Widespread HIV Counseling and Testing Linked to a Community-Based Tuberculosis Control Program in a High-Risk Population[1]

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The aim of the work reported here was to evaluate community-wide screening for HIV infection that was linked to a tuberculosis control program in a population at high risk for both infections. Between May 1990 and August 1992, adults in Cité Soleil, Haiti, were recruited by community health workers at their homes and in clinics for individual, clinic-based counseling and testing for HIV and tuberculosis. All of the screened subjects were offered post-test HIV counseling. Those with active tuberculosis received treatment, while those with latent tuberculosis and HIV infection were offered an opportunity to participate in a trial of antituberculosis chemoprophylaxis.

The 10 611 individuals screened for HIV represented 10.0% of the adult population in Cité Soleil. HIV infection was detected in 1 629 (15.4%) and active tuberculosis in 242 (2.3%). Latent M. tuberculosis infection was found in 4 800 (67.5%) of 7 309 community residents who completed tuberculosis screening, 781 (16.3%) of whom were coinfected with HIV.

The high prevalence of HIV infection found in this screened population, as compared to other groups undergoing HIV screening in the same community, suggests that people at high risk for HIV infection selectively sought or accepted tuberculosis clinic screening. Also, many people with active tuberculosis were identified earlier in the course of their disease than they would have been in the absence of a screening program. Overall, the results indicate that community-based screening for HIV infection within a tuberculosis control program can result in effective targeting of screening for both infections.

C ounseling and testing for human immunodeficiency virus (HIV) are important components of HIV prevention efforts because most infected people are unaware of their HIV serostatus and unknowingly transmit the infection to others

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(1, 2). Testing identifies individuals infected with HIV, and counseling, among other things, encourages behavior that limits the risk of infecting others. Counseling may heighten uninfected people's awareness of the risk of acquiring HIV (3). The U.S. Centers for Disease Control and Prevention spend over US$ 100 million annually to support HIV counseling and testing sites in the United States (4). However, widespread screening is hindered by the stigmatization surrounding HIV, which makes some people reluctant to seek HIV counseling and testing due to fears that confidentiality will be lost and they will be ostracized by their peers (5, 6).

The strong association between HIV and other sexually transmitted diseases (STDs) has stimulated efforts to link HIV counseling and testing to STD diagnosis and treatment (7). Testing people with STDs for HIV infection is an important intervention. Nevertheless, this approach is of limited effectiveness for widespread HIV screening because of stigmatization associated with STDs (8), the limited STD services that exist in many countries (9), and the services' ability to identify HIV only in people with symptoms of other STDs. Routine HIV counseling and testing for HIV among all hospital patients has also been suggested (10). However, this approach targets only a small percentage of the population, particularly in areas with limited health care resources. HIV counseling and testing has also been linked to prenatal care (11). This approach has been somewhat successful but excludes men.

Over 4 million people worldwide are infected with HIV and M. tuberculosis (12). Mathematical models predict a 60% increase in smear-positive tuberculosis among 15–45-year-old people by the year 2000 (13). The risk of tuberculosis in HIV-infected, tuberculin-positive individuals is 50 to 100 times greater than in comparable HIV-uninfected individuals (14),

and HIV-infected patients with tuberculosis appear to be efficient transmitters of tuberculosis (15). Early identification of people doubly infected with M. tuberculosis and HIV, followed by prompt institution of antituberculosis chemoprophylaxis and encouragement of adherence to therapy, are crucial public health interventions for controlling tuberculosis. In addition, tuberculosis control programs could provide a nonthreatening setting for HIV counseling and testing activities serving large numbers of people.

We have examined the outcome of a large community-based effort to screen people for tuberculosis and HIV in an area where both infections are common and where stigmatization associated with HIV infection has made people reluctant to undergo testing. The screening program data examined included both the number and certain characteristics of those identified with HIV, active tuberculosis, and M. tuberculosis-HIV coinfection.

METHODS

The study was performed in Cité Soleil, Haiti, a periurban community north of Port-au-Prince, where 180 000 people live in an area of five square kilometers. Per capita income averages less than US$ 150 per year, and literacy is estimated at 20%. Between 6% and 10% of the pregnant women and approximately 42% of the tuberculosis patients have been found HIV-1 seropositive in recent years (16, 17). The average annual incidence of tuberculosis among adults in this community has been 260 cases per 100 000 residents (Clermont HC, unpublished data).

