Assessing Missed Opportunities for HIV Testing in Medical Settings

Rebecca V. Liddicoat, MD, MPH, Nicholas J. Horton, ScD, Renata Urban, BA, Elizabeth Maier, BA, Demian Christiansen, MPH, Jeffrey H. Samet MD, MA, MPH

BACKGROUND: **Many HIV-infected persons learn about their diagnosis years after initial infection. The extent to which missed opportunities for HIV testing occur in medical evaluations prior to one's HIV diagnosis is not known.**

DESIGN: **We performed a 10-year retrospective chart review of patients seen at an HIV intake clinic between January 1994 and June 2001 who 1) tested positive for HIV during the 12 months prior to their presentation at the intake clinic and 2) had at least one encounter recorded in the medical record prior to their HIV-positive status. Data collection included demographics, clinical presentation, and whether HIV testing was recommended to the patient or addressed in any way in the clinical note. Prespecified triggers for physicians to recommend HIV testing, such as specific patient characteristics, symptoms, and physical findings, were recorded for each visit. Multivariable logistic regression was used to identify factors associated with missed opportunities for discussion of HIV testing. Generalized estimating equations were used to account for multiple visits per subject.**

RESULTS: **Among the 221 patients meeting eligibility criteria, all had triggers for HIV testing found in an encounter note. Triggers were found in 50% (1,702/3,424) of these 221 patients' medical visits. The median number of visits per patient prior to HIV diagnosis to this single institution was 5; 40% of these visits were to either the emergency department or urgent care clinic. HIV was addressed in 27% of visits in which triggers were identified. The multivariable regression model indicated that patients were more likely to have testing addressed in urgent care clinic (39%), sexually transmitted disease clinic (78%), primary care clinics (32%), and during hospitalization (47%), compared to the emergency department (11%), obstetrics/gynecology (9%), and other specialty clinics (10%) ($P < .0001$). More recent clinical visits (1997–2001) were more likely to have HIV addressed than earlier visits ($P < .0001$). Women were offered testing less often than men ($P = .07$).**

CONCLUSIONS: **Missed opportunities for addressing HIV testing remain unacceptably high when patients seek medical care in the period before their HIV diagnosis. Despite improvement in recent years, variation by site of care remained important. In particular, the emergency department merits consideration for increased resource commitment to facilitate HIV testing. In order to detect HIV infection prior to advanced immunosuppression, clinicians must become more aware of clinical triggers that suggest a patient's increased risk for this infection and lower the threshold at which HIV testing is recommended.**

KEY WORDS: **multiple informants; delay; HIV screening; AIDS; risk factors.**

J GEN INTERN MED 2004;19:349–356.

Received from the Clinical Addiction Research and Education (CARE) Unit (RU, EM, JHS), Section of General Internal Medicine and the Clinical A1DS Program, Departments of Medicine (RU, EM, JHS) and Social and Behavioral Sciences (JHS), and Data Coordinating Center (DC), Boston University Schools of Medicine and Public Health, Boston, Mass; and Department of Mathematics (NJH), Smith College, Northampton, Mass; and General Medicine Division (RVL), Department of Medicine, Massachusetts General Hospital, Boston, Mass.

Address correspondence and requests for reprints to Dr. Samet: Section of General Internal Medicine, 91 East Concord St., Suite 200, Boston Medical Center, Boston, MA 02118 (e-mail: jsamet@bu.edu).

Approximately 900,000 persons in the United States are infected with HIV, a national prevalence of 0.3%.[1,2] Current Centers for Disease Control and Prevention estimates suggest that 30% of these individuals are unaware of their diagnosis; as many as 275,000 people are infected with HIV but do not know it.[3] HIV infection has become a chronic and treatable disease, but in order to benefit from treatments, infected individuals must be tested for the virus and linked to medical care. This is a challenging goal, as the infection is often asymptomatic until the onset of opportunistic infections, and without treatment the median time between diagnosis and the development of clinical AIDS is 9 to 11 years.[4,5] Patients frequently become aware of their HIV serostatus very late in the course of their disease, many years after seroconversion.[6] In two different clinical studies at our institution assessing patients between 1990 and 1991, and again from 1994 to 1996, the median CD4 cell count at the time of presentation for medical care for HIV infection was 300 and 280 cells/μl, respectively.[7,8] Although delays do occur between HIV testing and linking to care,[9,10] the greatest delay occurs between initial infection and HIV testing.[7] The value of HIV testing goes beyond enabling medical care for the infected individual. Some studies have demonstrated that knowledge of HIV serostatus, particularly when positive, decreases behavior that can result in HIV transmission.[11–13] Over a decade has passed since an early call to action about HIV testing was prominently stated, "the nation's physicians and other health care providers should assume a much more active role in promoting HIV testing."[14]

In order to assess the clinical response to this call to action, we investigated the extent to which physicians in a variety of care settings within a single urban medical center adopted recommended approaches to HIV testing. We assessed 2 issues among recently tested HIV-infected patients: 1) whether prior to HIV diagnosis, clinical opportunities for health providers to recommend HIV testing had arisen; and 2) the clinician's response regarding HIV testing when a clinical opportunity occurred.

