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Brief motivational intervention at a clinic visit reduces cocaine and heroin use

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Abstract

Background: Brief intervention is effective for alcohol misuse, but not adequately tested in the clinical setting with drug using patients. This study tested the impact of a single, structured encounter targeting cessation of drug use, conducted between peer educators and out-of-treatment cocaine and heroin users screened in the context of a routine medical visit.
Methods: A randomized, controlled trial was conducted in inner-city teaching hospital outpatient clinics with 3 and 6 months follow-up by blinded observers. Drug abstinence was documented by RIA hair testing. Analysis was limited to enrollees with drug-positive hair at baseline.
Results: Among 23,669 patients screened 5/98–11/00, 1232 (5%) were eligible, and 1175 enrolled. Enrollees (mean age 38 years) were 29% female, 62% non-hispanic black, 23% hispanic, 46% homeless. Among those with positive hair at entry, the follow-up rate was 82%. The intervention group was more likely to be abstinent than the control group for cocaine alone (22.3% versus 16.9%), heroin alone (40.2% versus 30.6%), and both drugs (17.4% versus 12.8%), with adjusted OR of 1.51–1.57. Cocaine levels in hair were reduced by 29% for the intervention group and only 4% for the control group. Reductions in opiate levels were similar (29% versus 25%).
Conclusions: Brief motivational intervention may help patients achieve abstinence from heroin and cocaine.
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Keywords: Cocaine; Heroin; Brief motivational intervention; Abstinence; Motivational; Interviewing

1. Introduction

Cocaine and heroin use have an enormous personal and social cost (ONDCP, 2000), and there is a need to identify practical methods that health care providers can use to assist patients to cut back or quit using illegal substances (SAMHSA, 2002). Brief motivational interventions, which consist of negotiation to facilitate positive behavior change, have been shown to be effective in a variety of medical settings with alcohol abusers (Chafetz, 1962; D'Onofrio and Degutis, 2002; Gentillelo et al., 1999). A recent meta-analysis suggests an overall reduction of 56% in number of drinks. The effect size for motivational intervention of all types ranged from 0.25 to 0.57, with participants followed from 3 to 24 months (Burke et al., 2003). Motivational interventions for drug abuse have been employed most extensively with individuals waiting for treatment or currently in treatment, with contradictory results ranging from enhanced treatment outcomes (Saunders et al., 1995; Stotts et al., 2001; Donovan et al., 2001) to no effect on either treatment entry rates or outcomes (Booth et al., 1998; Miller et al., 2003), and it is difficult in any case to generalize results from individuals who are actively seeking treatment to outpatient clinic patients who are not in contact with the treatment system.

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Brief motivational interventions have been piloted with out-of-treatment illicit drug users in the medical setting (Dunn and Ries, 1997), but not yet adequately tested (Dunn et al., 2001). In an initial descriptive study in an emergency department (ED) setting (Bernstein et al., 1997), outreach workers screened 7118 patients for substance abuse and provided brief motivational intervention and treatment referral to 1096. Among a subset of 245 patients followed for 3 months, there was a 45% reduction in self-reported drug abuse severity test (DAST) scores and a 50% rate of contact with substance abuse treatment. These results were achieved by interventionists who resembled the patients with whom they interacted in three critical ways. First, they were african american and hispanic, cape verdean and haitian, like most of our patients. Second they were non-professionals, who could meet each prospective participant as an equal. Third, they were themselves in recovery from cocaine and/or heroin for at least three years or had grown up in a home dominated by substance.

Because these preliminary results were encouraging, a randomized, controlled trial was developed to test the effectiveness of a peer-delivered brief motivational intervention in the medical setting. The goal of this study was to find out-of-treatment cocaine and heroin users, and motivate them to quit or cut back their illicit drug use. The study was limited to cocaine and heroin users, because other drugs such as amphetamines, ecstasy, and the benzodiazepines are not in general use in our patient population (<3% prevalence).

2. Study structure: design issues

The study design we selected reflects the state of current knowledge in the field of addiction, as well as the need to balance responsiveness to the concrete conditions of the study setting and sample with the aim of generalizeability of study results. For example, although urine testing would have been a useful endpoint for this study, samples could not be collected during the clinic visit because patients might lose their turn to see the doctor if they left the exam room to find a bathroom. Also the security necessary to prevent substitution or adulteration of a urine sample (e.g. observed collection) is less acceptable to patients in the medical setting than it is in a treatment program. Because hair samples could be collected in the exam room and kept tamper-proof, and provided a 30-day window for drug use, hair was selected as a biochemical marker. Similarly, we opted to use peers as interventionists instead of training physicians in this role, because of the diversity of our population, the difficulty that physicians encounter in crossing language and cultural barriers in order to establish trust, and the extreme pressures on providers' time in our setting. Again, there is no decisive trial of peer intervention against physician intervention to direct researchers' choice of intervention strategies. In the field of motivational intervention, many models have been loosely applied, and existing studies reflect the obstacles encountered in trying to obtain large, cohesive samples and maintain scientific rigor

(Dunn et al., 2001). For these reasons, we describe study methods at some length, and the reader's interpretation and evaluation of study methods and results should be guided by a careful consideration of these types of tradeoffs (Rollnick et al., 2001).

