Self-Efficacy Estimates for Drug Use Practices Predict Risk Reduction Among Injection Drug Users

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ABSTRACT We used baseline outcome efficacy (OE) estimates for human immunodeficiency virus (HIV) risk reduction to predict subsequent risk reduction 6 months hence among 792 injection drug users in a prospective study. Declines in drug use, frequency of injection, and needle sharing were found among those with high OE scores after adjustment for baseline behavior and antecedent factors. No OE effect was found in multivariate analysis for shooting gallery attendance, a risk that substantially declined in this cohort. OE for needle disinfection was associated with reduced drug risk behaviors, but not for improved needle hygiene practices over time. The self-efficacy model is useful in understanding psychological factors in risk reduction among injection drug users.

KEYWORDS HIV Risk Reduction, Injection Drug Use, Outcome Efficacy, Risk Perception, Self-Efficacy, Social Learning Theory.

INTRODUCTION

A large and consistent body of evidence on social and behavioral aspects of risk reduction and behavior change was developed in the first decade of the human immunodeficiency virus (HIV) epidemic.¹ Because HIV is transmitted through unprotected sexual intercourse and the use of inadequately disinfected injection equipment among injection drug users, it is believed that such behavior can be prevented through appropriate behavior change strategies.² It is possible for individuals engaging in such behaviors to avoid these behaviors or their cues, to engage in less-risky (or safer) variants of these behaviors, or to select the context (and partners) in which the behaviors are performed to reduce their risk of HIV infection. Behavior change has been inconsistently practiced among injection drug users³ and others at high risk for HIV infection,⁴ and relapse has remained a significant concern among prevention scientists.⁵

Fisher and Fisher,⁶ among others, have reviewed the literature on HIV/AIDS (acquired immunodeficiency syndrome) behavior change models and offer a consensus model comprised of the following components: HIV risk reduction is a function of information and/or knowledge, motivation to reduce risk, and appropriate

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behavioral skills for performing specific acts involved in risk reduction. These factors are common to most behavioral models of AIDS risks, incorporating the theoretical perspectives of Bandura's self-efficacy model,⁷ Fishbein's theory of reasoned action,⁸ the Health Belief Model,⁹ and harm avoidance.¹⁰ While these approaches vary somewhat in the locus of intervention and the specific behaviors or antecedents to behavior that they address, in general, these concepts provide understanding of the basis for risk behaviors among IDUs and offer suggestions for interventions to effect behavior change.

One popular approach to understanding the dynamics and antecedents of HIV/AIDS risk behaviors comes from the approach based on the AIDS risk reduction model (ARRM).¹¹ Among the essential elements of the ARRM applied to injection drug use are knowledge of HIV infection, transmission routes, and risk perceptions¹²; social norms of appropriate drug use and disinfection practices¹³; motivation and perceived efficacy of behavior change¹³; and behavioral skills for risk reduction among injection drug users.¹⁴ This model suggests ways to understand why some injection drug users alter their behavior and why some seem impervious to change and to predict relapse in this population.¹⁵ These factors are important in investigations of the dynamics of HIV/AIDS risk behaviors, and the use of this approach offers a framework for analyzing complex behavioral phenomena. In this report, we assess the predictive power of self-efficacy estimates for behavior change in a cohort of active injection drug users and provide empirical data on the relative importance of selected components of the ARRM for risk reduction in this high-risk population.

METHODS

Subjects

Between February 1988 and March 1989, we recruited 2,921 injection drug users into the ALIVE Study (AIDS Links to the Intravenous Experience) in Baltimore, Maryland, principally (approximately 85%) through word of mouth, although participants were also recruited from emergency departments, HIV/AIDS clinics, health centers, and drug treatment programs.¹⁶ This longitudinal study seeks to characterize the risk factors for and the natural history of HIV infection among injection drug users. Less than 15% of participants were identified as being in active treatment for drug abuse at the time of enrollment. Enrollment criteria initially included being 18 years age and older, reporting a history of injection drug use at some time since 1977, and being free of AIDS at screening.