From May 1990 through August 1992, healthy adults 16 years of age or older were screened for tuberculosis and HIV. Antituberculosis chemoprophylaxis is not routinely administered in this community; however, chemoprophylaxis was offered to screening subjects who were found doubly infected with M. tubercu-

losis and HIV as part of a trial comparing the effects of isoniazid with those of rifampin and pyrazinamide.

Residents had previously been recruited from this community and trained as volunteer health promoters. Following a two-week training program, these community health workers (CHWs) were serving as a link between the health care delivery system and the community, performing work that included encouraging prenatal care visits, childhood vaccinations, and early clinic visits for illness.

As part of the tuberculosis-HIV screening program, six CHWs underwent a specially designed two-day training program in which they learned about tuberculosis and the relationship of tuberculosis with HIV. These CHWs recruited residents by walking through all 13 recognized neighborhoods within the community of Cité Soleil, informing local leaders individually and in scheduled meetings (and informing other adult residents in chance meetings) about the risk of tuberculosis and the availability of tuberculosis testing and treatment at the tuberculosis clinic. (Group and individual HIV education was provided in the private setting of the tuberculosis clinic.) The CHWs also provided similar information to adults attending three outpatient clinic sites in Cité Soleil which offered general medical, obstetric, gynecologic, and pediatric services. Clients were not given a monetary incentive to make an initial visit to the tuberculosis clinic, but the CHWs were given incentives for meeting performance standards as measured by the number of persons referred to the tuberculosis clinic. No formal public information campaign was included in this recruitment effort.

Trained nursing personnel at the tuberculosis clinic provided group education about tuberculosis and HIV followed by individual HIV pretest counseling and procurement of oral informed consent. After the participant's consent was obtained, nurse auxiliaries requested demographic information, placed a Mantoux tuberculin skin test (5TU), scheduled a chest radiograph at the Cité Soleil hospital located about half a kilometer from the clinic, provided additional pretest counseling, and drew blood for HIV testing.

Tuberculin skin tests were read by trained nursing personnel two to seven days after placement. In accord with American Thoracic Society and CDC recommendations (*18*), positive results were considered to be an induration ≥5 mm in HIV seropositive subjects and ≥10 mm in HIV seronegative subjects. Blood specimens were screened for antibodies to HIV-1 using a commercial enzyme immunoassay (Organon-Teknika, Durham, North Carolina), HIVCHEK (Dupont, Wilmington, Delaware), or Latex agglutination (Cambridge Bioscience, Worcester, Massachusetts). Samples positive at least twice by these methods were tested by Western blot with commercially prepared strips (Dupont, Wilmington, Delaware). HIV test results and HIV posttest counseling were provided by a trained nurse counselor. Chest radiographs were read by physicians who were unaware of the patient's HIV-1 serologic status. Clients with abnormal chest radiographs or symptoms suggestive of tuberculosis were evaluated by microscopic sputum examination and culture. Active tuberculosis was defined by isolation of *M. tuberculosis* from sputum, by identification of acid-fast bacilli of characteristic morphology on a sputum smear from a patient with clinically compatible disease, or by the presence of clinically compatible disease that responded to antituberculosis therapy.

Proportions were compared by chi-square and analysis of variance, and means were compared using Student's *t*-test. The Statistical Package for the Social Sciences (SPSS) software was used for this analysis.

RESULTS

In all, 11 068 people 16 years of age or older initiated screening for tuberculosis and HIV over a 27-month period. These participants represented 10.5% of the adult population of Cité Soleil, which was estimated at 105 616 by the 1990 census. The total number of people who were informed about the screening project but did not attend the clinic is unknown. However, in response to a group interview, the six CHWs estimated that approximately 60% of the persons with whom they had individual contact accepted screening.

Of the 11 068 participants, 443 (4.0%) yielded incomplete HIV screening data, (e.g., test result documentation form missing, demographic data not completely obtained, etc.). Fourteen others (0.1%) had indeterminate Western blot results, leaving 10 611 subjects who completed HIV screening. As the figures in Table 1 indicate, the mean age of the screened population was slightly younger than that of the overall adult population, and a disproportionate number of females participated in the study.

