HIV Partner Notification Outcomes for HIV-Infected Patients by Duration of Infection, San Francisco, 2004 to 2006

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Background: The San Francisco Department of Public Health conducts HIV third-party partner notification in the following populations based on standard Centers for Disease Control and Prevention (CDC) guidelines: (1) persons with acute and nonacute incident HIV infection tested at the municipal sexually transmitted disease (STD) clinic and the county hospital and (2) all county residents with early syphilis and long-standing HIV infection.

Methods: We reviewed routinely collected demographic and partner notification outcome data among acute and nonacute cases between 2004 and 2006 and among long-standing cases between July 2005 and December 2006. Outcomes were examined among the 3 case types.

Results: Most acute (n = 30), nonacute (n = 398), and long-standing cases (n = 335) occurred in gay/bisexual men (89%), and most case-patients were interviewed (80%). In acute and nonacute cases, 13% of partners tested for HIV were newly identified as HIV-infected. The number of patients interviewed per new HIV infection identified was 25 for acute cases, 21 for nonacute cases, and 39 for long-standing cases; however, half of recent new HIV infections were identified among partners of long-standing patients. Few patients or partners refused partner notification services.

Conclusions: Partner notification was acceptable and successfully identified new HIV infections. Other jurisdictions should consider implementing or expanding partner notification for HIV infection. More evaluation is needed of the effectiveness of partner notification among HIV-infected persons with other STDs.

Key Words: HIV, partner notification, public health

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Partner Services for HIV infection is a comprehensive HIV prevention intervention and includes third-party partner notification services. As opposed to partner notification initiated by a patient, where the HIV-infected person notifies his partners himself, in third-party partner notification the medical provider or health department staff confidentially notifies persons who might have been exposed to HIV of their exposure and offers counseling, HIV testing, and referral services. In addition to finding potential new cases of previously unknown HIV infection, third-party partner notification offers an opportunity for counseling of HIV-infected and HIV-uninfected partners about risk reduction strategies to prevent future transmission and acquisition of HIV. Federal law mandates that recipients of federal funds for HIV prevention and clinical care establish partner notification programs (patient notification, third party notification, or both) and make "good faith efforts" toward notifying spouses of HIV-infected individuals. In accord, most states have enacted state laws specific to HIV partner notification.[1] Third-party partner notification has been demonstrated to be more effective at notifying partners than patient-initiated notification in a small randomized controlled trial[2] and efficient HIV case-finding strategy in several states and cities,[3,4] and it can be cost-effective in terms of preventing new HIV infections as a supplement to standard publicly funded HIV testing programs.[5] Despite this, third-party partner notification is not routinely practiced in the United States, and in many third-party partner notification programs outcomes are unknown.[3,6] Furthermore, areas with a high proportion of HIV infection among gay men and other men who have sex with men report less success in identifying new cases of HIV infection through third-party partner notification,[3] and it has not been successful in San Francisco in the past.[7]

The San Francisco Department of Public Health (SFDPH) Sexually Transmitted Disease (STD) Prevention and Control Section conducts third-party HIV partner notification in the following select patient populations: (1) persons with acute HIV infection (with or without syphilis comorbidity) as detected by positive HIV RNA/negative

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HIV-antibody test results, (2) persons with nonacute incident HIV-infection (with or without syphilis comorbidity) as detected by new positive HIV-antibody test results, and (3) persons diagnosed with early syphilis who report nonincident long-standing HIV infection. To examine the association between duration of HIV infection and partner notification outcomes, we present outcomes of HIV partner notification among persons within those 3 groups, hereafter referred to as acute, nonacute, and long standing. We also examined the cost of HIV partner notification versus the cost of our municipal STD clinic's comprehensive HIV testing program in terms of detecting new cases of HIV infection.