Participants in ALIVE all gave a history of injection drug use and are predominantly African Americans with low socioeconomic status, as determined by self-reported legal income, attained education, and current employment. A history of arrest and detention is common, and a large proportion of participants report having been homeless at some time during the prior 10 years. The majority of subjects are daily injectors, and the median duration of drug use at baseline interview was 12 years.¹⁷

Procedures

On entry into the study, and at 6-month intervals thereafter, participants followed a prescribed set of procedures. At baseline, after obtaining voluntary informed consent, all participants completed a demographic questionnaire, were provided pretest

AIDS counseling, submitted to venipuncture for the collection of serum for HIV antibody testing, and completed an in-depth interview on HIV risks (focusing on drug use and sexual activities). All subjects were asked to return to the clinic 2 to 4 weeks later to receive their antibody test results. Subjects were reimbursed \$10 for the initial screening visit and for returning for HIV test results. Sera were tested for antibody using enzyme-linked immunosorbent assay (ELISA; Genetic Systems, Seattle, WA), and repeatedly reactive specimens were confirmed using Western blot (DuPont, Wilmington, DE).

All participants found to have antibody to HIV were enrolled in the longitudinal natural history study of HIV infection, which required a visit every 6 months. Seronegative subjects were requested to return for repeat HIV testing at 6-month intervals. At the interval visits, participants responded to an interview about recent drug use, including frequency of injection, needle sharing, needle disinfection practices, and use of shooting galleries. A psychosocial assessment was incorporated into the interviews approximately a year after enrollment and was repeated on the next 6-month-interval visit. Trained interviewers with experience working with this population administered all questionnaires. In this report, we provide information on 792 IDUs (288 with antibody to HIV and 504 who are HIV seronegative) who provided data at three consecutive visits (a visit before the psychosocial assessment, the baseline self-efficacy estimate visit, and the subsequent 6-month follow-up visit) to ascertain drug behaviors. We included only participants who were active injection drug users (i.e., all reported having injected within the past 3 months) when the psychosocial measures were administered. Subjects with missing data ($n = 31$) were excluded from the analysis.

Instrument Development

A self-report, interviewer-administered questionnaire was developed to gather information about drug use, sexual behavior, condom use, outcome efficacy (OE) expectancies about drug use and disinfection procedures, perceived risk for HIV infection or AIDS, and social desirability. A review of the literature, intensive personal interviews, and focus groups were used to generate domains of content for scales and to develop wording appropriate for the subjects. Additional items were adapted from published studies. After pilot testing the resulting instrument with 50 subjects, the final questionnaire was administered to the cohort on two serial visits 6 months apart.

Measures

Besides demographic information and information concerning history of drug use and current drug and sexual practices, data were gathered on the following major constructs: outcome expectancies, drug use, HIV/AIDS knowledge, drug treatment, and antecedent factors.

Outcome Expectancies Two principal outcome expectancy measures were created for this study: (1) participants' perceived confidence in their ability to stop using drugs (three items) and (2) the extent to which they thought they could engage in safer needle hygiene practices (four items). We asked subjects to respond on a 5-point scale, ranging from "a good chance" (5) of making the behavior change, to "no chance" (1). Scales were summed across items and divided by the number of items. The scales demonstrated acceptable reliability as determined by Cronbach's alpha measure of internal consistency (outcome expectancy for cessation $\alpha = .92$;

outcome expectancy for disinfection $\alpha = .82$). We dichotomized each scale into low and high OE for use in this analysis (<4 was considered low OE for stopping drug use, 44.1% of subjects; ≤ 4 was considered low OE for disinfection practices, 15.7% of subjects).

Drug Use Several measures of drug use were collected by self-reported interview. Any use of injection drugs was based on reports of injecting drugs in the 6 months between the psychosocial interview and the next follow-up visit. Heavy injection drug use was defined as use at least once per day or more often. Sharing of injection equipment was defined as use of drugs by injection by subjects prior to any disinfection procedure; shared injection equipment included needles and syringes, as well as “cookers” (spoons, bottle caps, etc., used to liquefy drugs prior to injection) and cotton swabs. Attendance at shooting galleries (generally clandestine locations where injection equipment can be rented, borrowed, or purchased¹⁸) was determined by asking for their use in the prior 6-month period. Finally, disinfection of injection equipment was determined at each visit by asking for the procedure(s) used to disinfect or clean their injection equipment before use. Reports of the use of bleach or alcohol as the specified cleaning method were scored as “adequate” disinfection. Subjects who reported always using new sterile injection equipment at each use were also scored as appropriately disinfecting their equipment. Disinfection practices other than these were scored “inadequate.”