Of the 10 611 who completed HIV screening, 1 629 (15.4%) were HIV seropositive, as compared to 6%–10% of the community's pregnant women who were tested in recent years (16). In addition, 242 (2.3%) of the screened adults were diagnosed as having pulmonary tuberculosis, indicating a prevalence of 2 281 cases per 100 000 among the adults participating in this screening project.

Tuberculin skin testing was completed in 7 309 (68.9%) of the 10 611 subjects screened for HIV. The most common reason for incomplete tuberculin skin testing was failure of the subject to return for interpretation of the test after seven days.

Compared to those who failed to return, the participants who returned to obtain skin testing and other test results tended to be older (mean age 31.9 years versus 27.9 years, $P < 0.01$), were more likely to be married (69.5% versus 63.7%, $P = 0.03$), and tended to have less education (mean years of schooling 2.8 versus 3.7, $P < 0.01$). However, they showed no significant differences in terms of HIV serologic status, gender, employment, or the likelihood of having an abnormal chest radiograph.

Positive tuberculin reactions were observed in 781 (70.0%) of the HIV seropositive participants and 4 019 (64.9%) of the HIV seronegative participants. Among those 16 to 29 years of age, the prevalence of positive tuberculin skin tests was significantly greater ($P < 0.01$) among HIV seropositive individuals than among HIV seronegative individuals (Figure 1). Bacille Calmette-Guerin (BCG) scars were found on 31.6% of the HIV-seropositive and 33.1% of the HIV-seronegative participants.

On the average, participants who were HIV-seropositive tended to be slightly younger than their HIV-seronegative counterparts and were slightly more likely to be male and to have a positive tuberculin skin test; they were also considerably more likely to have an abnormal chest X-ray and/or active tuberculosis (Table 2). Pulmonary tuberculosis was diagnosed in 5.8% of the HIV-seropositive participants, as compared to 1.6% of those who were HIV-seronegative (odds ratio [OR] = 3.7, 95% confidence limits [CL] = 2.8, 4.8).

Table 1. Characteristics of the population screened for HIV and tuberculosis. Cité Soleil, Haiti, 1990–1992.

	Screened	General community*
Adults (No.)	10 611	105 616
Mean age in years (± 1 SD)	31.1 (± 11.3)	37
Female (%)	71.1	53.0
HIV prevalence (%)	15.4	6–10†

*Estimated from the 1990 census.
†HIV seroprevalence in pregnant women (16) and unpublished data.

Figure 1. Percentages of HIV seropositive and seronegative participants who responded positively to PPD tuberculin testing, by age group. (* indicates $P < 0.01$).
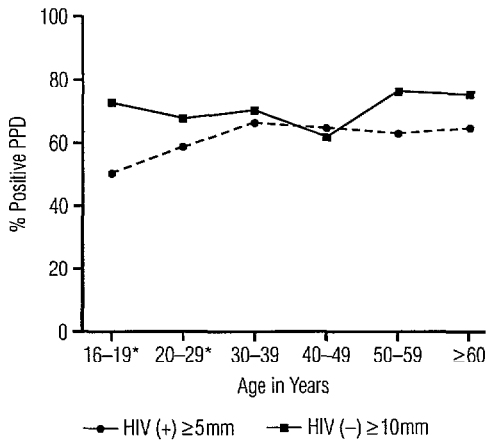
DISCUSSION AND CONCLUSIONS

In the United States, between 1985 and 1992 over 51 700 "excess" tuberculosis cases were attributed to declining socio-economic conditions, a diminishing tuberculosis control infrastructure, and the HIV epidemic (19, 20). Although less accurately quantified in highly endemic areas such as Africa and Southeast Asia, in general the prevalences of both HIV and tuberculosis have continued to increase (1, 21). Coinfection with these agents has been observed in 10% to 46% of the tuberculosis patients in the United States (22) and in up to 66% of the tuberculosis patients in other nations (21). Given the impact of HIV infection on the risk of developing tuberculosis (14) and the probable impact of tuberculosis on the clinical course of HIV (23, 24), the health benefits of screening for both infections are substantial in populations where the prevalences of these infections are high.

Public health efforts to control HIV and tuberculosis depend upon identification of large numbers of latently infected or asymptomatic individuals. Within this context, it is noteworthy that tuberculosis control in the United States during the first half of the twentieth century was based on early case-finding through widespread community-based screening efforts (25). These mass surveys included physical examinations (26), chest radiographs (27, 28), and tuberculin skin testing (29, 30). Such surveys done in settings with high rates of tuberculosis have identified large numbers of candidates for chemotherapy and chemoprophylaxis, though screening surveys conducted among populations with lower tuberculosis prevalences have not proved cost-effective (25, 30).