Table 1. Triggers for HIV Testing Categorized by the Likelihood of Its Clinical Association with an HIV Diagnosis

Category 1 Unequivocable Triggers	Category 2 Strongly Suggestible Triggers	Category 3 Reasonable Triggers	Category 4 Borderline Triggers
Men Sex with Men	Tuberculosis	STDs	Alcohol abuse
IDU	Varicella Zoster	Gonorrhea	Alcohol withdrawal
PCP	Lymphadenopathy	PID	Homelessness
Esophageal Candidiasis	Hepatitis B/C	Chlamydia	Psychiatric diagnosis
MAC		Syphilis	Pregnancy
Toxoplasmosis		Trichomoniasis	Abnormal Pap smear
Cryptococcemia		Genital herpes	Candida Vaginalis
Kaposi's Sarcoma		Condyloma Acuminata	Comm acquired pneumonia
Oral Thrush		Pediculosis Pubis	Otitis Media
ITP		Urethritis	Oral herpes
Bacterial endocarditis		Prostatitis	Onychomycosis
Leukopenia		Epididymitis	Unspecified HSV
Thrombocytopenia		Heroin/crack/ substance abuse	Abscess
Pancytopenia		Sepsis	Cellulitis
Parotid tumor		Perleche	Psoriasis
		Candida groin rash	Seborrheic dermatitis
		Anal/penile Candida	Sinusitis
		Meningitis (bacterial/viral)	Pyelonephritis
		Staph Aureus bacteremia	Aspergilloma

IDU, injection drug use; PCP, Pneumocystis carinii pneumonia; MAC, Mycobacterium avium complex; ITP, idiopathic thrombocytopenic purpura; STDs, sexually transmitted diseases; PID, pelvic inflammatory disease.

METHODS

Study Subjects

We performed a retrospective chart review of patients who initiated HIV-related medical care at Boston Medical Center in the HIV Diagnostic Evaluation Unit (DEU) between January 1994 and June 2001. The DEU is a weekly clinic designed for the initial assessment and triage of all nonpregnant patients presenting for primary care (PC) for their HIV infection, regardless of insurance status.[15] Referrals to the DEU come from a wide variety of sources, including inpatient hospital services, hospital outpatient clinics, the emergency department (ED), the urgent care clinic (UCC), community health centers, drug treatment programs, HIV testing sites, local correctional institutions, as well as self-referrals.

Patients were eligible for this study if they were 18 years or older, had their initial positive HIV test within 1 year of their DEU visit, and had received medical care at Boston Medical Center prior to their first positive HIV test. We included clinic visits only after March 1985, when HIV testing became widely available.[6] Medical care at Boston Medical Center was required as these were the medical records available for review. This study was approved by the Institutional Review Board of Boston Medical Center.

Data Collection

We requested medical records of patients who met inclusion criteria based on the DEU clinic's log, which contained date of initial HIV-positive test and the hospital's computerized records, which listed the dates and sites of prior clinic visits and hospitalizations. Information abstracted from medical records included the following: date of birth, gender, race/ethnicity, homelessness status prior to initial positive HIV test, date of positive HIV test, initial DEU visit date, total number of visits to Boston Medical Center in the 10 years prior to the patient's initial positive HIV test, and CD4 cell counts.[16] If 2 initial CD4 counts were available from the first month of HIV-related care, then the mean number was recorded. If, in the encounter note, a patient was noted as homeless or living in a shelter, then the patient was considered homeless. When medical records were incomplete (e.g., missing certain volumes of a multivolume chart), whatever visit data were available were assessed. Each visit in the 10 years prior to the patient's initial positive HIV test, but none earlier than March 1985, was reviewed for patient characteristics or conditions considered as clinical triggers for HIV testing (Table 1). Three of the authors—two medical students (EM, RU) and a medical resident (RL)—performed all chart reviews and

recorded if the patient had any of the listed characteristics or conditions. Charts were reviewed with a predetermined list of clinical conditions. Chart reviewers could list other conditions that they considered potential triggers for HIV testing; however, after review with study investigators, greater than 95% of triggers came from the predetermined list. The site of the clinical encounter was recorded.

