Tuberculosis Screening and Compliance with Return for Skin Test Reading among Active Drug Users

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ABSTRACT

Objectives. This study assessed the independent and combined effects of different levels of monetary incentives and a theory-based educational intervention on return for tuberculosis (TB) skin test reading in a sample of active injection drug and crack cocaine users. Prevalence of TB infection in this sample was also determined.

Methods. Active or recent drug users (n = 1004), recruited via street outreach techniques, were skin tested for TB. They were randomly assigned to 1 of 2 levels of monetary incentive ($5 and $10) provided at return for skin test reading, alone or in combination with a brief motivational education session.

Results. More than 90% of those who received $10 returned for skin test reading, in comparison with 85% of those who received $5 and 33% of those who received no monetary incentive. The education session had no impact on return for skin test reading. The prevalence of a positive tuberculin test was 18.3%.

Conclusions. Monetary incentives dramatically increase the return rate for TB skin test reading among drug users who are at high risk of TB infection. (*Am J Public Health.* 1998;88:792–796)

Introduction

Injection drug users are at increased risk for tuberculosis (TB),[1–3] and crack cocaine use has been associated with TB infection as well.[4,5] There are significant problems in conducting TB screening with out-of-treatment drug users and ensuring adequate therapy for those found to be infected.[6–8] Methods for increasing adherence include developing specialized educational interventions and providing incentives for adherence. Theories of human behavior may assist in the design of compliance interventions. One such theory, the theory of reasoned action,[9,10] postulates that changing a person's behavior is primarily a matter of changing the person's underlying beliefs about that behavior.

Incentives in TB treatment programs have rarely been systematically studied,[11] although the possible benefits of using incentives have long been recognized[12,13] and anecdotal evidence supports the usefulness of this approach.[14,15] A randomized trial that combined education and a monetary incentive showed that, for participants receiving preventive therapy, all measures of compliance were significantly better for the intervention group than for the control group.[16] Because the intervention group received both education and incentives, it was not possible to assess how each part of the intervention influenced compliance. A study with homeless individuals found that a monetary incentive appeared to be superior to either a peer advisor or usual care in increasing adherence to a first follow-up appointment.[17]

Our study was designed to assess the effects of different levels of monetary incentive, with and without a theory-based educational intervention, on return for TB skin test reading in a sample of active injection drug and crack cocaine users.

Methods

Participants

Participants (n = 1004) were recruited in Long Beach, Calif, from April 1994 to August 1995, either directly, through street outreach, or after completion of participation (length of participation: approximately 6 months) in a street outreach project aimed at human immunodeficiency virus (HIV) prevention for out-of-treatment injection drug and crack cocaine users. This project (the Cooperative Agreement for AIDS Community-Based Outreach/Intervention Research Program), sponsored by the National Institute on Drug Abuse (NIDA), was designed to evaluate the efficacy of alternative behavioral interventions to reduce the risk of HIV transmission. Participants in the present study were offered $5 for completion of a baseline study interview and skin test placement. All directly recruited participants were active injection drug and/or crack cocaine users who displayed evidence of recent drug use and who were not in a drug treatment program at the time. Participants recruited after participation in the HIV prevention study were active drug users at the time they were enrolled in the HIV prevention study, but some may have stopped using drugs prior to enrolling in the current study. Self-reported drug use for all subjects was validated by inspection for needle track marks

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and urine testing for opiates and cocaine at the time of initial study enrollment.

Study Procedures and Design

Study procedures were approved by the institutional review board at California State University, Long Beach. After providing informed consent, participants completed a brief interview that included questions about their TB history, drug use history, personal demographic characteristics, and knowledge and beliefs about TB. Individuals providing clear histories of a positive skin test were considered infected by history and were not eligible for this study. These individuals were offered follow-up testing and treatment as appropriate. As a means of minimizing duplicate enrollment, a list of previously enrolled individuals and their basic demographic characteristics was checked by study staff prior to enrollment of new participants.