A consistent finding from population-based surveys is the heterogeneity of tuberculosis in a population. This has led to recommendations for targeted tuberculosis screening (31). However, experience is limited in determining the feasibility and utility of community-wide screening in populations where HIV-re-

Table 2. Characteristics of screened population by HIV serologic status. Cité Soleil, Haiti, 1990–1992.

	HIV-seropositive n = 1 629	HIV-seronegative n = 8 982	Odds ratio (95% CL)	P value
Mean age in years (± 1 SD)	30.1 (± 8.4)	31.4 (± 11.9)		< 0.001
Female, No. (%)	1 076 (67.7)	6 464 (73.7)	0.76 (0.68, 0.85)	< 0.001
PPD skin test positive,* No. (%)	781 (70.0)	4,019 (64.9)	1.26 (1.10, 1.45)	< 0.001
Abnormal chest radiograph, No. (%)	277 (18.8)	744 (9.2)	2.27 (1.95, 2.65)	< 0.001
Active tuberculosis, No. (%)	94 (5.8)	148 (1.6)	3.66 (2.79, 4.81)	< 0.001

*Cutoff points for positive readings: ≥5 mm among HIV positives, ≥10 mm among HIV negatives.

lated immunodeficiency is altering the natural history of tuberculosis.

Passive case-finding for tuberculosis in the 180 000-member Haitian study community of Cité Soleil identified approximately 250 individuals with active tuberculosis per year. Community-based screening in the study reported here detected 242 previously undiagnosed cases — indicating a prevalence of 2 281 active tuberculosis cases per 100 000 among screened adults in our study population. In addition, latent *M. tuberculosis* infection was detected in 781 individuals with HIV infection, which resulted in the administration of chemoprophylaxis to a majority of these people, who were at very high risk of developing active tuberculosis.

Although BCG vaccination in infants could have affected the skin test results, skin test reactivity usually wanes within several years of BCG vaccination (32). In areas where tuberculosis is prevalent, positive reactions among adults most likely signal true infection with *M. tuberculosis* (15). BCG scars were equally prevalent among the HIV seropositive and HIV seronegative adults in this study. The higher PPD reactivity in HIV seropositive individuals is most likely explained by the fact that the younger HIV-infected individuals, (i.e., ages 16–29) had acquired HIV infection more recently and were at an earlier stage of immune system deterioration than their older counterparts. Also, the smaller criteria (5 mm induration as opposed to 10 mm) used to define positive PPD reactions among HIV-seropositive individuals could have contributed to a higher positive skin test reaction rate being found among them than was observed among HIV-seronegative participants.

Besides promoting tuberculosis control, screening programs can provide an effective setting for HIV counseling and testing. In the case of the work reported here, 10% of the adult population of Cité Soleil was screened for HIV. A potential limitation here is the questionable effectiveness of HIV counseling and testing in preventing the spread of HIV. That is, HIV counseling and testing have been effective means of decreasing high-risk behavior among some groups (3), but these interventions have not been uniformly effective (33, 34). Effective counseling probably requires multiple contacts as well as development of interpersonal relationships and support in order to have a lasting impact (35). Moreover, an optimal counseling intervention needs to be developed and implemented in each setting where it is to be applied if it is to have the greatest possible impact upon HIV control. Counseling must also seek to protect the confidentiality and human rights of persons who undergo an HIV test. In our case we did not conduct postcounseling follow-up to determine if the screening and counseling resulted in reported changes of behavior.

This study may have a limited potential for replication in many countries where resources are scarce, even if both HIV and tuberculosis are endemic. This barrier is not easily overcome. However, the provision of HIV counseling and testing by activities such as tuberculosis control programs that provide health services to large numbers of people should be considered an important part of HIV prevention work as resources become available for HIV control activities. Large-scale community-based screening for HIV and tuberculosis may prove an important public health approach to disease control, provided that antituberculosis chemotherapy and HIV counseling services are available. To the degree that this is done, screening for both infections can lead to effective targeting of the screening effort. However, further investigation is needed to determine whether the investment made in providing these services to entire communities will lead

to long-term savings through illness prevention.

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Database Coverage of PAHO Journals

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