Triggers for HIV Testing

Triggers were hierarchically categorized based on the level of clinical suspicion for HIV infection associated with each after review of the medical literature.[16] For example, injection drug use (IDU) and men having sex with men (MSM) were defined as category 1 (unequivocable triggers), while homelessness and alcohol abuse were defined as category 4 (borderline triggers). Visits were categorized according to the highest (i.e., most unequivocable) category trigger present during that visit. For example, if a visit noted injection drug use, homelessness, lymphadenopathy, and gonorrhea, it was defined as a category 1 visit, due to the presence of IDU. We stratified triggers as either unequivocal, strongly suggestible, reasonable, or borderline for triggering HIV testing discussions; categories were identified as 1 to 4, respectively. If a trigger diagnosis was considered but not made definitively such as "tuberculosis versus bronchitis," then that was labeled borderline, category 4, even if the differential diagnosis included conditions listed in categories 1 to 3.

A "missed opportunity" for HIV testing was a visit in which HIV was not discussed yet contained at least 1 of the patient characteristics defined as "triggers." Visits with physicians, nurse practitioners, nurses, and dentists were reviewed for the presence of HIV trigger conditions recorded in the clinical note. Although clinician type was not possible to abstract in the chart review, physicians account for the overwhelming majority of clinical encounters with the exception that nurse and nurse practitioner encounters were most common in the sexually transmitted disease (STD) clinic. If a visit included 1 or more triggers, then additional information was collected about that visit assessing visit location, date, and other triggers, as well as whether HIV testing was considered or recommended to the patient. Examples of the "HIV considered" group were notes that stated "HIV negative 4 months ago" and "HIV a possibility." All potential HIV-associated conditions were recorded and categorized into the diagnoses in Table 1.

Defining Patient Characteristics

Prior to medical record review, we explicitly defined several patient characteristics. Alcohol abuse was recorded if "alcohol abuse" or "alcohol withdrawal" was noted or if the patient had a history of alcohol detoxification or was being admitted to alcohol detoxification. If a patient was recorded as drinking 12 or more beers or 1 pint of liquor/day, that was also recorded as alcohol abuse. Psychiatric diagnoses included depression and anxiety in addition to schizophrenia and psychosis. Abnormal Pap smears included histories and/or diagnoses of cervical dysplasia and cervical cancer. Substance abuse was checked if it was not specified which substances were being abused. Tuberculosis was not recorded if a patient had only a positive PPD in the absence of a positive chest radiograph. Lymphadenopathy included lymph node biopsy in addition to generalized and localized lymphadenopathy found on physical exam. Pregnancy included those patients admitted for spontaneous or induced abortion in addition to those that were receiving prenatal care or were admitted for delivery. Homelessness was recorded for persons living in shelters in addition to street dwellers. The time period of the clinical encounter was divided into 4-year intervals beginning with 1985 to 1988 and continuing through 1997 to 2001.

Statistical Analysis

Simple proportions of patients who had a record of a clinician's recommending or considering HIV infection were calculated for each of the trigger conditions. We examined triggers associated with a provider's missed opportunity to consider HIV testing using generalized estimating equation (GEE)[17,18] as implemented in SAS PROC GENMOD (SAS Institute, Cary, NC). These models accounted for the correlation between visits recorded for a given subject. An exchangeable working correlation matrix was assumed, and an empiric variance estimator was used to generate standard error estimates for the regression parameters. Potential confounding variables (gender, age of first diagnosis, race/ethnicity, homeless status, and time period of the clinical encounter) were included in the model, along with visit site and trigger category. In secondary analyses, the model was also fit excluding visits from 1985 to 1993, to assess the consistency of results only using more recent data, and also refit excluding category 4 (borderline triggers).

We performed additional secondary analyses with 10 selected triggers of particular clinical interest: men having sex with men, community-acquired pneumonia, hepatitis B and/or C, homelessness, sexually transmitted diseases, weight loss, zoster, injection drug use, cocaine use, and alcohol abuse. For the analyses of the 10 individual triggers, we used an extended GEE model considering whether use of a particular trigger will yield different associations. These methods are similar to fitting separate logistic regression models for each of these specified triggers. A limitation of fitting separate models has been the lack of a method for deciding whether regression coefficients are different in the separate models, and how to combine results if they are not. We used new techniques[19–21] to fit models that allow different parameters for the association between trigger and outcome to appear in each of the equations. Using this model, it is possible to test whether there are different associations between each of these triggers and the outcome. Each subject contributes 10 observations to the data set (one for each trigger) for each visit, with an indicator as to whether that trigger was observed for that subject. An exchangeable working correlation structure was used, with subject as the

clustering variable. For these models, using the previous results for guidance, a parsimonious regression was fit that dropped race/ethnicity, homelessness status, and used a 2 category period variable (1985 to 93 vs 1994 to 2001).