HIV/AIDS Knowledge We constructed a measure of HIV/AIDS knowledge using a subset of eight items from the National Health Interview Study.¹⁹ Items selected reflected the pathogenesis of HIV/AIDS and transmission routes. We calculated the proportion correctly answered by respondents.

Drug Treatment Individuals were asked about their lifetime and recent history of drug treatment. For the purposes of this analysis, subjects were dichotomized into those who reported detoxification services or other drug treatment services, principally methadone maintenance treatment programs, as well as residential treatment of longer duration.

Antecedent Factors We classified the subjects on a number of demographic factors, including gender, race (African American, other), and age (≤ 34 and ≥ 35 years). We also assessed the influence of HIV serological status on behavior. To simplify this analysis, we limited subjects to those whose HIV status did not change between the baseline visit and the following two visits (i.e., we did not include seroconverters).

Model Building

For each behavioral outcome (any injection drug use, daily drug use, sharing of injection equipment, shooting gallery attendance, and proper injection equipment disinfection), measured 6 months after the baseline assessment, we constructed multiple logistic regression models incorporating baseline variables. The factors considered were outcome expectancies (for drug cessation or needle disinfection), baseline behaviors (e.g., current disinfection practices, needle sharing, drug use), drug treatment, HIV status, and demographic factors (gender, age, and ethnicity). The objective was to determine the predictiveness of outcome expectancy at baseline in relationship to behavior 6 months subsequently. All regression models included all

factors simultaneously, and we present adjusted odds ratios in which all factors are jointly considered.

RESULTS

Table 1 provides the baseline risk behaviors for the sample, with the risk behaviors stratified by HIV status. The mean age was 37.7 years (standard deviation [SD] = 6.6), with no difference in age noted by HIV status ($t = 0.75$, $P = .45$). Females (21.1% of the subjects) were slightly more likely ($\chi^2 = 3.89$, $P = .05$) to be HIV positive than males. While the majority of the participants were African American (95.1%), African American subjects were significantly more likely than other races to be HIV-1 infected ($\chi^2 = 9.83$, $P < .01$).

With respect to prior drug treatment (both detoxification and methadone maintenance combined), approximately one quarter of the subjects reported treatment in the prior 6 months; there was no difference in HIV status by history of drug treatment ($\chi^2 = 2.64$, $P = .10$). Daily or more frequent use of injection drugs was commonly reported at baseline, with one half of all subjects reporting injecting at least once per day. Sharing of injection equipment was reported by 43% of subjects at the baseline interview and was associated with prevalent HIV infection ($\chi^2 =$

TABLE 1. Descriptive information about subjects' demographic background and drug use behaviors, ALIVE cohort, Baltimore, MD, 1990–1991

Variable	Total sample (N = 792)	HIV negative (n = 504)	HIV positive (n = 288)
Age, years			
≤34	32.2	32.1	32.3
35+	67.8	67.9	67.7
Gender			
Male	78.8	81.0	75.0
Female	21.1	19.0	25.0
Race			
African American	95.1	93.3	98.3
Other	4.9	6.8	1.7
Prior drug treatment			
Yes	24.5	22.6	27.8
No	75.5	77.4	72.2
Current use daily or more frequently			
Yes	49.9	49.8	50.0
No	50.1	50.2	50.0
Share needles/syringes			
Yes	43.0	50.6	29.6
No	57.0	49.4	70.4
Shooting gallery use			
Yes	14.1	14.7	12.9
No	85.9	85.3	87.1
Appropriate disinfection			
Yes	71.5	67.1	79.2
No	28.5	32.9	20.8

TABLE 2. Association between baseline outcome expectancy for drug use cessation and drug use 6 months later, ALIVE cohort, Baltimore, MD, 1991–1992

Behavior at 6 months	Baseline outcome expectancy for drug use cessation		χ^2
	Low	High	
No drug use	4.3%	11.3%	12.66*
Daily use	59.6%	45.4%	15.82*
Needle sharing	47.6%	36.6%	9.73*
Shooting gallery use	15.0%	10.8%	3.09
(n)	(349)	(443)	

* $P < .001$.