3. Methods

We utilized a randomized controlled design to test the effectiveness of a brief motivational intervention by peer educators during a medical visit in an episodic care setting. The goal of this intervention was to negotiate with heroin and cocaine users to increase their commitment to reduce drug use, and change drug-associated behaviors. The main outcome measured in this study was abstinence from cocaine and/or heroin at 6 months post-enrollment, as measured by radio-immune assay of hair (RIA). Level of drug in hair was also ascertained to document attempts to cut back on drug use. We hypothesized that at the 6 month follow-up visit there would be a reduction in drug use in the intervention group compared to controls who had received only written advice. We would have liked to use entry into treatment as a measurement outcome, especially since we had access to a state database for substance abuse treatment utilization. Unfortunately it was not possible to use treatment entry as an endpoint, because treatment resources available to our target population in this setting during the study period were so restricted that numbers would be inadequate to discriminate differences; only 59 of our enrollees had contact with treatment beyond detox according to the Massachusetts database (see Section 4.6).

The trial was conducted from 5/98 to 11/00 in walk-in clinics at Boston Medical Center (Urgent Care, Women's clinic, Homeless clinic), an urban teaching hospital, where enrollees presented for routine care of non-acute health problems such as respiratory infections, gastroenteritis, vaginal discharge, management of hypertension, and diabetes. Five bilingual 'peers' (experienced substance abuse outreach workers who were themselves in recovery) were hired and individually assigned to separate roles to permit blinding; three were selected to be interventionists, and two were assigned as research assistants. The interventionist was trained to screen, detect, enroll, and intervene, and the research assistant to assess, follow and track enrollees. No crossover was permitted between these two roles. Training was intensive, systematic, and manual driven. Adherence to the intervention was demonstrated through role-plays with simulated patients, supervised patient interviews, and completion of a form for each intervention patient that documented the elements of the intervention (key phrases said by interventionist and key phrases elicited from enrollees).

3.1. Sample selection

A sample size of 1175 was selected to provide power for analysis. Patients were screened at episodic clinic vis-

its. Screening was universal, conducted privately in each patient cubicle, rather than limited to individuals presenting with drug-related diagnoses. Inclusion criteria included age — 18 years of age and older, and use of cocaine and/or heroin use in the last 30 days (see instruments). Patients in drug abuse treatment, in protective custody, or unable to speak Spanish, Haitian Creole, Portuguese Creole or English were excluded.

3.2. Enrollment

Eligible patients were offered enrollment in a study to test the value of a brief conversation about their drug use. A stringent informed consent process required orientation to time and place, three item recall, and verbal paraphrase of study requirements. This process also assured that drug use at the time of enrollment did not interfere with ability to comprehend assessment questions. All patients received breath analysis prior to signing consent forms. If patients were intoxicated at the time that they were approached, study personnel waited until they were able to meet these criteria and produce a negative breathalyzer test before proceeding. The Boston University School of Medicine Institutional Review Board (IRB) approved the study protocol, and a certificate of confidentiality was obtained from NIDA.

Patients were enrolled on the basis of self-report of cocaine and heroin use. Criteria for inclusion in analysis, however, included confirmation of that self-report with biochemical evidence of cocaine and heroin use in the last 30 days (the time frame for hair analysis). This decision was taken to assure the accuracy of the time frame for self-reported use. Furthermore, the IRB required that we explain to patients prior to screening that they might be eligible for a study about cocaine and heroin use, and there was concern that without biochemical confirmation there might be some instances of false report to obtain reimbursement.

3.3. Instruments and laboratory procedures

3.3.1. Screening
Standard substance abuse screening questions for quantity and frequency in the last month were embedded in a health needs history (Bernstein et al., 1997) along with the euroquol scale, a general measure of health status (Gold and Muenning, 2002). Eligibility was determined on the basis of current use and a score of ≥ 3 (the established cut point for moderate severity) on the 10 item drug abuse severity test (DAST), a standardized instrument for clinical screening (French et al., 2001; Skinner, 1982, 1995). A readiness to change ruler (Miller et al., 1999) was included in the screening instrument along with the DAST for those individuals who screened positive for cocaine and/or heroin use. This picture of a ruler has a simple scale of 1 (not ready) to 10 (very ready) on which the patient self-assesses how ready he or she

is to change behavior, and how ready he or she is to enter treatment.

3.3.2. Enrollment
Following enrollment, but prior to randomization, the peer interventionist introduced participants to the research assistant (RA) who administered the baseline assessment: an abbreviated version of the addiction severity index (ASI), which provides composite scores for medical, legal, employment, drug, alcohol, family, and psychological functioning (McLellan et al., 1985; McLellan et al., 1992). They also collected a hair sample (a half inch in length and the width of a pencil lead), cut at the root from the crown of the head. Samples were foil-wrapped and batch analyzed in a single laboratory (Psychemedics®) and analyzed by radio immune assay (RIA), with confirmation of opiate results by gas chromatography/mass spectrometry (GC/MS) (Baumgartner et al., 1979; Welch et al., 1990; Cone et al., 1995). We utilized RIA analysis of hair as an objective measure of drug use because it was less invasive than urine collection, has a window of detection of 30 days versus 24–48 h for urine drug testing, is resistant to attempts to substitute or counterfeit, and has a high sensitivity and specificity (96% sensitivity and 100% specificity, for cocaine (Callahan et al., 1992).