RESULTS

Between 1994 and 2001, 1,400 patients were seen at the DEU clinic and of those, 358 preliminarily met the study eligibility criteria based on DEU and administrative hospital computerized records: HIV tested in the previous 12 months and received prior care at Boston Medical Center. Of the eligible 358 patients, medical records of 256 (72%) were located by the hospital records department. After review of the individual medical records, 7% (19/256) of patients were excluded because they did not meet 1 of the 2 eligibility criteria. Among the 237 remaining patient charts, we reviewed a total of 3,742 clinic visits. An additional 16 medical records were excluded because they did not have visits after March 1985, the year that the HIV test became widely available.[6] Among the remaining 221 patients' medical records, 5 were incomplete, but the available data were included in this study. There were 3,424 clinic visits for the 221 patients included in the final analyses.

All 221 patients had one or more triggers for HIV testing found in at least one encounter note. Triggers for HIV testing were noted in 50% (1,702/3,424) of the eligible visits reviewed among the 221 patients. HIV testing was recommended to the patient in 18% (299/1,702) of visits in which triggers were noted. HIV was considered in the note by the clinician without recommending testing in another 10% of visits (169/1,702). In total, HIV testing was recommended or considered in the provider note in 27% (468/1,702) of visits with triggers noted. The median number of visits per patient with a trigger was 5 (mean 7.7). The median number of triggers that a patient had per visit was 2.0 (mean 2.1).

Table 2. Characteristics of HIV-infected Patients Who Received Medical Care at Boston Medical Center Prior to Their HIV Diagnosis (*N* = 221)

	Characteristics	*n* (%)
Race/ethnicity	African-American	109 (49)
	White	27 (12)
	Hispanic	28 (13)
	Haitian/African	50 (23)
	Other	7 (3)
Age,* y†	18 to 24	10 (5)
	25 to 34	68 (31)
	35 to 44	96 (43)
	45 to 54	36 (16)
	55+	10 (5)
Gender	Male	146 (66)
	Female	75 (34)
CD4* (cells/μl)	≥200	124 (56)
	<200	96 (44)

* N = *220*.
† *Age at time of DEU clinic presentation.*

Demographic characteristics of the 221 patients (Table 2) include the following: 66% male, 49% African-American, 23% immigrants from an HIV endemic country, and 22% homeless. The mean age at the time of a positive HIV test was 39 years. In 44% of patients (96/220), the initial CD4 count was less than 200 cells/μl when diagnosed with HIV. The mean CD4 count was 328 cells/μl, while the median was 256 cells/μl. Only 51% (113/221) of patients had any PC visit in the Boston Medical Center system prior to the date of their initial positive HIV test.

Thirty-nine percent (670) of the clinical visits (*n* = 1,702) with HIV triggers were to the ED (370) or UCC (300). Primary care was the second most common clinical site with 18% (306). Hospitalization accounted for 13% (218) of such visits and obstetrics/gynecology 7% (119). Although HIV was addressed in 28% of the 1,702 visits, the percentage of these visits varied widely by site (Table 3). While 32% of visits to PC clinic and 39% of visits to UCC addressed HIV, only 12% of ED visits considered HIV infection. The site that most routinely considered HIV was STD clinic (78%), followed by hospitalization (47%). Other sites with low percentages for addressing the issue of HIV testing were other specialists (10%), obstetrics/gynecology (9%), and dermatology (14%).

The multivariable model for missed opportunities for recommending testing or considering HIV found that gender was a borderline significant predictor, with women being more likely to have a missed opportunity (odds ratio [OR], 1.42; 95% confidence interval [CI], 0.98 to 2.07). There was no overall association between race/ethnicity and discussion (degrees of freedom [d.f.], 4; $P = .44$). Older age at first HIV diagnosis was associated with missed opportunities (OR, 1.26 for each additional decade of age; 95% CI, 1.02 to 1.55), while homelessness ($P = .90$) had no significant association with HIV discussion or testing.