32.84, $P < .01$). However, recent shooting gallery use, reported only rarely by our subjects after a year in the study, was not associated with HIV infection ($\chi^2 = 0.46$, $P = .50$). HIV-seropositive subjects were more likely ($\chi^2 = 13.1$, $P < .01$) to report adequate disinfection practices than seronegative participants, although nearly three quarters of the sample reported acceptable cleaning technique.

The predictiveness of OE estimates for drug use cessation and 6-month subsequent drug risk behaviors are shown in Table 2. Subjects with high OE for stopping injecting drugs at baseline were more likely to report not using any drugs (by injection) during the subsequent 6 months (although most respondents continued injection drug use). Subjects with high OE were significantly less likely to report daily drug use, to share injection equipment, and to visit shooting galleries, all behaviors that increase the risk of HIV transmission.

Table 3 shows that OE estimates for disinfection of injection equipment are associated with reduced risk for HIV-1 transmission. Subjects with high OE for needle hygiene practices were less likely to report daily drug use, needle sharing, and attending shooting galleries, but, incongruently, they were less likely to report the actual use of bleach or alcohol for disinfection in the subsequent 6 months.

TABLE 3. Association between baseline outcome expectancy for drug paraphernalia disinfection and drug use 6 months later, ALIVE cohort, Baltimore, MD, 1991–1992

Behavior at 6 months	Baseline outcome expectancy for needle disinfection		χ^2
	Low	High	
No drug use	4.8%	8.8%	2.21
Daily use	64.5%	49.2%	9.76*
Needle sharing	69.4%	36.2%	47.31*
Shooting gallery use	21.9%	11.0%	11.33*
Bleach/alcohol use	42.7%	23.2%	20.62*
(n)	(124)	(668)	

* $P < .001$.

TABLE 4. Multiple logistic regression of baseline drug use outcome expectancy, drug use behaviors, and antecedent factors on any injection drug use (IDU) 6 months later, ALIVE cohort, Baltimore, MD, 1991–1992

Baseline variable	Odds ratio for cessation	95% CI
Outcome expectancy (high)	0.53	0.28, 0.99
Daily drug use	2.48	1.35, 4.57
Drug treatment history	0.80	0.43, 1.48
HIV status (positive)	0.54	0.31, 0.95
Female gender	1.07	0.55, 2.09
Age <35 years	0.92	0.53, 1.60
African American race	2.11	0.74, 5.98
AIDS knowledge score	0.92	0.21, 4.10

CI, confidence interval.

We next constructed a series of longitudinal logistic regression models in which we modeled the predictors of “unsafe” drug behaviors 6 months after (at t_1) determining outcome expectancies, drug-related behaviors, and antecedent factors (at t_0). Table 4 presents the results of the logistic regression analysis of predictors of interval drug use at t_1 . Baseline daily or more frequent injection is the strongest predictor of drug use 6 months later. OE for stopping drug use was significantly associated with drug cessation; subjects with high OE estimates were twice as likely as those with low OE to report not using drugs at the subsequent 6-month interview. In addition, subjects who were HIV-1 infected at t_0 were significantly more likely (about two times) to have stopped using injection drugs 6 months later. Race, age, gender, and drug treatment history were not associated with subsequent drug use after adjustment for the other risks incorporated into the model. Baseline HIV knowledge was not predictive of subsequent injection drug use after adjusting for other predictors.

Longitudinal predictors of daily (frequent) injection were considered next (Table 5). Baseline frequency of drug use is the strongest predictor of subsequent heavy drug use; OE for drug use cessation was marginally associated ($P = .06$) with decreased daily use. Younger age was marginally associated ($P = .05$) with more frequent drug use, although there is no association in this model between HIV-1 sero-status and frequency of injection drug use. None of the remaining antecedent factors attained statistical significance for frequent injection.