Because of different social-sexual networks of patients, and perhaps the higher HIV viral load in patients during acute HIV infection, we expected that the highest proportion of newly identified HIV-infected partners would be observed among partners of acute patients, followed by nonacute and long-standing patients. This expectation was lent support by a recent study that found early HIV infection (<6 months' duration) accounted for half of new HIV infections in Quebec, Canada during 2001 to 2005.[8]

METHODS

The SFDPH staff members who conducted partner notification were trained extensively on standard Centers for Disease Control and Prevention (CDC) Partner Services methods, which included third-party partner notification.[9]

Since January 2004, Partner Services has been initiated with all acute and nonacute HIV-infected patients diagnosed at the San Francisco municipal STD clinic and, since July 2005, with these patients diagnosed at the county hospital and its affiliated clinics. Since July 2005, we have also conducted HIV Partner Services with all San Francisco residents diagnosed with early syphilis who report a long-standing HIV infection. Analysis of third-party partner notification outcomes was restricted to partners linked to persons who were diagnosed within our observation period (January 2004 to December 2006) and were interviewed by our staff.

San Francisco's Partner Services program offers an array of services to HIV-infected individuals (index cases): counseling sessions; referrals to social service, mental health and substance abuse treatment agencies; linkages to HIV primary care; and third-party partner notification. These services benefit the index cases and the greater community by notifying community residents of exposure to HIV, referring partners of index patients to needed medical and social services, and counseling partners at risk of acquiring or transmitting HIV, thereby potentially reducing HIV transmission within the community.

Third-party partner notification is available for all index case "contacts," which include known sex partners, persons with whom the index patient might have had sex (this is particularly relevant for anonymous Internet contacts), persons within the index patient's social/sexual network, and needle-sharing partners. During the interview, the index patient is asked about the total number of recent contacts (during the preceding year or since 3 months before his or her last negative HIV test result), the total number of contacts for which he or she is willing and able to give locating information, and the number of contacts he or she refuses to name. All contacts for which the index patient provided locating information are hereafter referred to as "named partners." Named partners were notified of their potential exposure by health department staff or, in some cases, by the index patient himself or herself with assistance from health department staff. Named partners were offered fast-tracked STD/HIV medical evaluation, including HIV testing at our municipal STD clinic.

Partner notification outcomes were recorded using standard CDC disposition codes. Any original dispositions incorrectly indicating a new case of HIV infection identified were reassigned to dispositions indicating a previous HIV infection if the following were true: the partner's date of HIV diagnosis preceded or was the same as the index patient's date of HIV diagnosis or the investigation initiation date, or the partner was already listed as a new HIV infection to an earlier index case. Partner HIV status outcomes were determined by staff investigation of SFDPH HIV testing records, self-report from the partner, or self-report from the index patient about the partner.

Comparison of cost per new HIV-infected person identified between partner notification and our municipal STD clinic's HIV testing and counseling program relied on several baseline assumptions. We estimated that investigators spent an average of 8 hours on partner notification for each acute and nonacute HIV index case, regardless of whether or not the index patient was actually interviewed. Because partner notification for syphilis is supported by syphilis control funds, the time required to investigate HIV outcomes for named partners was only an average of 1 additional hour per long-standing index case (regardless of whether or not the index patient was actually interviewed). These time estimates were derived from informal interviews with investigators. The hourly cost (including fringe benefits) of an average health department employee who conducts partner notification in San Francisco is $30. To estimate the cost of our partner notification program, we assumed that all partners tested for HIV infection were counseled and tested at our facility using rapid antibody and HIV RNA testing protocols and were given their HIV test results in a posttest counseling session. We did not include the cost of investigators' supervision, computers, office space rental, or overhead because these are fixed costs. Cost estimates for our municipal STD clinic's HIV testing program relied on current SFDPH laboratory fees and reimbursement rates for HIV counseling (Table 1). Clinic HIV test volume and positivity during 2003 to 2006 were obtained from a previously presented analysis.[10]