RAs were instructed in procedures for ASI administration and hair sample collection during hands-on, on-site workshops conducted by trainers from the ASI Institute in Philadelphia and from the Psychemedics laboratory. Performance of procedures was subsequently evaluated for quality by certified trainers.

3.3.3. Follow-up instruments
The ASI was repeated at the three and 6 month follow-up, and a follow-up questionnaire was also administered. At 6 months a repeat hair sample was obtained. The follow-up questionnaire elicited self-report of referrals given, contacts made with the treatment system, sources of support, and self-report of drugs used in the last 30 days.

3.4. Randomization

After the assessment process at the baseline visit, the enrollee returned to the interventionist for random allocation into (1) an intervention group receiving the motivational interview, active referrals, the written handout (a list of treatment sources) and a ten day follow-up phone call, or (2) a control group receiving only the handout. Cards generated by a computerized randomization program (in blocks of ten) were sealed in opaque envelopes and used in numerical order. Health care providers, RAs and enrollees were all blinded to randomization status. The interventionist, who knew the enrollee's allocation, did not participate in the follow-up process. Because the intervention consisted of a conversation at the end of an assessment process, enrollees were not made explicitly aware of their own status.

3.5. Intervention

The Control Group received only the handout from the interventionist stating that "based on your screening responses, you would benefit from help with your drug use." This form included a list of treatment options including detox, AA/NA, acupuncture, residential treatment facilities, and harm reduction information about safe sex and needle exchange, but there was no discussion about this information. Patients who asked questions were encouraged to call the referral number of their choice. The Intervention Group received a semi-scripted brief motivational interview delivered by a peer, a substance abuse outreach worker in recovery. In addition to this interview, semi-scripted and tailored to individual behavior, risks, culture, and language, participants in the intervention group received referrals if desired, and a telephone booster to in ten days, during which the interventionist asked what had transpired and if any new referrals were needed.

The brief motivational intervention, first developed in 1994 in consultation with Dr. Stephen Rollnick for Project ASSERT in the ED (Bernstein et al., 1997), is a strategy to assist patients to recognize and change behaviors that pose significant health risks. Adherence to the intervention protocol was documented through use of a form requiring text entry for 12 required elements.

The motivational interview involves the following steps: establishing rapport, asking permission to discuss drugs, exploring the pros and cons of drug use, eliciting the gap between real and desired quality of life, and assessing readiness to change on a ruler scaled from 1 (not ready) to 10 (ready). The peer interventionist negotiates an action plan based on examples of the enrollee's past successes in making behavior change. Finally, the handout is provided. This part of the intervention averages 20 min (range 10–45 min), and is completed during the course of clinical care for the problem that initiated the clinic visit, while the patient is waiting for the doctor or for lab results or medications. In a subsequent 5–10 min 'booster' call, which occurs ten days later, the original interventionist reviews the action plan and negotiates alternative referrals if necessary.

3.6. Follow-up

At 3 and 6 months enrollees returned for follow-up with the RA to report drug use (repetition of the quantity and frequency questions administered at baseline) and specific source of help if they had cut back or quit. The follow-up visit at 3 months was designed primarily to permit a good follow-up rate at the 6-month interval, and the ASI was repeated at this time. Hair samples were obtained at the 6-month visit only. RAs tracked no-shows using the hospital clinic appointment system, and visited shelters and known sites for drug users, such as the fast food outlet in the hospital lobby.

3.7. Incentives

All participants received reimbursement for time and effort: US$ 15 at enrollment, US$ 25 for the first follow-up visit, and US$ 35 for the second follow-up visit.

3.8. Data analyses

We calculated a recruitment goal of 1200 enrollees, which would allow for 80% power to detect a 10% reduction in cocaine and/or heroin levels, based on effect sizes obtained in previous studies. This power calculation was based on results obtained on composite ASI scores for drug use on a sample of substance abusers from public inpatient facilities (Argeriou et al., 1994). All enrollees completed their assigned intervention.

At 6 months post-enrollment, we measured the percentage of participants with 30 days of abstinence from both drugs, from opiates only, and from cocaine only, by self-report and by hair testing, limiting the analysis to those participants with positive hair tests at enrollment who returned for follow-up at 6 months. Abstinence was defined per laboratory standard as $<5 \, ng/10 \, mg$ hair for cocaine and $<2 \, ng/10 \, mg$ hair for opiates. For reductions in the amount of drug present in hair as evidenced by chemical analysis, we compared changes in levels of cocaine from baseline to 6 months and conducted a similar analysis of opiate levels. The amount of hair collected provided a 30-day window for use. Because we were interested in capturing crossover use (from heroin only at entry to cocaine only at follow-up, or visa versa), we assayed for both drugs in all participants who were positive for either drug at baseline, and did not restrict our follow-up analysis to the drug of choice at entry.

We also asked patients at follow-up to record their contacts with the substance abuse treatment system, and confirmed these reports through analysis of admissions for substance abuse treatment recorded in the Massachusetts Bureau of Substance Abuse Services database.