Needle sharing at t_1 was less common among participants with high OE for drug cessation at baseline ($P = .05$) (Table 6). In addition, besides baseline rates of sharing, HIV-positive subjects were over twice as likely to report no needle sharing 6 months later. Frequency of injection was not associated with sharing, as was the case for other antecedent factors. Finally, an examination of longitudinal predictors of risks for shooting gallery attendance showed that OE expectancy was not associated with subsequent risk (Table 7); the only significant variables of later shooting gallery use were baseline shooting gallery use and needle sharing.

Outcome expectancies for needle disinfection were not predictive of reported cleaning practices at the 6-month follow-up (Table 8). The important predictive factors from the baseline interview for subsequent needle hygiene were baseline sharing practices, disinfection practices, and being HIV negative.

TABLE 5. Multiple logistic regression of baseline drug use outcome expectancy, drug use behaviors, and antecedent factors on daily injection drug use (IDU) 6 months later, ALIVE cohort, Baltimore, MD, 1991–1992

Baseline variable	Odds ratio for daily IDU	95% CI
Outcome expectancy (high)	0.79	0.57, 1.08
Daily drug use	3.99	2.92, 5.46
Drug treatment history	0.98	0.68, 1.41
HIV status (positive)	0.81	0.59, 1.12
Female gender	0.83	0.56, 1.21
Age <35 years	1.31	0.96, 1.79
African American race	1.32	0.65, 2.70
AIDS knowledge score	1.01	0.43, 2.38

CI, confidence interval.

DISCUSSION

Our results demonstrate that outcome expectancies for behavior change are generally predictive of risk reduction among active injection drug users. OE predictions for drug cessation were found to be statistically significant for stopping injection drug use, daily use, needle sharing, and shooting gallery attendance in unadjusted analysis. In multivariate analysis, after adjusting for baseline behavior and antecedent factors (drug treatment history, gender, age, ethnicity, and HIV serostatus), baseline outcome expectancies predicted 6-month risk reduction in drug use cessation (a two-fold decrease) and was marginally predictive of reduced daily injection use ($P = .065$), but needle sharing and shooting gallery attendance were less clearly associated. This fits predictions of this model in action, in which outcome expectancies are viewed to be domain specific. Beliefs about one's ability to stop using drugs thus should be more strongly associated with nonuse of drugs subsequently than

TABLE 6. Multiple logistic regression of baseline drug use outcome expectancy, drug use behaviors, and antecedent factors on sharing of drug paraphernalia 6 months later, ALIVE cohort, Baltimore, MD, 1991–1992

Baseline variable	Odds ratio for sharing	95% CI
Outcome expectancy (high)	0.75	0.53, 1.06
Needle sharing	6.78	4.83, 9.51
Daily drug use	1.14	0.80, 1.61
Drug treatment history	0.96	0.65, 1.43
HIV status (positive)	0.43	0.29, 0.61
Female gender	1.08	0.71, 1.64
Age <35 years	1.02	0.73, 1.44
African American race	0.70	0.33, 1.50
AIDS knowledge score	0.43	0.17, 1.07

CI, confidence interval.

TABLE 7. Multiple logistic regression of baseline drug use outcome expectancy, drug use behaviors, and antecedent factors on shooting gallery attendance 6 months later, ALIVE cohort, Baltimore, MD, 1991–1992

Baseline variable	Odds ratio for shooting gallery	95% CI
Outcome expectancy (high)	0.85	0.52, 1.38
Shooting gallery use	6.27	3.77, 20.44
Needle sharing	2.28	1.35, 3.86
Daily drug use	1.29	0.78, 2.13
Drug treatment history	1.25	0.73, 2.14
HIV status (positive)	1.09	0.65, 1.83
Female gender	0.58	0.29, 1.15
Age <35 years	1.44	0.86, 2.42
African American race	3.24	0.71, 14.80
AIDS knowledge score	0.75	0.21, 2.74

CI, confidence interval.

for another drug-related behavior (e.g., needle sharing). While OE predictions for needle disinfection were statistically significant in univariate analyses, their importance as longitudinal predictors of behavior in multivariate analysis was not upheld. Loss of statistical significance in longitudinal analyses occurred after adjusting for baseline behaviors, which are clearly strongly correlated. Thus, the psychological measures were less strongly predictive of future behavior than was past history.