After administration of the interview, participants were randomly assigned to 1 of 6 experimental treatment conditions stratified by recruitment source (HIV prevention study cohort or direct street outreach). Participants were assigned to the 6 experimental conditions in a ratio of 2:2:1:1:2:2.

Condition 1 participants (n = 203) received a 5- to 10-minute motivational education session based on the theory of reasoned action and were offered $10 to return for skin test reading. The motivational education session was provided by the study nurse at the time of the skin test placement, and the $10 incentive was paid if the participant returned as scheduled for skin test reading. Condition 2 (n = 198) was identical to condition 1 except that the monetary incentive was $5. Condition 3 participants (n = 99) did not receive any monetary incentive but did receive the motivational education session. In condition 4 (n = 100), the importance of returning for the skin test reading was stressed, but no additional education or incentive was provided. Condition 5 participants (n = 204) received a $5 monetary incentive for on-time return; however, except for the importance of returning being stressed, they did not receive any educational intervention. Condition 6 (n = 200) was identical to condition 5 except that these participants received $10 for on-time return.

The motivational education session was based on the theory of reasoned action and guided by information obtained from a prior exploratory elicitation study. Intervention content focused on those components of behavioral beliefs and subjective norms that most related to behavioral intention. An individual counseling format was used. Expectations of normative referents were identified, personal beliefs and outcome expectancies were clarified, and personal barriers to returning for test results and potential methods for overcoming these barriers were identified.

Skin testing was done through the intracutaneous administration of 5 units of purified protein derivative tuberculin (Mantoux test). All participants who had not had an HIV antibody test within 6 months were offered HIV testing and counseling as part of their participation in the TB screening study on the same day that the skin test was placed. All known HIV-seropositive subjects were tested for anergy at the time of their Mantoux test according to Centers for Disease Control and Prevention guidelines.[18] Those subsequently found to be HIV positive were asked to return for anergy testing if the tuberculin skin test was negative. All interviews, educational sessions, and skin tests were conducted by 1 of 2 study nurses.

An outside limit of 4 days (96 hours) for reading of skin tests was used. Those who had a skin test on Monday through Wednesday were given an appointment to return to have it read in 48 hours. No skin tests were given on Thursdays. Participants who had the test on Friday were given an appointment to return early Monday morning (after 63 to 72 hours). The percentage of subjects who returned as scheduled was calculated for each study treatment condition. The criterion for a positive skin test was greater than or equal to 5 mm of induration for both HIV-seronegative participants and HIV-seropositive participants who were nonanergic. All anergic participants were referred for follow-up testing.

As a means of determining skin test results for participants who did not return as scheduled, outreach workers began follow-up tracking if a participant had not returned within 4 hours of the scheduled appointment. Outreach workers were trained in measurement of purified protein derivative induration and were aware of the HIV serostatus of the participants.

Statistical Analyses

Analysis of variance (for continuous variables) and contingency table (chi-square) analysis (for categorical variables) were used in assessing baseline differences among the 6 treatment conditions. Univariate relationships of return for skin test reading with treatment condition, demographic characteristics, drug use characteristics, and intention were tested by means of chi-square analyses; when appropriate, continuity correction was applied. Intervention effects were also tested, in both univariate and multivariate logistic regression analyses, on a strict intention-to-treat basis. The univariate logistic regression tested the effect of treatment condition, with the no-intervention condition as the reference. The multivariate analysis included as covariates all variables that were found to be related ($P < .10$) to return for skin test reading in univariate comparisons. Parallel analyses assessing the relationship of demographic and drug use characteristics with Mantoux test results were conducted, with anergic participants included in the negative skin test group. Analyses were performed with a standard statistical software package.[19]

Results

Of the 1004 study participants, 707 (70.4%) were previous participants in the NIDA HIV prevention study, and 297 (29.6%) were new recruits. HIV test results were available for 934 participants; of these individuals, 34 (3.6%) were HIV seropositive. Table 1 contains descriptive data on participant characteristics. Nearly half of the participants reported current (previous 30 days) injection drug use, and more than 60% reported current crack use. (Urine drug screen results confirmed self-reported drug use in most cases; rates of agreement were 86% between self-reported cocaine use and the urine test result for cocaine and 87% between self-reported heroin use and the urine test result for opiates.) After randomization, there were no differences between treatment conditions for any demographic, drug use, or cognitive variables.