SAS version 8.2 was used for performing statistical procedures. For participant demographics, the t test was used for comparison of measurement level data and the Pearson χ^2 for categorical data. Odds ratios for the effect of intervention on drug use were calculated using logistic regression analyses for the categorical outcome of use versus abstinence for cocaine, for opiates, and for both drugs. GLM analysis was employed to evaluate differences between intervention and control groups in levels of cocaine and opiates at 6 months, controlling for levels of cocaine and opiates at enrollment. These analyses were then performed controlling for differences in randomized groups at baseline. For each of these analyses a core model was stipulated, consisting of variables for gender, race, age, Euroquol (health status) scores, previous psychiatric history, and randomization status. Variables measuring educational level, drug route and drug problem severity (DAST score at baseline, polydrug use, injection drug use, baseline ASI drug score, and number of previous

treatment episodes) and readiness to change were then added in sequentially to identify potential confounders.

4. Results

During the course of the study, 23,669 patients were screened for current cocaine and/or heroin use, 1232 or 5% of patients screened at the clinic visit met eligibility criteria, and 1175 or 95% of eligible patients were enrolled (see Fig. 1). The 57 refusers (5%) were more likely than enrollees to have some college education (33% versus 17%), and less likely to have reported on the DAST that they neglected their families (58% versus 82%) or engaged in illegal activities due to their drug use (52% versus 83%). Scores for readiness to change drug use were similar. For readiness to enter treatment, however, enrollee scores were higher than scores

for refusers (6.0 ± 3.2 versus 4.7 ± 3.2, $p = 0.003$). Reasons for refusal were too general to analyze (i.e. "too sick", "too tired", "not interested").

4.1. Enrollee characteristics

Demographic characteristics and substance abuse history for the intervention and control groups at the time of enrollment are described in Table 1. The intervention group was less likely than the control group to be homeless, and more likely to have health insurance. The mean ASI drug and medical severity subscale score at the time of enrollment was higher in the intervention than the control group.

Baseline ASI scores for our study group of Boston residents, who were not seeking treatment were higher for medical, legal, and psychiatric severity than ASI sub-scale scores reported in a larger sample of 8900 Boston residents who
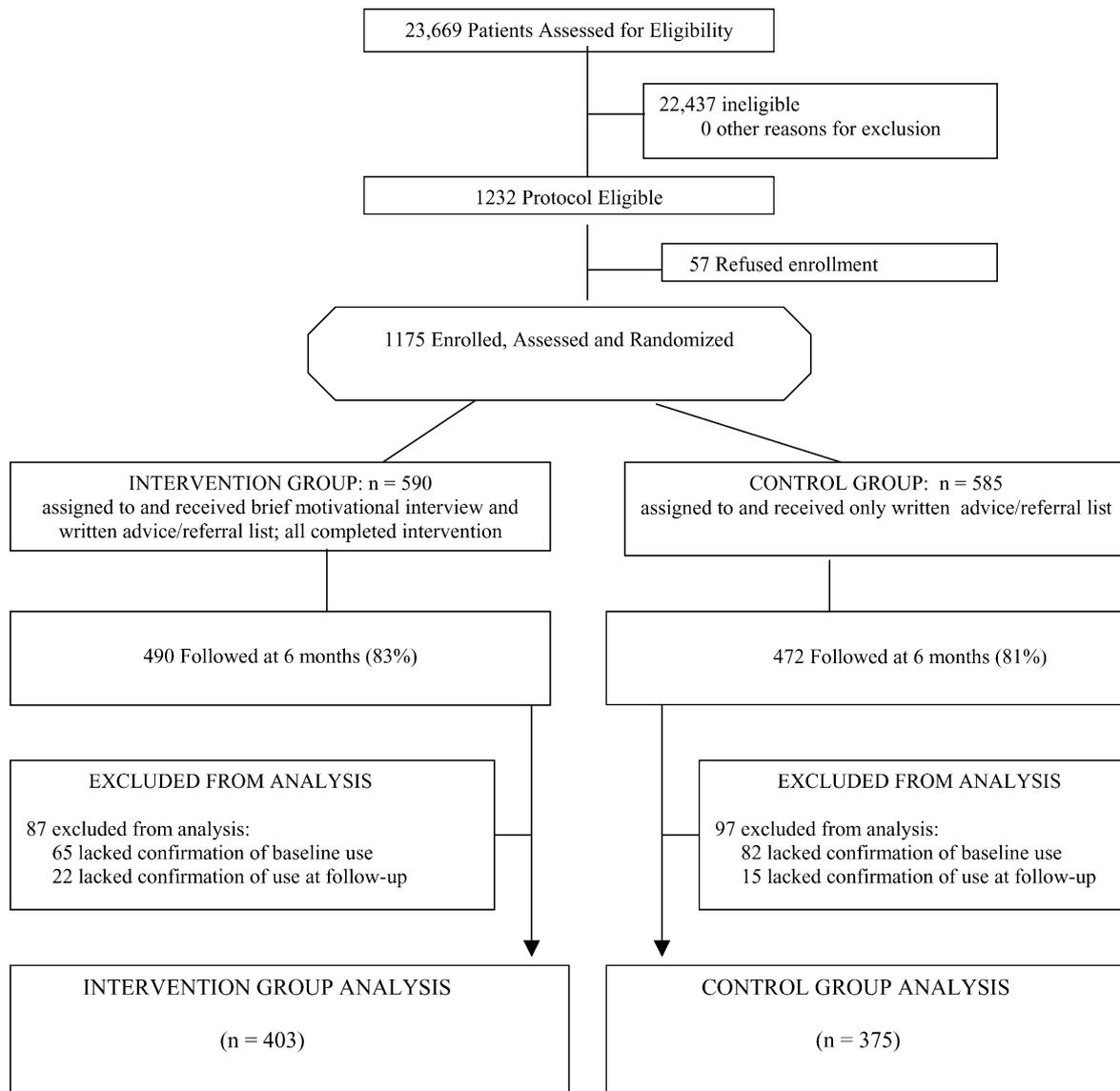