The year of the visit had a significant association with addressing HIV, showing that more HIV testing occurred over time (d.f., 3; $P < .001$). Compared to visits during the periods 1997 to 2001, visits during 1985 to 1988 (OR, 12.0; 95% CI, 6.0 to 23.9), 1989 to 1992 (OR, 3.6; 95% CI, 2.4 to 5.3), and 1993 to 1996 (OR, 1.9; 95% CI, 1.4 to 2.6) had greater odds of missed opportunities. Site of visit was also a significant predictor of missed opportunities for discussion (d.f., 7; $P < .0001$). Compared to the UCC, visits to the ED (OR, 4.2; 95% CI, 2.6 to 6.7), obstetrics/gynecology clinic (OR, 2.0; 95% CI, 1.1 to 3.6), other specialty clinic (OR, 4.0; 95% CI, 2.3 to 6.9), and surgical clinic (OR, 10.3; 95% CI, 2.0 to 53.3) had greater odds of a missed opportunity. Visits to the PC clinic (OR, 1.0; 95% CI, 0.7 to 1.5) were not significantly different from the UCC, while the STD clinic had lower odds of a missed opportunity (OR, 0.07; 95% CI, 0.04 to 0.15).

Trigger category was significantly associated with missed opportunities for testing (d.f., 3; $P < .0001$). Table 4 shows the percentage of time that HIV was discussed in visits stratified by trigger category. Compared to category 4 (borderline triggers), category 1 had lower odds of missed

Table 3. By Visit Site, the Percentage of Visits Where HIV Testing Was Recommended or Considered by a Clinician Stratified by Trigger Category

Visit Site	HIV Testing Was Recommended or Considered									
	Category 1 Trigger % (*n**/total†)		Category 2 Trigger % (*n*/total)		Category 3 Trigger % (*n*/total)		Category 4 Trigger % (*n*/total)		Total % (*n*/total)	
Primary care	67	(45/67)	42	(27/65)	22	(20/91)	7	(6/83)	32	(98/306)
ED	23	(19/84)	16	(10/64)	11	(11/104)	3	(3/118)	12	(43/370)
Urgent care center	62	(56/90)	41	(36/87)	31	(22/72)	6	(3/51)	39	(117/300)
STD clinic	100	(8/8)	89	(8/9)	74	(51/69)	100	(2/2)	78	(69/88)
Obstetrics/ gynecology	0	(0/4)	20	(1/5)	10	(5/48)	8	(5/62)	9	(11/119)
Other/ specialist	29	(8/28)	12	(3/26)	3	(1/32)	0	(0/28)	11	(12/114)
Hospital	68	(60/88)	73	(22/30)	32	(17/53)	9	(4/47)	47	(103/218)

* *n = number of HIV recommended/discussed visits.*

† *Total number of visits at that clinical site within the column's particular trigger category.*

ED, emergency department; STD, sexually transmitted disease.

opportunities (OR, 0.05; 95% CI, 0.03 to 0.08), as did category 2 (OR, 0.13; 95% CI, 0.08 to 0.21) and category 3 (OR, 0.27; 95% CI, 0.18 to 0.42). There were also statistically significant differences in missed opportunities among trigger categories 1 to 3. Compared to categories 2 and 3, respectively, category 1 had lower odds of missed opportunities (OR, 0.38, 95% CI, 0.25 to 0.58; OR, 0.18, 95% CI, 0.12 to 0.28). Category 2 had lower odds of missed opportunities than category 3 (OR, 0.49; 95% CI, 0.34 to 0.70).

In secondary analyses using only visit data from 1993 to 2001, the results were generally consistent, though women had significantly more missed opportunities for HIV testing ($P = .01$), and the age association was attenuated ($P = .16$). Results from the regression model were also similar when the category 4 trigger visits were excluded from the analysis.

When individual triggers were compared to one another, there was a significant difference between trigger type and whether HIV testing was recommended or considered (d.f., 9; $P = .05$), indicating that there were significant differences in clinicians' perceptions of the associations between the individual triggers and HIV discussion (while controlling for gender, age, location, and period). To help illustrate these differences, Table 5 lists the unadjusted percentage of visits with specific triggers where HIV was recommended or considered. Men having sex with men as a trigger was associated with the highest proportion of HIV testing being recommended or considered, 71%. When injection drug use was noted, HIV testing was recommended or considered 54% of the time. Zoster was the weakest trigger for HIV testing recommendation or consideration among the 10 individually assessed triggers.

DISCUSSION

More than 2 decades after AIDS was first described, patients continue to present for initial HIV-related medical care years after acquiring the virus. Although diagnosis of HIV infection at an asymptomatic stage is a challenge, it

Table 4. Examined by Patient Characteristic, Percentage of Visits Where HIV Testing Was Recommended, or Considered by a Clinician Stratified by Trigger Category

