Dis*. 2003;30:850-853.
30. Mobius S, Willard N, Villarroel M, et al. STI screening and patient/partner follow-up in an emergency department setting. 2004 American Public Health Association Conference; November 8-10, 2004; Washington, DC.
31. Chicago Department of Public Health. STD/HIV/AIDS Chicago Surveillance Report, Summer 2005. Available at: http://egov.cityofchicago.org/webportal/COCWebPortal/COC_EDITORIAL/AIDSChicagoSummer05.pdf. Accessed October 23, 2006.
32. Centers for Disease Control and Prevention. Revised guidelines for HIV counseling, testing, and referral. *MMWR Morb Mortal Wkly Rep*. 2001;50:1-53.
33. US Preventive Services Task Force. Screening for chlamydial infection. *Am J Prev Med*. 2001;20:90-93.
34. Begley CE, McGill L, Smith PB. The incremental cost of screening, diagnosis, and treatment of gonorrhea and chlamydia in a family planning clinic. *Sex Transm Dis*. 1989;16:63-67.
35. Medical Economics Company. *2003 Drug Topics Red Book*. Montvale, NJ: Medical Economics Company, Inc; 2003.
36. Gift TL, Malotte CK, Ledsky R, et al, and The GCAP Study Group. A cost-effective analysis of interventions to increase testing in patients treated for gonorrhea or chlamydia at public sexually transmitted disease clinics. *Sex Transm Dis*. 2005;32:542-549.
37. Beckwith CG, Flanigan TP, del Rio C, et al. It is time to implement routine, not risk-based, HIV testing. *Clin Infect Dis*. 2005;40:1037-1040.
38. Manavi K, Welsby PD. HIV testing should no longer be accorded any special status. *BMJ*. 2005;330:492-493.
39. Lyons MS, Lindsell CJ, Ledyard HK, et al. Health department collaboration with emergency departments as a model for public health programs among at-risk populations. *Public Health Rep*. 2005;120:259-265.
40. Soofi H, Benbow N. HIV/AIDS: an epidemiologic profile. CITY X, Illinois: CITY X Department of Public Health Epidemiology Program, 2002.
41. Mehta SD, Rompalo A, Rothman RE, et al. Generalizability of STD screening in urban emergency departments: comparison of results from an inner city and urban sites in Baltimore, Maryland. *Sex Transm Dis*. 2003;30:143-148.
42. Marks G, Crepaz N, Senterfitt JW, et al. Meta-analysis of high-risk sexual behavior in persons aware and unaware they are infected with HIV in the United States: implications for HIV prevention programs. *J Acquir Immune Defic Syndr*. 2005;39:446-453.
43. Weinhardt LA, Carey MP, Johnson BT, et al. Effects of HIV counseling and testing on sexual risk behavior: a meta-analytic review of published research, 1985-1997. *Am J Public Health*. 1999;89:1397-1405.
44. Mehta SD, Bishai D, Howell MR, et al. Cost-effectiveness of five strategies for gonorrhea and chlamydia control among female and male emergency department patients. *Sex Transm Dis*. 2002;29:83-91.
45. Thomas P, Pollack HA, Boulton ML, et al. Cost-effectiveness strategies for screening chlamydia trachomatis in Michigan. 2004 American Public Health Association Conference. November 8-10, 2004; Washington, DC.
46. Aledort JE, Hook EW III, Weinstein MC, et al. The cost effectiveness of gonorrhea screening in urban emergency departments. *Sex Transm Dis*. 2005;32:425-436.
47. Chesson HW, Pinkerton SD. Sexually transmitted diseases and the increased risk for HIV transmission: implications for cost-effectiveness analyses of sexually transmitted disease prevention interventions. *J Acquir Immune Defic Syndr*. 2000;24:48-86.
48. Harris SK, Samples CL, Keenan PM, et al, Boston HAPPENS Program. Outreach, mental health, and case management services: can they help to retain HIV-positive and at-risk youth and young adults in care? *Matern Child Health J*. 2003;7:205-218.
49. Sherer R, Stieglitz K, Narra J, et al. HIV multidisciplinary teams work: support services improve access to and retention in HIV primary care. *AIDS Care*. 2002;14(suppl 1):S31-S44.
50. Haukoos JS, Witt MD, Coil CJ, et al. The effect of financial incentive on adherence with outpatient human immunodeficiency virus testing referrals from the emergency department. *Acad Emerg Med*. 2005;12:617-621.

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