Fig. 1. Profile of a randomized control trial through 6 months follow-up.

Table 1
Demographic characteristics of participants at baseline by randomization status

Variables	Intervention ($n = 590$)	Control ($n = 585$)
Mean age (S.D.)	37.8 (8.3)	38.1 (8.2)
Female (%)	30.6	28.2
Race (%)		
Black non-hispanic	61.5	62.5
White non-hispanic	13.8	14.6
Hispanic	24.1	22.3
Other	0.7	0.5
Education less than high school (%)	37.3	38.3
US Born (%)	81.4	82.4
Has health insurance coverage (%)* (Medicaid, Medicare, Managed Care or Private Insurance)	68.1	64.6
Homeless (%)*	42.9	48.7
Currently Working %	17.5	16.1
General health euroqol (S.D.) (scale 1–100)	60.4 (18.1)	61.3 (19.0)
Self report of psychiatric diagnosis (%)[a],*	26.4	21.8
DAST Scores (S.D.): range 3–10	8.0 (1.7)	7.9 (1.8)
Readiness to change drug use (S.D.)[b] (scale 1–10)	7.0 (2.5)	7.0 (2.6)
Prior admissions for detox or substance abuse treatment		
0	56.2	51.0
1	21.4	25.8
≥ 2	22.4	23.2
ASI subscores (range 0–1)		
Medical*	0.59 (0.33)	0.54 (0.35)
Drug*	0.26 (0.13)	0.24 (0.14)

[a] Percent with prior psychiatric hospitalization or currently taking psychiatric medications for conditions not directly related to drug use, by self-report.
[b] The Rollnick Ruler, scaled 1–10: 0–3 = not ready; 4–6 = unsure; 7–10 = ready to change (Miller et al., 1999).
* $p < 0.05$.

were seeking treatment through three central intake units (Leonhard et al., 2000). For the medical subscale, mean value at intake was 0.56 for our study, versus 0.19 for patients entering treatment, while for the legal sub score it was 0.22 versus 0.15 and for psychiatric it was 0.33 versus 0.22.

Of the 1175 participants, 962 were followed at 6 months (490 or 83% of the intervention group and 472 or 81% of the control group). The proportion followed did not differ by randomization status. Those followed were significantly older (average age 38.2 compared to 36.7, $p = 0.011$), more likely to be insured (47% versus 31%, $p < 0.0001$), black (64% versus 51%, $p = 0.001$), more likely to have a previous psychiatric history (26% versus 15%, $p < 0.001$), and more likely to self-report the use of cocaine only (50% versus 45%, $p = 0.053$) than those lost to follow-up.

4.2. Intervention adherence

Adherence to the intervention (i.e. no missing items) was documented for 90% of the enrollees. Only 10% of forms documenting the elements of the intervention were missing a single item, but none were missing more than one item. Outcomes (abstinence and mean drug level) did not differ by interventionist.

4.3. Results of 'booster' telephone call to offer resources

Only 31% of enrollees in the intervention group could be reached at 10 days by telephone to evaluate their success in

attempting to connect with treatment resources or their need for other referrals. Fewer than 10% of the enrollees contacted by phone requested new referrals.

4.4. Self-report of drug use

There was relatively good agreement between self-reported use and biochemical test results at baseline (88% sensitivity for self-report of cocaine use, as a screen for the biochemical analysis result, and 90% for opiates). Only 6.8% of those reporting cocaine or heroin use tested negative for both cocaine and opiates, despite self-report of use during the designated time frame. However, there was substantial under-reporting of cocaine and/or heroin use at follow-up (45% of participants reported no cocaine/opiate use, but only 18% tested negative for both substances, a 53% sensitivity for cocaine, and a 32% sensitivity for opiate use). There were no differences between intervention and control groups in the proportion with biochemical evidence of use who reported no use.