Patient Characteristics	HIV testing was recommended or considered									
	Cat 1 Trigger % (*n*/total)		Cat 2 Trigger % (*n*/total)		Cat 3 Trigger % (*n*/total)		Cat 4 Trigger % (*n*/total)		Total % (*n*/total)	
AA	48	(119/250)	36	(70/193)	26	(86/334)	6	(15/240)	29	(290/1017)
White	63	(45/71)	6	(4/64)	26	(12/46)	2	(1/52)	27	(62/233)
Hispanic	62	(24/39)	41	(16/39)	20	(11/56)	6	(3/51)	29	(54/185)
Haitian/African	58	(14/24)	30	(20/66)	22	(13/58)	8	(7/89)	23	(54/237)
Other	0	(0/6)	33	(3/9)	71	(10/14)	0	(0/1)	43	(13/30)
Male	49	(143/291)	32	(82/259)	29	(75/258)	4	(9/201)	31	(309/1009)
Female	60	(59/99)	38	(31/81)	23	(57/250)	6	(17/263)	24	(164/693)
All	52	(202/390)	33	(113/340)	26	(132/508)	6	(26/433)	28	(473/1702)

AA, African-American.

Table 5. Examination by Specific HIV Triggers in Medical Encounters Between 1994 and 2001 Where HIV Testing Was Recommended or Considered by the Clinician

HIV Trigger	% (Number of visits with HIV testing recommended or considered/total number of visits with triggers)
Men sex with men	71 (32/45)
Weight loss	68 (54/80)
Injection drug use	54 (91/167)
Hepatitis B and/or C	50 (51/103)
Community acquired pneumonia	50 (66/132)
Sexually transmitted disease	46 (100/217)
Crack/cocaine	42 (98/235)
Alcoholism/alcohol abuse	35 (49/139)
Homelessness	34 (57/167)
Herpes Zoster	21 (19/90)

is a goal worth pursuing, as early testing to achieve this objective can benefit both the patient and society.[13,22–25] Examination of the medical care of HIV-infected persons prior to an HIV diagnosis has received limited attention.

Demographic characteristics of the 221 patients in this study are similar to national averages for HIV-infected persons: 66% male and 49% African-American compared to 70% male and 54% African-American nationally;[26] 44% with CD4 counts below 200 cells/μl, similar to 36% found in several other urban centers.[27] Our study found that in less than 1 of 5 encounters with a clinical trigger for HIV infection, documentation was found in the chart that HIV testing was recommended to the patient. Clinical documentation of "consideration" of HIV infection, a less stringent criterion, occurred in only 28% of encounters. In the case of category 1 and 2 visits, with triggers such as injection drug use, lymphadenopathy, and varicella zoster, testing was recommended or considered only 52% for category 1 and 33% for category 2 visits.

A large number of the visits with triggers for HIV testing (39%, 670/1,702) were found in patients presenting to the ED or UCC, while 18% of visits were to PC clinic. Only half of the 221 patients had even 1 PC visit. This finding indicates that successful early HIV diagnosis in medical settings requires outreach beyond the PC clinical arena.

The site of the encounter was highly associated with HIV testing's being recommended or considered. Hospitalized and STD clinic patients had a relatively high level of addressing HIV while the ED and obstetrics/gynecology and surgical clinics had lower levels. Barriers to testing at these sites may relate to time pressures and absence of a structured system to facilitate testing. The STD clinic routinely highlights HIV testing on patient forms as a physician reminder, while the ED did not have a reminder system or a staff member to encourage HIV testing. However, neither the UCC nor PC clinic had a system for HIV testing, yet the rates of recommending HIV testing, while still poor, were 3 times that of the ED. Several possible explanations may account for the discrepancy between testing in the UCC and ED: the level of medical acuity in the UCC is less than the ED setting, and ED staff have less training in preventive medicine as compared to internal medicine physicians in the UCC. Only 21% of TB clinic patients with triggers had a documented HIV test recommendation. Considering that 28% to 46% of adults with TB in the United States are HIV infected,[28] 21% is a very low percentage. However, the small number of TB clinic encounters (n = 33) makes conclusions in this setting difficult.

Missed opportunities for HIV testing may reflect the lack of adequate HIV services in the clinics and ED. Requiring patients to return to an unfamiliar clinical setting like the ED to receive HIV test results may be more likely to result in persons not returning for test results.[29] It is also necessary for transient care sites to have effective systems for follow-up so that patients who test positive are able to engage in care.[30]

Our data indicate that even when triggers for HIV are present, clinicians either do not think of testing or do not document the consideration of this diagnosis. Developing systems whereby patients with selected "trigger" conditions presenting to EDs or other sites with high HIV prevalence are automatically offered HIV testing independent of the provider, would increase testing yet not add substantially to the burden of the provider. The Centers for Disease Control and Prevention has recommended that all high prevalence hospitals, those with greater than 1 new diagnosis of HIV per 1,000 inpatients, should implement testing for all inpatients. Implementation of such recommendations has yielded enhanced case findings of undiagnosed HIV-infected individuals.[31] Expanding this recommendation to other high-risk clinical sites would enhance testing efforts.