TABLE 1. Cost Incurred by Type of HIV Test at City Clinic, San Francisco, 2006

HIV Test Type	Total Cost Incurred
Standard antibody-negative with RNA testing	$75
Standard antibody-negative without RNA testing	$45
Standard antibody-positive	$60
Rapid antibody-negative with RNA testing	$86
Rapid antibody-negative without RNA testing	$56
Rapid antibody-positive	$86

RESULTS

From January 1, 2004 to December 31, 2006, HIV partner notification outcomes were recorded for 763 HIV-infected index patients, of whom 89% were gay men or other men who have sex with men and 54% were white. Of these, 80% (607 of 763) were interviewed and offered third-party partner notification, 12% (93 of 763) were unable to be located, and 8% (63 of 763) refused to speak with health department staff. Table 2 describes these findings by duration of HIV infection.

Interviewed index patients (n = 607) provided locating information on a total of 907 partners (1.49 partners/interviewed index patient = [partner index]). These named partners represented 11% (907 of 8263) of total acknowledged contacts and varied by case type: 3% (15 of 432) for acute, 7% (339 of 4947) for nonacute, and 19% (553 of 2884) for long-standing cases. For the acute and nonacute cases, a handful of individuals accounted for most of the total unnamed contacts, and many of these were anonymous contacts who were unable to be named. The 907 named partners were reported by 47% (285 of 607) of the interviewed index patients (53% did not name any partners). Fifty-six percent (161 of 285) of interviewed patients who named partners provided contact information for 1 partner, 17% (49 of 285) provided information for 2 partners, and 26% (75 of 285) provided information for 3 or more partners.

Partner notification outcomes varied by index case type (Table 3). Acute patients had the highest proportion of named partners with newly identified HIV infection at 7% (1 of 15), followed by nonacute patients at 4% (15 of 339) and long-standing patients at 1% (7 of 553). Including only partners who were tested for HIV infection, 25% (1 of 4 partners) were newly identified as HIV-infected among partners of acute patients, 13% (15 of 119 partners) among partners of nonacute patients, and 7% (7 of 95 partners) among partners of long-standing patients (Fig. 1). Because of insufficient locating information, residing outside of San Francisco, or other undocumented reasons, 20% (3 of 15) of acute, 30% (102 of 339) of nonacute, and 33% (180 of 553) of long-standing patients' named partners did not have HIV status outcomes investigated by staff. The proportion of partners refusing to speak with health department staff ranged from 20% (3 of 15) for acute cases to approximately 6% (21 of 339) and 9% (47 of 553) for nonacute and long-standing cases, respectively.

The number needed to interview (NNTI) per new HIV infection detected was 25 (25/1) for acute, 21 (308/15) for nonacute, and 39 (274/7) for long-standing cases. Combining acute and nonacute cases yielded an NNTI of 21 (333/16). When we restricted the analysis to July 1, 2005 through December 31, 2006, the period during which partner notification services were offered to all 3 HIV case types concurrently, 47% (7 of 15) of new HIV infections detected among partners were attributed to partner notification on long-standing HIV cases.

The 23 newly identified HIV-infected individuals were partners of 21 index patients. Most were sex partners (22 of 23), and 1 was not a sex partner but was within the index patient's social/sexual network of partners. Most (17 of 23) were tested at our facilities and, in turn, became index patients themselves in our analysis. One of these 17 cases led to 1

TABLE 2. Characteristics of HIV Cases Assigned for Partner Services by Duration of HIV Infection, San Francisco, 2004 to 2006*

