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Comparison of Emergency Department HIV Testing Data with Visit or Patient as the Unit of Analysis

Michael S. Lyons, MD,
Department of Emergency Medicine, University of Cincinnati College of Medicine, lyonsme@ucmail.uc.edu

Christopher J. Lindsell, PhD,
Department of Emergency Medicine, University of Cincinnati College of Medicine, lindsecj@ucmail.uc.edu

Dana L. Raab, RN, MS,
Department of Emergency Medicine, University of Cincinnati College of Medicine, raabd@ucmail.uc.edu

Andrew H. Ruffner, MA,
Department of Emergency Medicine, University of Cincinnati College of Medicine, ruffneah@email.uc.edu

Alexander T. Trott, MD, and
Department of Emergency Medicine, University of Cincinnati College of Medicine, trotta@ucmail.uc.edu

Carl J. Fichtenbaum, MD
Infectious Disease Center, University of Cincinnati College of Medicine, fichtecj@ucmail.uc.edu

Abstract

Objectives—Outcomes in an episodic care setting like an Emergency Department (ED) are traditionally evaluated with comparison to the number of visits as opposed to the number of unique patients, yet it is common for a patient to present to the ED multiple times. We examined the differences in HIV screening programmatic outcomes that would occur if the analysis were conducted at the patient-level rather than the traditional visit-level. We hypothesized that while our ED-based HIV testing program does test some patients repeatedly, the primary programmatic outcome of percent positive is not substantially altered by the unit of analysis.

Methods—We reviewed the clinical database of an ED HIV testing program at a large, urban, teaching hospital from 2003–2007. Data were analyzed descriptively. The main outcome measure was the rate of positive test results computed with either the visit or the patient as the unit of analysis.

Corresponding Author, Michael S. Lyons MD, Department of Emergency Medicine, 231 Albert Sabin Way, University of Cincinnati Medical Center, PO Box 670769, Cincinnati, OH 45267-0769, Phone: 513-558-9180, Fax: 513-558-5791, E-mail: E-mail: lyonsme@ucmail.uc.edu.

Author Contributions:

MSL, DLR, AHR, CJL, ATT, and CJF participated in the conception and design of the program from which data was obtained. MSL, CJL, and CJF conceived the study. MSL, DLR, and CJL were involved with IRB approval. CJL provided data management and primary analysis. CJF, ATT, and CJL assisted MSL, DLR, and AHR in the supervision of the clinical program from which the data were collected. MSL, and CJL drafted the manuscript and all authors contributed substantially to its revision. MSL takes responsibility for the paper as a whole.

Conflict of Interest: none

Results—HIV testing was provided at 9,629 visits, representing 8,450 unique patients. For patient-level analysis, the proportion of patients found to be positive was 0.91%. For visit-level analysis, the proportion of tests with positive results was 0.83%. Of the 910 patients with repeat testing, 7 (0.77%) were identified as positive at a repeat test. The median time between tests was 383 days (range 1–1742).

Conclusions—Results changed little regardless of whether unique patients or unique visits were used as the unit of analysis. Any differences in positive rates were mitigated by the contribution of repeat testing to the identification of newly infected patients. Given these findings, and the difficulty of tracking repeat testing over time, visit-level analysis are appropriate for comparing programmatic outcomes when detailed modeling of epidemiology, cost, and/or outcomes is not required.

Keywords

Emergency Service, Hospital; Communicable Disease Control; Mass Screening; Preventive Health Services; Risk Factors; HIV seropositivity

Introduction

HIV continues to represent an enormous public health burden. In the United States, HIV incidence is estimated to be 54,230 new infections per year.[1] Further, it is estimated that approximately 21% of HIV infections remain undiagnosed, and nearly 38% of HIV diagnosis occur late within one year of AIDS diagnosis.[2] Of greater concern, there has been little improvement in these statistics over the past decade demonstrating the need for revised strategies and expanded efforts.[3]

Earlier diagnosis of HIV is a critical prevention measure; those who are aware of their infection can limit further transmission and receive life-saving therapy.[4–10] Because missed opportunities for earlier diagnosis are common in US healthcare settings,[11] the CDC has called for dramatic expansion of screening in healthcare settings. At the direction of the CDC, implementation efforts have primarily focused on non-conventional settings that serve disadvantaged patient populations without ongoing patient-provider relationships, such as emergency departments.[12, 13]