Components of the ARRM were sparingly informative when considered with outcome expectancies. AIDS knowledge scores were uncorrelated with behavior change, although perceived risk was associated with both cessation and reduced paraphernalia sharing, but not daily drug use, shooting gallery attendance (which

TABLE 8. Multiple logistic regression of baseline needle disinfection outcome expectancy, drug use behaviors, and antecedent factors on proper needle disinfection 6 months later, ALIVE cohort, Baltimore, MD, 1991–1992

Baseline variable	Odds ratio for needle cleaning	95% CI
Outcome expectancy (high)	0.71	0.45, 1.12
Disinfection practice	1.74	1.08, 2.80
Needle sharing	2.79	1.69, 4.61
Daily drug use	1.29	0.97, 1.84
Drug treatment history	1.09	0.73, 1.62
HIV status (positive)	0.67	0.45, 0.98
Female gender	1.51	0.99, 2.30
Age <35 years	1.42	0.99, 2.04
African American race	1.09	0.50, 2.38
AIDS knowledge score	0.70	0.27, 1.79

CI, confidence interval.

was a rare risk in this population), and disinfection techniques. In addition, HIV serostatus (which was known to all participants) was predictive of cessation of drug use, paraphernalia sharing, and disinfection practices, each of which reduced the risk of HIV transmission to others (needle-sharing partners). Antecedent factors (principally drug treatment history, gender, age, and ethnicity) were generally uninformative concerning HIV risk reduction in this population. In light of these results, the important contribution made to longitudinal predictions of outcome expectancies is magnified.

It has been asserted that risk reduction efforts among injection drug users is difficult,²⁰ and that successes seen in the homosexual community²¹ have not been replicated among drug users and heterosexuals, who may not view themselves at risk for HIV infection.²² Nevertheless, trends in risk behaviors among injection drug users presenting to treatment in New York show large-scale declines in risk behaviors.²³ Between 1984 and 1992, while frequency of injection did not change, reported use of previously used injection equipment dropped from 50% to 5%, and adequately disinfected injection equipment rose from 20% to 54% of reported instances of drug use. Much of the decline in shared injection equipment is attributed to participation in needle-exchange schemes.²⁴ Risk reduction has also been reported in other injection drug user cohorts,²⁵ even in the absence of needle exchange, an effective intervention strategy for reducing the transmission of HIV in this community.²⁶

Understanding the psychological processes underlying HIV/AIDS risk behavior maintenance and change among injection drug users is important in developing more effective intervention strategies and motivation messages to encourage more effective and sustained behavior change. Bandura²⁷ proposed a model of safer sex behavior based on social-cognitive theory, in which knowledge and skills are viewed as important when cognitive appraisal is considered as a mediator for practicing safer behaviors. We have incorporated outcome expectancies into our modified ARRM model to capture the relevant psychological mediators for drug use risk reduction.

Self-efficacy and outcome expectancies have emerged in the past 20 years since its introduction by Bandura²⁸ as important and controversial concepts in health psychology. Expectancies are generally found to correlate with and predict behavior^{29,30} and, as such, have been incorporated into competing models of health behavior. Self-efficacy reflects one's confidence in performing specific behaviors in specific situations³¹; for example, confidence in one's ability to stop using drugs at a specified time in the future is an example of self-efficacy. OE refers to the belief that a specified behavior will result in a specified outcome (e.g., that stopping using drugs will lead to diminished risk of acquiring [or transmitting] HIV). Most social learning theory research has demonstrated that perceptions about specific behaviors are most strongly associated with healthful behaviors in a number of domains,³²⁻³⁴ rather than generally (globally).³⁵ The data presented here demonstrate the high degree of association between specific expectancies for drug-related risk reduction and subsequent behavior.

Interventions to assist improvement in perceptions should be guided based on these results. Efforts to bolster confidence in risk reduction require setting specific objectives for behavior change in a meaningful context. Determinants of drug use cessation and reduction appear to be salient to current injectors. In addition, efficacy estimates can be raised through appropriate skills building for sharing. Media-

tors of needle disinfection practices, as currently conceived, appear to require additional conceptualization.

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