	Acute HIV		Nonacute HIV		Long-Standing HIV		All	
	N	(%)	N	(%)	N	(%)	N	(%)
Total	30	(100.0)	398	(100.0)	335	(100.0)	763	(100.0)
Offered Partner Services								
Interviewed	25	(83.3)	308	(77.4)	274	(81.8)	607	(79.6)
Refused	3	(10.0)	37	(9.3)	23	(6.9)	63	(8.3)
Unable to locate	2	(6.7)	53	(13.3)	38	(11.3)	93	(12.2)
Race/ethnicity								
Asian/Pacific Islander	2	(6.7)	32	(8.0)	24	(7.2)	58	(7.6)
African American	5	(16.7)	69	(17.3)	28	(8.4)	102	(13.4)
Hispanic	9	(30.0)	100	(25.1)	65	(19.4)	174	(22.8)
Native American	0	(0)	4	(1.0)	6	(1.8)	10	(1.3)
White	14	(46.7)	188	(47.2)	209	(62.4)	411	(53.9)
Unknown	0	(0)	5	(1.3)	3	(0.9)	8	(1.0)
Gender								
Male	30	(100.0)	370	(93.0)	333	(99.4)	733	(96.1)
Female	0	(0)	22	(5.5)	0	(0)	22	(2.9)
Transgender	0	(0)	5	(1.3)	2	(0.6)	7	(0.9)
Gay/bisexual men								
Yes	30	(100.0)	322	(80.9)	327	(97.6)	679	(89.0)
No	0	(0)	76	(19.1)	8	(2.4)	84	(11.0)

*Acute HIV and nonacute HIV cases from January 1, 2004 to December 31, 2006; long-standing HIV cases from July 1, 2005 to December 31, 2006.

TABLE 3. Partner Notification Outcomes of HIV Cases Assigned for Partner Services by Duration of HIV Infection, San Francisco, 2004 to 2006*

	Acute HIV		Nonacute HIV		Long-Standing HIV	
	N	(%)	N	(%)	N	(%)
Total	15	(100.0)	339	(100.0)	553	(100.0)
Final disposition						
Negative	3	(20.0)	104	(30.7)	88	(15.9)
New positive	1	(6.7)	15	(4.4)	7	(1.3)
Not tested	0	(0)	3	(0.9)	4	(0.7)
Out of jurisdiction	0	(0)	4	(1.2)	8	(1.4)
Previous positive	5	(33.3)	97	(28.6)	231	(41.8)
Refused	3	(20.0)	21	(6.2)	47	(8.5)
Other	0	(0)	15	(4.4)	22	(4.0)
Unknown	0	(0)	5	(1.5)	9	(1.6)
Unable to locate	3	(20.0)	75	(22.1)	137	(24.8)

*Acute HIV and nonacute HIV cases from January 1, 2004 to December 31, 2006; long-standing HIV cases from July 1, 2005 to December 31, 2006.

newly identified HIV-infected partner through a second wave of partner notification (this case was included in the 23 cases previously identified). This individual was not tested at our facilities, and therefore did not become an index patient himself in our analysis. The remaining 6 newly identified HIV-infected individuals were missing the date and provider where the HIV diagnosis occurred (n = 4), or the recorded date of diagnosis was greater than that of the index case's diagnosis and the initiation of the investigation (n = 2).

The cost incurred per new HIV case found through partner notification approached that of our comprehensive HIV counseling and testing program. The 428 acute and nonacute cases required a combined 3424 (428 × 8 hours) worker hours, or $102,720 in labor, to complete. These resulted in 107 named partners testing negative for HIV infection (107 × $86 = $9202) and 16 testing positive for HIV infection (16 × $86 = $1376). Therefore, a total of $113,298 was spent in identifying 16 new infections, which is equivalent to $7081 per new case identified. The 335 long-standing cases required an additional 335 (335 × 1 hour) worker hours, or $10,050 in labor, to complete. These resulted in 88 named partners testing negative for HIV (88 × $86 = $7568) and 7 testing positive for HIV (7 × $86 = $602). Therefore, a total of $18,220 was spent in identifying 7 new infections, which is equivalent to $2603 per new case identified in addition to costs already incurred for syphilis partner management. The total cost of our municipal STD clinic's comprehensive testing and counseling program, including pooled RNA testing for acute HIV infection detection during a similar time period, was $598,524, and we identified 260 HIV-infected persons, which is equivalent to $2302 per case identified. If we excluded pooled RNA testing from our program, the cost would be $371,664 to identify 236 HIV cases at a cost per case identified of $1575.