In November 2002, the Food and Drug Administration approved OraQuick, a rapid fingerstick test with results in 20 minutes (sensitivity of 99.6%, specificity of 100%).[32] Its utility may be particularly valuable in the UCC and ED setting in which patients are less likely to return for test results.[29] If instituted in the ED and other high-volume sites, rapid testing might enhance testing and increase linkage to care.[33,34]

The lower proportion of testing for females (24%) compared to males (31%) has been shown previously.[35] As the HIV epidemic becomes increasingly equally distributed between men and women, this past bias in provider risk perception for HIV needs to be eliminated.

Another potential barrier to expanded testing is the requirement of informed consent prior to testing. This requires a provider's time, which may decrease testing recommendation. If broader testing is to be implemented and explicit written informed consent continues to be considered essential prior to testing, then resources to enable this activity will be necessary.

A limitation of our study was dependence on chart review methodology to determine whether HIV testing had been considered or recommended between providers and patients. It is possible that discussions occurred but were not

accurately documented. Another limitation is the need to make explicit and categorize the triggers for HIV testing derived from recently published reports. This is necessarily an approximation and differences of opinion may exist about the categorization of particular characteristics or diagnoses. In addition, category 4 triggers may have been less broadly appreciated in the earlier years assessed. Another limitation is that these data reflect a single urban northeastern U.S. hospital. Although representative of many clinical settings, generalization of these results may not be applicable to all hospitals. Patients were chosen based on the existence of documented clinical encounters at the study institution prior to their knowledge of HIV infection. Some patients may have been ineligible due to their receiving care at other institutions prior to a positive HIV test. These patients' encounters may have differed from study patients.

CONCLUSIONS

Missed opportunities for earlier HIV testing have been the norm for patients who received medical care prior to their HIV diagnoses. Recommendation or consideration of HIV testing was noted in the clinical record in less than a third of such opportunities. Many HIV-infected patients received their medical care prior to HIV diagnosis at transient sites, the emergency department, and urgent care clinic. These data indicate the need to initiate expansive HIV testing in transient sites with high volumes of HIV-infected individuals. It should be the responsibility of providers in all clinical sites to ensure that opportunities to address HIV testing are not missed.

We appreciate Jennifer Whiteley's assistance with the preparation of this manuscript and Colleen LaBelle for her selfless efforts to address patients' needs in the DEU clinic and with the preparation of this manuscript. We would also like to thank Ernesto Falcon and the Medical Records Department of Boston Medical Center for their assistance with this project. Dr. Horton was supported in part by NIH grant NIMH RO1-MH54693. Ms. Urban and Ms. Maier were supported by the Boston University Medical Student Summer Research Program and the General Clinical Research Center at Boston University School of Medicine (M01-RR00533).