Return for Skin Test Reading

Of the 1004 participants, 782 (78%) returned on time for their skin test reading. There was a large difference in percentage of on-time return between individuals who received a monetary incentive and those who did not (see Table 2). More than 90% of those who received a $10 incentive and approximately 85% of those who received a $5 incentive returned on time, as opposed to only 33% of those who received no monetary incentive. Unadjusted odds ratios with the no-intervention group as the reference were 1.1 for the motivational education group, 12.3 for the $5-only group, 10.9 for the $5-plus motivational education group, 27.0 for the $10-only group, and 23.7 for the $10-plus motivational education group. Collapsing across incentive level and comparing the no-education participants (reference condition) with the participants who received

TABLE 1—Characteristics of Active Drug Users and On-Time Return for Skin Test Reading: Long Beach, Calif, April 1994 through August 1995

Characteristic	Total Sample (n = 1004), %	Returned on Time,%	P[a]
Age, y			.02
18–30	13.3	68.7	
31–40	47.3	77.9	
41–50	32.5	81.0	
51–69	6.9	76.8	
Race/ethnicity			.79
Native American	2.8	78.6	
African American	53.5	79.3	
Hispanic	15.2	77.1	
White	23.9	75.8	
Not classified	4.6	73.9	
Sex			.35
Male	68.1	78.8	
Female	31.9	75.9	
Education			.91
Less than high school	36.9	77.8	
High school graduate	40.2	78.5	
More than high school	22.9	77.0	
Work status			<.001
Some	22.5	67.7	
None	77.5	80.8	
Living arrangement			.59
Own home/apartment	43.5	79.9	
Other's home	37.7	75.5	
Motel	5.0	82.0	
Shelter	1.9	84.2	
Street	10.5	76.2	
Other	1.4	71.4	
Prior TB exposure (self-report)			.29
No	90.0	77.2	
Yes	7.9	83.5	
Don't know	2.1	85.7	
Ever injected drugs			.47
No	31.6	76.3	
Yes	68.4	78.6	
Ever used crack			.65
No	8.2	80.5	
Yes	91.8	77.7	
Ever been in drug treatment			.55
No	44.3	78.9	
Yes	55.7	77.1	
Self-reported current (prior 30 days) drug use			.77
None	11.7	74.4	
Injection only	24.2	79.4	
Crack only	40.7	78.2	
Crack and injection	23.4	77.4	
Urine drug screen results			.93
Negative	16.6	77.1	
Opiates only	4.2	76.2	
Cocaine only	46.7	78.8	
Both	32.6	77.4	
Binge drinking: prior month			.08
None	54.6	75.7	
Some	45.4	80.5	
Prior study participation			.06
Past participant	70.4	76.2	
New street outreach	29.6	81.8	
Reported return intention			.09
Very likely	85.8	78.9	
Other than very likely	14.2	72.0	

*Chi-square test

the motivational education intervention, the odds ratio was 0.97. Collapsing across education and using the no-monetary-incentive participants as the reference, the odds ratios were 11.2 and 24.5 for the $5 and $10 incentive participants, respectively.

Participants 30 years of age or younger were less likely to return than older participants, and participants who worked, even on a part-time basis, were less likely to return on time than those who did not work (Table 1). Three additional variables approached statistical significance. Subjects who reported that they had consumed 5 or more alcoholic drinks on at least 1 occasion in the prior 30 days were somewhat more likely to return on time than participants who had not done so, and subjects who reported, prior to treatment condition assignment, that they were very likely to return were more likely to do so than those who were less sure of their return likelihood. In addition, subjects who had not participated in prior research activities at our site were more likely to return than those who had. In the treatment conditions that did not receive any monetary incentive, much of the effect of prior participation status was due to a large difference in on-time return between those who had been in the HIV prevention study (29% on-time return) and those who were newly recruited (45% on-time return). The differences were much smaller for the groups that received $5 (84% vs 87%) or $10 (92% vs 94%). No difference was found between study nurses in the percentage of participants who returned on time for reading (78% for both nurses).