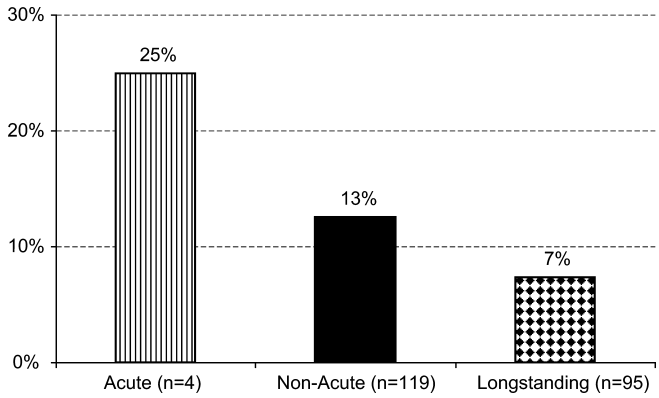

FIGURE 1. Percent of partners newly identified with HIV infection among those tested for HIV infection by duration of HIV infection in the index case, San Francisco, 2004 to 2006.*

*Acute HIV and nonacute HIV cases from January 1, 2004 to December 31, 2006; long-standing HIV cases from July 1, 2005 to December 31, 2006.

DISCUSSION

Partner notification successfully identified new cases of HIV infection among a primarily gay/bisexual male HIV-infected population in San Francisco. We found that 13% of named partners of acute and nonacute index patients tested for HIV infection were newly identified as HIV-infected. Few index patients or partners refused our HIV Partner Services. On average, 21 newly identified HIV-infected patients needed to be interviewed (NNTI) to identify 1 previously unknown HIV-infected person. This is substantially lower than the national average in a similar population (36.2 index cases per new infection).[3] It approaches the NNTI estimated to be cost-effective from a societal perspective in terms of HIV prevention when added to standard HIV testing programs (9.3 index patients per new infection).[3,5] Given the yield of newly identified HIV-infected individuals, third-party partner notification for HIV infection performed by well-trained staff should be further evaluated and potentially expanded locally and in other jurisdictions, including those with a high proportion of cases among gay men and other men who have sex with men.

Because of different social-sexual networks and higher viral loads during initial infection, we expected that the highest proportion of newly identified HIV-infected partners would be observed among partners of acute patients, followed by nonacute and long-standing patients. Although there were few partners of acute patients tested for HIV infection (n = 4), we did observe our hypothesized pattern with 25%, 13%, and 7% of named and tested partners of acute, nonacute, and long-standing patients having a newly identified HIV infection. Our findings are limited by the low number of acute cases overall (n = 30), the low proportion of named partners among all acknowledged partners (3%), and the low proportion of named partners who were tested for HIV infection (27%). Therefore, the increased biologic infectivity during acute HIV infection is just a single factor determining the proportion of partners newly identified with HIV infection found through partner notification services. This alone would not lead to a dramatic

difference between index case types unless a high proportion of all partners were named and tested for HIV infection.

Because almost half (47%) of new HIV infections during the most recent 18 months were identified among named partners of index patients with syphilis and long-standing HIV infection, more evaluation is needed of the yield and effectiveness of HIV partner notification among HIV-infected persons diagnosed with another STD. If partner notification is already occurring for an STD such as syphilis, formally adding HIV notification seems beneficial. Because there are substantially more people with long-standing HIV infection in San Francisco than with newly identified HIV infection, it seems that they might contribute equally or even more in absolute numbers to ongoing HIV transmission than newly identified HIV cases. In addition, early syphilis infection is associated with increased HIV viral load, perhaps increasing HIV transmissibility to partners of coinfected individuals.[11] The case-finding effectiveness of Partner Services among long-standing HIV-infected syphilis cases may not be generalizable to other locales not experiencing the coepidemics of syphilis and HIV infection currently occurring in San Francisco, however.