4.5. Biochemical analysis

4.5.1. Sample characteristics

Because of the over-reporting of use at baseline, we decided to restrict eligibility to participants with biochemical confirmation at both baseline and at 6 months ($n = 778$ or 81% of those followed). We restricted our sample for this analysis

Table 2
Biochemical confirmation of cocaine and heroin in hair: rates of abstinence at 6 months

Abstinent from	Intervention group	Control group	OR[a]	Adjusted OR[b]
Both cocaine and opiates				
Number negative at 6 months	70 (17.4%)	48 (12.8%)	1.43	1.51
Number positive at study entry	403	375	(0.96, 2.13) $p = 0.076$	(0.98, 2.26) $p = 0.052$
Cocaine				
Number negative at 6 months	84 (22.3%)	58 (16.9%)	1.42	1.51
Number positive at study entry	376	344	(0.98, 2.06) $p = 0.065$	(1.01, 2.24) $p = 0.045$
Opiates				
Number negative at 6 months	76 (40.2%)	49 (30.6%)	1.52	1.57
Number positive at study entry	189	160	(0.98, 2.38) $p = 0.063$	(1.00, 2.47) $p = 0.050$

[a] Significance via the Chi-square test.
[b] Significance via logistic regression, model adjusted for variables that groups differed on at baseline (health insurance, homelessness).

to the 778 participants who tested cocaine or opiate positive at baseline and had follow-up results available for comparison (403 in the intervention group and 375 in the control group). Among the 778 enrollees included in this analysis, the intervention and control groups differed only in the proportion with health insurance and the rate of homelessness. There were no differences in baseline ASI scores or demographics between those selected for this sample and those who were excluded.

4.5.2. Abstinence from cocaine and/or heroin

Results are presented in Tables 2–5. Among participants in the intervention group, 22.3% were abstinent from cocaine at 6 months post-intervention, compared to 16.9% of the controls (adjusted OR 1.51; 95% CI 1.01, 2.24; $p = 0.045$). A similar pattern held for opiate use, with abstinence from opiates documented among 40.2% of the intervention group compared to 30.6% of the controls (adjusted OR 1.57; 95% CI 1.00, 2.47; $p = 0.050$). And for abstinence from both drugs, 17.4% of the intervention group participants were drug-free compared to 12.8% of the control group (adjusted OR 1.51; 95% CI 0.98, 2.26; $p = 0.052$).

4.5.3. Drug crossover

At baseline, intervention and control groups were not different in the type of drug they used. Among enrollees in the intervention group, 53% used cocaine only, 7% used opiates only, and 40% used both. In the control group, 49% of en-

rollees used cocaine only, 9% used opiates only, and 33% used both. At follow-up, while there was a general move towards abstinence, among those who were still using drugs there was no difference between control and intervention group in type of drug used, and no noticeable crossover between drugs. In the intervention group 48% used cocaine only, 9% used opiates only, 26% used both, and 17% were abstinent from both drugs. In the control group, 48% used cocaine only, 9% used opiates only, 29% used both, and 13% were abstinent from both drugs. A significant crossover effect, i.e. a shift in type of drug used from time one (enrollment) to time two (6 month follow-up), could not be demonstrated.

4.5.4. Reduction in drug levels

Levels of cocaine and heroin in hair were, significantly lower at follow-up than at enrollment for the group as a whole. For cocaine, there was greater improvement in the intervention group — 29% reduction versus a 4% reduction for the control group (see Table 3). When we used a logarithmic adjustment to mediate the effects of outliers, the difference between the intervention and control groups bordered on significance ($p = 0.058$). For opiates, however, the difference in mean log level between intervention and control groups (29% versus 25%) was not significant.

In the logistic regression analysis, younger age, white and Hispanic race, and the intervention predicted abstinence from both drugs and from cocaine, but race was not a significant predictor for abstinence from opiates (see Table 4). When

Table 3
Changes in cocaine and opiate levels in hair, adjusting for baseline level ($n = 770$)

	At baseline	At 6 months	Differences due to randomization
Cocaine			
Intervention group ($n = 376$)	616 ng/10 mg	436 ng/10 mg	$p = 0.058$
Mean log value	5.19 (CI 5.02, 5.36)	4.11 (CI 3.84, 4.37)	
Control group ($n = 344$)	485 ng/10 mg	464 ng/10 mg	
Mean log value	5.24, CI (5.07, 5.40)	4.46 (CI 4.19, 4.72)	
Opiates			
Intervention group ($n = 189$)	26.4 ng/10 mg	18.8 ng/10 mg	$p = 0.186$
Mean log value	2.81 (CI 2.66, 2.95)	1.75 (CI 1.52, 1.99)	
Control group ($n = 160$)	30.7 ng/10 mg	22.9 ng/10 mg	
Mean log value	2.93 (CI 2.77, 3.09)	2.01 (CI 1.79, 2.31)	

Table 4
Core model: Predictors of abstinence from drug use

Variables	From heroin and/or cocaine ($n = 773$)		From cocaine ($n = 716$)		From opiates ($n = 347$)	
	Adjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI
Intervention	1.51[†]	0.98, 2.26	1.51[*]	1.01, 2.24	1.57[†]	1.00, 2.47
Sex, male	0.00	0.61, 1.55	1.12	0.72, 1.76	1.00	0.59, 1.70
White vs. black	3.13[***]	1.58, 5.12	4.12[***]	2.31, 7.33	0.76	0.38, 1.52
Hispanic vs. black	2.93[***]	1.65, 4.46	4.32[***]	2.69, 6.94	0.84	0.48, 1.46
Age (10 year difference)	0.71[*]	0.55, 0.98	0.78[†]	0.59, 1.02	0.74[†]	0.54, 1.00
Insurance	0.89	0.56, 1.39	0.93	0.63, 1.44	1.02	0.61, 1.71
Homelessness	1.40	0.92, 2.12	1.34	0.90, 2.00	1.22	0.77, 1.96
Euroquol (10 pt. difference)	0.95	0.85, 1.06	0.97	0.88, 1.08	0.89[†]	0.78, 1.02
Previous psychiatric history	1.00	0.58, 1.52	1.11	0.70, 1.74	1.08	0.64, 1.84