Table 2 presents the results of a multivariate logistic regression analysis of on-time return that included all variables found in univariate analyses to be at least marginally related to on-time return. All of the included variables except binge drinking remained significantly related to on-time return. The adjusted odds ratios for treatment condition were slightly larger than the unadjusted odds ratios, but the pattern was the same.

Skin Test Results

The skin tests of 835 participants were read. Of these individuals, 153 (18.3%) had positive tests, including 139 (17.8%) of the 782 who returned on time and 14 (26.4%) of the 53 who did not return on time. Only 1 participant had an induration between 5 and 9 mm. Twenty-nine of 34 HIV-positive participants had skin tests read; 3 had positive tests, and 6 were anergic. All 3 of the participants with positive tests had an induration of 10 mm or greater. Despite multiple contact attempts, 2 participants whose positive HIV results became available after reading of the Mantoux test could not be found to provide the positive HIV results or to undergo anergy testing.

Age ($P < .001$), race/ethnicity ($P = .02$), and sex ($P < .001$) were all related to skin test results, with lower rates of skin test positivity for younger participants, White participants,

TABLE 2—Logistic Regression Analysis of On-Time Return for Tuberculosis Skin Test Reading by 1004 Active Drug Users: Long Beach, Calif, April 1994 through August 1995

	Returned on Time, %	Adjusted Odds Ratio	95% Confidence Interval	*P*
Treatment condition				
No intervention	33.0	Reference		
Motivational education only	34.3	1.09	0.35, 2.00	.786
$5 only	85.8	13.59	7.49, 24.63	<.001
$5 and motivational education	84.3	12.88	7.13, 23.24	<.001
$10 only	93.0	30.94	15.25, 62.77	<.001
$10 and motivational education	92.1	25.96	13.17, 51.17	<.001
Current work status				
Some	67.7	Reference		
None	80.8	2.31	1.50, 3.46	<.001
Prior study participation				
Yes	76.2	Reference		
No	81.8	1.57	1.03, 2.31	.035
Age, y				
18–30	68.7	Reference		
31–40	77.9	1.36	0.81, 2.29	.241
41–50	81.0	2.05	1.17, 3.61	.013
51–69	76.8	1.60	0.70, 3.65	.265
Intention to return				
Other than very likely	72.0	Reference		
Very likely	78.9	1.65	1.01, 2.68	.044
Binge drinking: prior month				
None	75.7	Reference		
Some	80.5	1.09	0.79, 1.67	.464

and female participants. Participants who reported living in unstable housing situations ($P = .95$) and those reporting prior exposure to TB ($P = .74$) were not more likely to be skin test–positive than their appropriate comparison groups. Nearly identical percentages of subjects who had participated in a prior study and those who were newly recruited through street outreach had positive skin tests (18.4% and 18.3%, respectively). Participants who reported some alcohol use in the prior month were more likely to have a positive skin test than those who did not report prior-month alcohol use ($P = .06$).

It appears that crack users were at an equally high risk for TB infection as injection drug users. Self-reported history of injection drug use ($P = .54$), self-reported current injection drug use ($P = .96$), and urinalysis for opiates ($P = .90$) were not related to Mantoux test result. Participants whose urine was positive for cocaine were more likely than those with a negative cocaine urine screen to have a positive skin test ($P = .01$). A positive cocaine urinalysis could be the result of smoking crack cocaine or of injecting or snorting cocaine. Of the 195 participants who reported current use of both crack cocaine and injection drugs, 21% had a positive skin test, as compared with 23% of 117 who were current noninjecting crack users but had a lifetime history of injection drug use, 17% of 229 who were current crack users with no history of injecting, 16% of 143 who were current injectors who did not currently use crack but had a lifetime history of crack use, and 15% of 59 who were current injectors with no history of crack use ($P = .58$).