REFERENCES

1. McQuillan GM, Khare M, Karon JM, Schable CA, Vlahov D. Update on the seroepidemiology of human immunodeficiency virus in the United States household population: NHANES III, 1988–94. J Acquir Immune Defic Syndr Hum Retrovirol. 1997;14:355–60.
2. CDC. Guidelines for national human immunodeficiency virus case surveillance, including monitoring for human immunodeficiency virus infection and acquired immunodeficiency syndrome. MMWR Recomm Rep. 1999;48:1–31.
3. CDC. HIV and AIDS cases reported through June 2000. HIV AIDS Surveill Rep. 2000;12:1–41.
4. Bacchetti P, Moss AR. Incubation period of AIDS in San Francisco. Nature. 1989;338:251–3.
5. Morgan D, Mahe C, Mayanja B, Okongo JM, Lubega R, Whitworth JA. HIV-1 infection in rural Africa: is there a difference in median time to AIDS and survival compared with that in industrialized countries? AIDS. 2002;16:597–603.
6. Wortley PM, Chu SY, Diaz T, et al. HIV testing patterns: where, why, and when were persons with AIDS tested for HIV? AIDS. 1995;9:487–92.
7. Samet JH, Freedberg KA, Savetsky JB, Sullivan LM, Stein MD. Understanding delay to medical care for HIV infection: the long-term non-presenter. AIDS. 2001;15:77–85.
8. Samet JH, Retondo MJ, Freedberg KA, Stein MD, Heeren T, Libman H. Factors associated with initiation of primary medical care for HIV-infected persons. Am J Med. 1994;97:347–53.
9. Samet JH, Freedberg KA, Stein MD, et al. Trillion virion delay: time from testing positive for HIV to presentation for primary care. Arch Intern Med. 1998;158:734–40.
10. Turner BJ, Cunningham WE, Duan N, et al. Delayed medical care after diagnosis in a US national probability sample of persons infected with human immunodeficiency virus. Arch Intern Med. 2000;160:2614–22.
11. Berrios DC, Hearst N, Coates TJ, et al. HIV antibody testing among those at risk for infection. The National AIDS Behavior Surveys. JAMA. 1993;270:1576–80.
12. Coates TJ. Efficacy of voluntary HIV-1 counseling and testing in individuals and couples in Kenya, Tanzania, and Trinidad: a randomized trial. The Voluntary HIV-1 Counseling Testing Efficacy Study Group. Lancet. 2000;356:103–12.
13. Higgins DL, Galavotti C, O'Reilly KR, et al. Evidence for the effects of HIV antibody counseling and testing on risk behaviors. JAMA. 1991;226:2419–29.
14. Rhame FS, Maki DG. The case for wider use of testing for HIV infection. N Engl J Med. 1989;320:1248–54.
15. Samet JH, Libman H, LaBelle C, et al. A model clinic for the initial evaluation and establishment of primary care for persons infected with human immunodeficiency virus. Arch Intern Med. 1995;155:1629–33.
16. Freedberg KA, Samet JH. Think HIV: why physicians should lower their threshold for HIV testing. Arch Intern Med. 1999;159:1994–2000.
17. Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes. Biometrics. 1986;42:121–30.
18. Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. Biometrika. 1986;73:13–22.
19. Horton NJ, Laird NM, Zahner G. Use of multiple informant data as a predictor in psychiatric epidemiology. Int J Meth Psychiatr Res. 1999;8:6–18.
20. Horton NJ, Laird NM, Murphy JM, Monson RR, Sobol AM, Leighton AH. Multiple informants: mortality associated with psychiatric disorders in the Stirling County Study. Am J Epidemiol. 2001;154:649–56.
21. Pepe MS, Whitaker RC, Seidel K. Estimating and comparing univariate associations with application to the prediction of adult obesity. Stat Med. 1999;18:163–73.
22. Stover E, Steinberg L. Early detection of HIV: implications for prevention research. J Acquir Immune Defic Syndr. 2000;25:S93.
23. Choi KH, Coates TJ. Prevention of HIV infection. AIDS. 1994;8:1371–89.
24. Ho DD. Time to hit HIV, early and hard. N Engl J Med. 1995;333:450–1.
25. Kaplan JE, Masur H, Holmes KK, et al. USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus: an overview. USPHS/IDSA Prevention of Opportunistic Infections Working Group. Clin Infect Dis. 1995;21:S12–31.
26. Centers for Disease Control and Prevention. A Glance at the HIV Epidemic. Available at: http://www.cdc.gov/nchstp/od/news/At-a-Glance.pdf. Accessed July 21, 2003.
27. Dybul M, Bolan R, Condoluci D, et al. Evaluation of initial CD4+ T cell counts in individuals with newly diagnosed human immunodeficiency virus infection, by sex and race, in urban settings. J Infect Dis. 2002;185:1818–21.

28. Weis SE, Foresman B, Cook PE, Matty KJ. Universal HIV screening at a major metropolitan TB clinic: HIV prevalence and high-risk behaviors among TB patients. Am J Public Health. 1999;89:73–5.
29. Samet JH, Mulvey KP, Zaremba N, Plough A. HIV testing in substance abusers. Am J Drug Alcohol Abuse. 1999;25:269–80.
30. Batal H, Biggerstaff S, Dunn T, Mehler PS. Cervical cancer screening in the urgent care setting. J Gen Intern Med. 2000;15:389–94.
31. Walensky RP, Losina E, Steger-Craven KA, Freedberg KA. Identifying undiagnosed human immunodeficiency virus. The yield of routine, voluntary inpatient testing. Arch Intern Med. 2002;162:887–92.
32. Anonymous. Advancing HIV Prevention: New Strategies for a Changing Epidemic-United States, 2003. MMWR April 18, 2003.
33. Spielberg F, Kassler WJ. Rapid testing for HIV antibody: a technology whose time has come. Ann Intern Med. 1996;125:509–11.
34. Irwin K, Olivo N, Schable CA, Weber JT, Janssen R, Ernst J. Performance characteristics of rapid HIV antibody assay in a hospital with a high prevalence of HIV infection. CDC-Bronx-Lebanon HIV Serosurvey Team. Ann Intern Med. 1996;125:471–5.
35. Stein MD, Crystal S, Cunningham WE, et al. Delays in seeking HIV care due to competing caregiver responsibilities. Am J Public Health. 2000;90:1138–40.