The number of patients tested for HIV in emergency departments (EDs) is growing dramatically, with some EDs now screening tens of thousands of patients annually.[12, 14–17] This likely leads to a proportion of tests that are not for newly tested patients, but that are repeat tests for patients that had already been tested. Until now, reports of ED HIV testing have considered visits as the primary unit of analysis, while some have not clarified the unit of analysis.[12, 14–19] Thus, any patient who underwent HIV testing in the same ED multiple times was counted in program statistics multiple times. To our knowledge, only two programs have considered the number of repeat tests in their screening programs. Mehta et al. reported that 17 of 1497 (1.1%) patients screened were repeat enrollments,[18] while White et al. reported that 885 of 9466 (9.3%) tests provided were for repeat visitors.[13] Although the characterization of repeat testing is beginning, the impact of repeat testing on clinical outcomes and programmatic reporting remains unknown. There is a growing need to understand service delivery on a longitudinal basis using unique patients rather than unique visits as the primary unit of analysis. Duplicate tests for the same patient are certain to have different and as yet unknown consequences for program costs and outcomes.

The episodic care settings targeted by the CDC, such as EDs, are in many ways primed to treat patient visits as discrete, independent events. There are also arguments for considering each test to be a unique event. Antibody testing may not detect very early infections, and there will be some number of incident cases among those who have been tested previously. Current CDC

recommendations call for repeat screening for patients 1) at each visit for a new complaint of STDs, 2) at least annually if they are at high risk for HIV, 3) before initiating a new sexual relationship, and 4) as needed on the basis of clinical judgment.[3] Conversely, HIV infection is not highly common in those without acknowledged risk in lower prevalence environments, and repeat encounters are not independent events, suggesting that treating repeat tests as unique events may be inappropriate. The importance of resolving duplicate tests for patients already known to be positive is particularly critical since epidemiological prevalence estimates depend on the number of people infected, not the number of tests conducted for which there was a positive result. Also, cost-effectiveness analyses promoting universal screening primarily consider a single lifetime test.[10, 20] While such debate sensitizes researchers and policy makers to the complexities of repeated tests, no consensus is likely without describing the extent of repeat testing in health-care based screening programs.

We quantify the extent of repeat testing in an ED-based HIV testing program, and explore the differences in programmatic outcomes that would be observed when reporting patient-level data compared with the traditional visit-level data. We hypothesized that while the program does test some patients repeatedly, the primary programmatic outcome of percent positive is not substantially altered by the unit of analysis.

Methods

Study Design

This was a secondary analysis of HIV risk counseling and testing data compiled in an electronic medical record. The Institutional Review Board approved the study.

Study Setting and Population

All adults presenting to the ED of a US Midwestern, urban, teaching hospital with an annual ED census of about 85,000 primarily indigent patients are eligible for HIV counseling and testing. The local county has a population of over 800,000 that is about 25% black, 72% white and 1.5% Latino.[21] We have previously estimated the lower limit of undiagnosed HIV prevalence in the ED as 43.3 per 100,000.[22] Health department surveillance data for the county indicate that the regional prevalence of HIV/AIDS is 217 per 100,000 persons.[23]

Our methods for the ED-based HIV counseling and testing program have been reported previously.[17] Briefly, patients are identified for targeted screening and diagnostic testing based on review of triage notations, electronic medical records, or referral by ED staff. Risk profile, clinician concern, and patient request are the primary means of selection. Patients are tested either by dedicated counselors or, when counselors are unavailable, by physicians. Written informed consent to undergo a confidential HIV test is required. Counselor-tested patients receive risk-reduction counseling using a structured interview seeking to promote an individualized, achievable plan for risk reduction. Program personnel undertake result notification when results become available, usually about a week after the patient encounter.

Outcome Measures

The main outcome measure for this study is the positive rate computed with the visit as the unit of analysis (positive test rate) or the patient as the unit of analysis (positive patient rate). The number of repeat tests and the duration of time between tests were also considered.

Data Analysis

Descriptive statistics are used to report the data. Data were managed using Microsoft Access (Microsoft Corporation, Redmond, WA) and they were analyzed using SPSS v 15.0 (SPSS Inc., Chicago, Il).

Results

From January 1, 2003 to December 31, 2007, HIV testing was offered during 15,462 visits. Overall, voluntary testing was accepted for 9,629 (62.3%) of these offers. There were 8,450 unique patients, 7,540 were tested only once and 910 were tested repeatedly; 734 were tested twice, 119 were tested 3 times, 39 were tested 4 times, and 18 were tested five or more times. The mean time between repeat tests was 478 days (SD 373 days) and the median time between tests was 383 days (range 1–1742 days). When considering only the time between the first and second test, the mean was 480 days (SD 386), and the median was 381 days (range 1 to 1742 days). Overall, 544 (46%) of the 1,179 repeat tests were conducted more than a year after the prior test.