In a logistic regression analysis of Mantoux test results that included all variables found to be at least marginally related in the univariate analyses, alcohol use in the prior month was not related to skin test result; all of the other variables, however, remained related to skin test result.

Discussion

This randomized trial confirmed less systematic studies indicating that incentives can have a substantial impact on compliance. The difference between individuals who received $5 and those who received $10 was not nearly as great, however, as the difference between those who received any monetary incentive and those who received none. Thus, it appears that relatively small monetary incentives are nearly as effective as larger incentives in motivating return.

By contrast, the educational intervention appeared to have no impact on return rates. Because the research design was explained to all participants as part of the informed consent process, participants' knowledge that some individuals were receiving a monetary incentive to return may have had a negative impact on the motivation of those receiving no incentive. This disincentive effect may have lowered return rates for these individuals and masked any positive impact of the educational intervention. This possibility is supported by data from another TB screening study showing a moderate increase in skin test return rate for HIV-positive clients when education was added to a food-voucher-alone intervention.[20]

The finding that individuals who had participated in 1 or more of our prior project's HIV prevention studies were somewhat less likely than others to return for skin test reading was unexpected. Participants were stratified on prior study participation before assignment to treatment condition on the assumption that those who had developed a relationship with our project would be more likely to return than newly recruited subjects. However, because former study participants had been paid for most of these prior study activities, they may have been expecting payment for participating in the present study. For these individuals, the absence of monetary incentives may have had a specific negative impact on their motivation to return. This is supported by the finding that similar percentages of former study subjects and newly recruited subjects returned if they received a monetary incentive, but in the treatment conditions that did not provide a monetary incentive, newly recruited subjects were significantly more likely to return than

former study subjects. The results for newly recruited participants may be more generalizable to other populations of drug users than the results for our prior study participants.

Recent research on the use of incentives with drug users has also been conducted to determine the impact of these incentives in areas such as increasing participation in AIDS prevention sessions[21] and outpatient treatment of cocaine dependency.[22] A potential drawback in using monetary incentives with drug users is the concern of some that the money may be used to purchase drugs and that this is therefore not an appropriate use of public funds. It has also been argued that limited funds should not be diverted from direct prevention and treatment efforts for use as incentives. However, in the case of tuberculosis, the treatment costs for the individuals who develop active disease because of poor compliance with screening or chemoprophylaxis, along with treatment costs for contacts infected by these individuals (or costs for others with active disease who may have been discovered in the screening effort), may be considerably greater than the cost of the incentives. In addition, a considerable percentage of the cost of screening is associated with identification of high-risk individuals and placement of the skin test. These funds are essentially wasted if the individual does not return for reading.

The Mantoux test positivity rate of 18.3 per 100 persons screened confirms that these drug users were at high risk for infection, although prior studies found even higher rates of infection among drug users screened at a methadone maintenance clinic[23] and in samples of homeless drug users.[24,25] We excluded potential subjects who reported a prior positive skin test, and our rates would have been somewhat higher had they been included. While many participants had complicated drug-use histories, current crack users had a TB infection rate similar to (or slightly higher than) that of current injectors. This high TB infection rate may have been the result of the often similar socioeconomic circumstances of crack users and injectors. Crack use also frequently takes place in small groups in closed, dark rooms, and long-term crack use often results in increased coughing.

A logistical concern associated with the use of incentives is that some individuals may attempt to enroll more than once in the study or that ineligible subjects may try to enroll. Although precautions were taken to reduce duplicate enrollment and attempts were made to mask the study eligibility requirements when screening for eligibility, some individuals nevertheless misrepresented their TB screening history, received a skin test, and later admitted that prior tests had been positive. While this logistical issue did not affect these study results, a substantial level of duplicate and unnecessary screening in an ongoing program would reduce the cost-effectiveness of providing monetary incentives to increase return rates. We conclude that modest monetary incentives provide an effective means of increasing compliance in returning for skin test reading in this high-risk population. □

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