Our Partner Services program was more successful at partner notification than was previously reported from San Francisco.[7] One reason is that index patients are reflexively assigned to Partner Services staff for interview; thus, this service is not elected voluntarily by the index patient, although it can be refused. Others reasons for this greater success likely are the result of dedicated formally CDC-trained staff interviewing and counseling index patients about the importance of partner notification. STD Prevention and Control Partner Services staff are experienced at interviewing hundreds of patients with syphilis in San Francisco per year and working with those patients to gather names and contact information for their partners. In addition, our staff members are able to locate partners through multiple means, such as confidential public records, homeless shelter admissions logs, Internet sex sites, and field visits. These factors also may explain our greater success than previously described.

The partner notification program cost per new HIV case found was higher than that of our comprehensive HIV testing program. Partner notification with newly identified HIV cases was more expensive in terms of case finding (approximately $7081 per new case found), whereas partner notification with long-standing HIV-infected syphilis cases was similar (approximately $2603) to our standard HIV testing program (approximately $2300 per new case found). All these estimates are less than the $30,000 per case of HIV infection identified, which has been a reported as a cost-effective estimate.[12]

The proper classification of partner notification outcomes is critical in the evaluation of the program. The case-finding effectiveness of our program was previously overestimated[13] as a result of inaccurately interpreting raw partner notification outcomes. We corrected this through a recoding procedure that reduced the number of new HIV infections identified among partners during our observation period by more than one third. In addition, analysis was restricted only to cases with documented interviews by Partner Services staff, further reducing new cases. Without these refined and more accurate steps, the NNTI would have been 8, 10, and 25 for acute, nonacute, and long-standing cases, respectively. Partner notification staff use standard CDC disposition codes that do not differentiate between partners testing positive for HIV infection recently (in the past few months) from partners newly identified with HIV infection after the index patient tested positive for HIV and the investigation was initiated. Most of the recoded outcomes were a result of making this distinction. The remaining recoded outcomes were necessary because of investigators recording partner outcomes for index patients they did not interview. This was presumably attributable to perceived pressure to increase the productivity of their partner notification activities. These 2 factors resulted in a misclassification toward a more favorable partner notification outcome when we used the raw partner notification data. Other published reports of case-finding effectiveness of partner notification programs may not have performed additional data recoding measures and might have also overestimated their success.[3,4] Despite our recoding efforts, there remained 4 newly identified HIV-infected partners with missing dates of diagnosis whom we included in our analysis. This may have led to overestimates of our case-finding effectiveness if they were actually diagnosed before the date the index case investigation was initiated.

Standard CDC partner notification outcomes are not adequate for addressing whether third-party partner notification is an effective tool for finding new HIV cases. Using standard partner notification outcomes alone we could not determine whether a partner was tested for HIV as a result of patient notification, third-party partner notification, or both. In addition, for partners not tested at our clinics, we could not determine if the partner's HIV test results or serostatus as recorded by the investigators was obtained from the partners themselves, confidential public health records, or index patient reports. Because of these data collection limitations it is incorrect to assume that all new cases of HIV infection among partners are new cases found exclusively by third-party partner notification. We suggest amending the standard partner notification field record to include exactly how notification was performed and how final partner disposition was obtained. Further, we suggest more clarification in how partner disposition codes are defined, especially in regard to new HIV infections identified.

Partner Services is an important tool for identifying new cases of HIV infection; providing timely risk reduction counseling for HIV-infected and HIV-uninfected persons; and referring patients and their partners into social services, substance abuse programs, and clinical care. Other jurisdictions should consider implementing or expanding Partner Services for HIV infection with well-trained staff and careful and regular monitoring of outcomes.

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