Age, euroquol included in the model as continuous variables.
 * $p < 0.05$.
 ** $p < .01$.
 *** $p < 0.001$.
 † $p < 0.10$.

variables related to education, drug use and drug problem severity and readiness to change were added sequentially to the core model (see Table 5), the odds ratios for the intervention effect were remarkably stable (a range of 1.44–1.53 for abstinence from both drugs, 1.40–1.53 for abstinence from cocaine, and 1.57–1.60 for abstinence from opiates).

4.6. Self-report of source of help

We examined self-report of source of help for those who had biochemical evidence for achieving abstinence from both drugs at 6 months ($n = 118$). Participants were free to choose multiple responses. Among them, 49% of those who achieved abstinence (as documented by absence of drug in hair) reported being helped by study research staff, 50% by family, 68% by Alcoholics Anonymous AA) or Narcotics Anonymous (NA), 18% by doctor or nurse, 17% by courts, 54%

by spiritual awakening, and 61% by substance abuse treatment. These self-reported results did not differ by randomization status (37% of the control group reported any treatment contact versus 39% of the intervention group). However, among the 962 participants who were followed, 'treatment' consisted of detox-only for 90% of those who self-reported contact with the treatment system. These self-report results were confirmed by analysis of the Massachusetts state treatment database, which records admissions to treatment facilities that receive Medicaid payments or other state reimbursement. Detox was not a road to treatment entry, because of the sharp reduction in state-based insurance coverage for substance abuse treatment resources during the study period. Those who became abstinent by the 6 month follow-up visit were no more likely to have entered detox or enrolled in substance abuse treatment than those who had biochemical evidence for cocaine or heroin (36% versus 38%).

Table 5
Analysis of intermediate factors

Variables	Either drug use ($n = 773$)		Cocaine ($n = 716$)		Opiates ($n = 347$)	
	Variable OR	Intervention OR	Variable OR	Intervention OR	Variable OR	Intervention OR
Educational level	1.44	1.53[*]	1.30	1.51	1.17	1.57[a]
Drug use/severity variables						
DAST	1.23[**]	1.49[†]	1.29[***]	1.45[†]	1.17[†]	1.58[*]
Baseline opiate use	1.76[*]	1.44[†]	2.46[***]	1.42[†]		
Polydrug use	0.84	1.50[†]	0.63[*]	1.49[†]		
Injection drug use	1.96[**]	1.45[†]	2.69[***]	1.40	0.91	1.58[*]
Baseline ASI drug subscale[a]	1.44[*]	1.47[†]	1.69[†]	1.44[†]	0.94	1.60[*]
#Recent treatment episodes[b]	1.70[*]	1.50[†]	3.64[***]	1.47[†]	0.84	1.57[†]
Readiness						
To change[a]	1.47[†]	1.52[*]	2.69[***]	1.40	0.94	1.60[*]
To enter treatment[a]	1.27	1.45[†]	1.69[**]	1.44[†]	0.84	1.57[†]

 [a] Measurement covariates-ORs reflect differences between subjects at the 75th percentile vs. 25th percentile. For readiness to change drug use, values of 10 vs. 5. For readiness to enter treatment, 9 vs. 3. for the ASI drug subscale score, 0.34 vs. 0.15.
 [b] Self-reported recent treatment episodes categorized as 0, 1 or 2, 3+. OR is for 3+ vs. 0.
 * $p < 0.05$.
 ** $p < 0.01$.
 *** $p < 0.001$.
 † $p < 0.10$.

4.7. Changes in ASI scores

4.7.1. Baseline to 3 months

Data points were available for comparison for 454 intervention group participants and 450 control group participants. While there were significant improvements over time (from baseline to 3 month follow-up) on all seven ASI subscales for the group as a whole, there were no significant differences between intervention and control groups.

4.7.2. Baseline to 6 months

Data points were available for comparison for 490 intervention group participants and 472 control group participants. Substantial improvements were noted for both the intervention and control groups in all ASI subscale scores over time (from baseline to 6 month follow-up). On the drug subscale there was a strong trend toward greater improvement for the intervention group (49% reduction versus 46% reduction for the control group, $p = 0.06$), and there was greater improvement in the medical subscale for the intervention group (56% reduction versus 50% for the control group, $p = 0.055$).

5. Discussion

In this first large-scale randomized trial of intervention in the clinical setting with out-of treatment cocaine and heroin users, a brief but intense interaction was tested against screening and written advice and referral, which is actually a higher level of care than most patients in the U.S. actually receive. Peer educators were able to recruit an appropriate sample of eligible participants, follow uniform procedures for assessment and randomization, conduct a standardized, manual-driven brief negotiated interview and active referral with intervention group participants, and achieve a substantial follow-up rate at 3 and 6 months post-enrollment.