The positive patient rate was 0.91%, while the positive test rate was 0.83%. The number of patients with repeat tests who tested positive was 7/910 (0.77%). Of seven patients who tested positive during a repeat test, six initially tested negative and converted during the course of the five years. The other had a missing result for the first test, returned to the ED 12 days later and was found to be HIV positive. Table 1 describes the sample with analysis at the level of the patient and visit.

Discussion

In our experience, one in eight HIV tests were for patients who had been tested previously. The positive patient rate and the positive test rate were comparable, likely because the positive test rate for repeat tests was not negligible. Reporting simple operational outcomes are unlikely to be greatly affected whether conducting analysis at the visit versus the patient level. Given the difficulties in resolving visit-level testing data in episodic care settings, per-visit analysis may remain acceptable when it is not possible to de-duplicate reports. However, the costs and outcomes of identifying a positive patient at a repeat test are unlikely to be the same as identifying a positive patient at their first. Patient-level data are required to understand the nuances of longitudinal population impact of screening in an episodic care setting. In our program, the number of repeat tests is sufficient to affect estimates of program impact measured using more comprehensive epidemiologic, cost, and outcomes analyses.

Results of this study and others indicate that repeat screening, whether intended or unintended, is likely to be an inevitable consequence of the CDC's recommendation to expand screening. In this study, we did not propose to implement a cost-effectiveness analysis of the benefits of including or excluding patients with a prior test from screening. Our data do suggest that such a study is warranted; repeat testing on a targeted basis was about as effective at identifying HIV positive patients as providing an initial test, and has implications for decreasing the time from infection to diagnosis. Until such a study has been completed, clinical programs should not consider excluding patients with a prior HIV test from screening efforts. Research studies would be well served by accounting repeat patients separately from patients without a prior test.

While our investigation is specific to ED HIV testing, the role of other health care settings in population-based screening initiatives is likely to grow and identical issues may surface. Within emergency medicine, any targeted screening for conditions other than HIV might be expected to have similar findings. Our expectation is that the use of emergency settings as a means of improving public health through screening for disease will become an area of increasing emphasis for which longitudinal study of patients with multiple visits will be required. This analysis represents a preliminary step towards this broader field of investigation.

Limitations

Our results should be interpreted with consideration to study limitations. First, testing was offered during only a minority of ED visits and on a targeted basis. Our results may be dissimilar from programs that operate on a larger scale, use less controlled methods, or emphasize non-targeted as opposed to targeted screening. Beyond generalizability, data collection was conducted on a clinical basis rather than as part of rigorous research methodology. However, the program uses a structured, comprehensive risk assessment questionnaire and maintains patient identifiers. This enhances the quality of the clinical data and does allow for accurate estimation of repeat testing.

Conclusions

Repeat screening is an inevitable consequence of large scale screening programs in high-volume episodic care settings. The programmatic outcome of test positivity rate changed little regardless of whether unique patients or unique visits were used as the unit of analysis; visit-level analysis remains an acceptable means of comparing such basic program methods and operational measures. However, even the small observed differences in programmatic outcomes occurring as a result of patient-level analysis are likely to impact epidemiological studies and detailed cost-effectiveness and outcome studies. While the relative costs and outcomes associated with repeat screening remain poorly characterized, current clinical priorities should emphasize expansion of testing even if this results in a proportion of patients who are screened repeatedly.

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Table 1

Sample with analysis at patient level versus visit level

	Per-patient (N=8450)		Per-visit (N=9629)	
Age	31	(11)	31	(11)
Sex				
Male	4448	(52.6)	5084	(52.8)
Female	3955	(46.8)	4489	(46.6)
Transgendered	2	(0.0)	2	(0.0)
Unknown	45	(0.5)	54	(0.6)
Race				
White	2262	(26.8)	2441	(25.4)
Black	5766	(68.2)	6721	(69.8)
other or mixed raced	92	(1.1)	100	(1.0)
Hispanic	184	(2.2)	196	(2.0)
Unknown	146	(1.7)	171	(1.8)
HIV test results				
Negative	8073	(95.5)	9208	(95.6)
Positive	77	(0.9)	77	(0.8)
Indeterminate	38	(0.4)	46	(0.5)
Unknown	262	(3.1)	298	(3.1)