This study provides data on a diverse sample of 1175 drug users. Despite the high level of risk and severity demonstrated on the baseline ASI, after adjustment for baseline differences between the intervention and control groups, there was a between-group difference in abstinence rates of 5.4% for cocaine use, a between-group difference of 9.6% for heroin use, and a between-group difference in abstinence rates of 4.6%. Brief motivational intervention appears to facilitate abstinence at 6 months, even in the absence of meaningful contact with the treatment system, and for cocaine it appears to result in reduced mean drug levels compared to controls. This reduction in levels may represent real efforts to cut back. If so, concomitant reductions in associated health and other consequences of drug use could reasonably be expected.

5.1. Limitations and interpretation issues

Although ASI results suggest significant improvements over time for the entire sample, it must be remembered that self-report of improvements in drug use in this sample was shown to be highly inflated. These ASI scores, based on self-report, may also result from a desire to conform to social expectations for improvement. There are a number of issues to consider in interpreting these results.

When this study was originally planned, eligibility was defined by self-report of heroin or cocaine use. We were surprised to find, after enrollment and randomization, that 147 enrollees had no biochemical evidence for use of these drugs in the last 30 days. There are two possible explanations for this finding. Participants who were negative had either used drug at a more distant time interval not reflected by testing, or they had not used drug at all but had enrolled seeking reimbursement for study participation. In order to avoid contaminating the study with individuals who did not qualify as cocaine and heroin users and were therefore not appropriate for the study, we decided to change the eligibility criterion to presence of cocaine or heroin in hair. This study cannot, therefore be considered as an 'intent to treat' design, and this limitation may raise concerns about the generalizeability of results. However, these subjects were dropped from analysis strictly because of lack of eligibility, not because of their lack of compliance with intervention or because of data collected during follow-up.

Using the eligibility criterion of biochemical positivity at baseline, we restricted the analysis to 778/1175 participants who provided hair for analysis at follow-up. This sample represented 66% of original enrollees if we had used self-report as our criterion for eligibility, and 82% of those followed (see Fig. 1).

The intervention would have been more powerful if it had been compared with controls under actual conditions of clinical practice rather than research structures. Assessment reactivity, for example, may have minimized the effect size for the intervention. The RAs administering the ASI observed participants thinking introspectively about several issues as they responded to standard ASI questions. In particular, enrollees made a lot of exclamations as they added up the amount of drug used and the amount spent on drug, and the RAs reported that this particular consequence of drug use appeared to have a big impact on a number of participants. If the ASI questions do serve as a kind of drug and moral inventory for participants, then the ASI assessment might actually act as type of brief motivational intervention. If this is the case, then a strong intervention (the brief motivational intervention) was being tested against a weak intervention (the ASI). Differences between intervention and control might have emerged more clearly if a non-assessed control group had been included in the study design.

Furthermore, we did not believe that it was ethical to screen for a condition without providing at least a written referral list. Therefore, the control group received much more than is commonly provided (current practice versus best practices) in many medical settings. In addition to the ASI, the control group and the intervention group both received a face-to-face screening interview (the health needs history), the

DAST, and finally advice to seek help along with a comprehensive treatment resource list.

There may also have been unavoidable effects from the peer model. The peer educator and a peer research assistant spent approximately 40 min with the control group and 60 min with the intervention group, except when active referral was required to find placement for individuals in the intervention group who requested treatment. Contact with the peer educators, who themselves were role models of successful recovery, holding a status job in the hospital, may have served as a powerful motivating example for both groups. In support of this premise, it is important to note that among participants who reported at follow-up that they had cut back or quit, a similar percentage of the control and intervention groups reported on follow-up that interacting with project link staff helped them to reduce their drug use (55% in the control group versus 59% in the intervention group, and 49% among the subgroup of individuals from both control and intervention groups who were abstinent). Participants were blinded, of course, to their own group status, since enrollees in the control group received a written handout that they might have perceived to be an intervention. Moreover, the discordance we found on follow-up between self report and hair analysis may result from the participants' desire to please peer research assistants, and if so, could be interpreted as another indication of the power (in this case unintentional) of the peer model. Peer researchers were used to conduct the assessment in order to encourage trust and disclosure, and in that sense provide greater accuracy of self-report, but their use may have limited the ability to discriminate the full impact of the intervention.

6. Conclusions

This study shows that a brief motivational intervention in the clinical setting can reduce heroin and cocaine use. Peer interventionists could play an important role as physician extenders in a busy clinical environment where providers are pressed for the time required to detect, intervene and refer patients who use cocaine and/or heroin, alcohol, and other drugs. Our data shows that 20 patients would have to receive an intervention for one to achieve abstinence from both drugs, but the impact is not small, because the problem is large, and abstinence may result in major improvements in health, reductions in long-term health care needs and criminal justice costs. The aggregate effects of intervention could thus be quite large if screening and brief motivational intervention were instituted universally as normal routine in clinical settings across the country.

Acknowledgement

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