A National 5-Year Follow-up of Treatment Outcomes for Cocaine Dependence

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Background: Long-term (5-year) outcomes of community treatment for cocaine dependence were examined in relation to problem severity at treatment entry and treatment exposure throughout the follow-up period.

Methods: Interviews were conducted at 1 and 5 years after treatment for 708 subjects (from 45 programs in 8 cities) who met DSM-III-R criteria for cocaine dependence when admitted to treatment in 1991-1993. Primary outcome measures included cocaine use and arrests. Self-reported cocaine use showed high overall agreement with urine (79% agreement) and hair (80% agreement) toxicology analyses.

Results: Weekly cocaine use was reported by 25% of the sample at 5 years, slightly higher than the 21% at 1 year. Similarly, 26% had cocaine detected in urine specimens at follow-up and 18% reported having been arrested. Poorer long-term outcomes were related to higher problem severity at treatment admission and low treatment exposure.

Conclusions: The large decreases in cocaine use 1 year after treatment discharge were sustained during the 5-year follow-up. Severity of drug and psychosocial problems at intake was predictive of long-term outcomes and outcomes improved in direct relation to level of treatment exposure.

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The 2001 Annual report of the Office of National Drug Control Policy (Washington, DC) notes that the high level of past-month cocaine use in the United States remained stable during the 1990s, but the number of new users rose by 37% during this period. Cocaine is the illegal drug mentioned most often in emergency department overdose admission records—roughly equal to heroin and marijuana combined—and is detected consistently in the urine specimens from more than one third of arrestees tested in this country each year. Behavioral therapies have proven to be effective treatments for cocaine addiction, particularly those using a manual-guided combination of intensive individual plus group drug counseling. At the individual patient level, outcomes are associated with the severity of drug and related problems, type of treatment setting, and length of stay.

Recent findings from the third national evaluation of treatment effectiveness, funded by the National Institute on Drug Abuse (NIDA) (Bethesda, Md), show that patients who are cocaine dependent and have high problem severity index (PSI) scores, based on background information obtained at treatment intake, have significantly better 1-year outcomes if treated for a minimum of 90 days in long-term residential (LTR) (usually intensive therapeutic community) programs. Similar findings apply to adolescents studied as part of this same project. Patients with moderate levels of problem severity can be treated with comparable effectiveness in either LTR or outpatient drug-free (ODF) treatment if they stay for a minimum of 90 days. Treatment setting and duration are less important for patients with low problem severity, for whom less expensive and shorter-term outpatient services seem to be the most cost-effective choice. Comparable results have been reported for patients who are addicted to opiates and treated in methadone programs.

Because the widespread use of cocaine began in the 1980s and it has taken years to develop appropriate interventions and demonstrate their effectiveness, long-term treatment follow-up studies of cocaine-dependent patients have been rare. The NIDA-funded Drug Abuse Treatment Outcome Studies (DATOS) therefore included 5-year follow-up interviews as part of its original scope of work. Our study builds on a large body of treatment process and outcome research already completed. It extends the scope of the 1-year treatment outcome study of the patients described above to a 5-year follow-up.
SUBJECTS AND METHODS

SUBJECTS

The original DATOS treatment population included a total of 10,010 patients admitted sequentially (during 1991 to 1993) to 96 drug treatment programs in 11 cities located throughout the United States.13 Our study is limited to the subgroup of 1648 patients with cocaine dependence included in a study of outcomes in the first year after treatment.15 In selecting the sample for 5-year follow-up interviews, 419 patients from 3 cities were excluded owing to small samples at 1 year (causing excessive costs per case for fieldwork), 163 were without locator information (which was lost owing to a change in the organization selected to conduct field interviews), 30 had moved away from the region in which they had originally received treatment, and 26 were institutionalized in a setting where interview access was denied. These exclusions left 1010 eligible patients, of whom 799 (79%) were located; 708 (70%) were interviewed, 40 (4%) had died, and 32 (3%) refused the interview. The 708 interviewees represented 73% of the eligible, living patients.

At treatment admission (Table 1), the mean (SD) age of the study sample was 33 (6.8) years, men composed 64%, and African Americans composed 56%. Nearly three fourths had a high school education or general educational development test score equivalent and nearly half had never been married. Also, almost half (46%) entered treatment with a legal status (usually probation). In addition to cocaine use, many were also dependent on alcohol (51%) or diagnosed as having psychiatric impairment (48%).

INTAKE AND FOLLOW-UP PROCEDURES

Each patient participated in a 2-part treatment intake interview, with sessions occurring approximately 1 week apart. Intake 1 addressed sociodemographic background, employment, alcohol and drug use history, criminal involvement, and employment. In intake 2, assessment modules based on standard clinical instruments, such as the Diagnostic Interview Schedule,16 Composite International Diagnostic Interview,17 and the Symptom Checklist 90,18 were administered; an abbreviated set of treatment motivation scales were also presented in the first year after treatment.9 In selecting the study (owing to managed care and cost containment pressures), 419 patients from 3 cities were excluded owing to small samples at 1 year (causing excessive costs per case for fieldwork), 163 were without locator information (which was lost owing to a change in the organization selected to conduct field interviews), 30 had moved away from the region in which they had originally received treatment, and 26 were institutionalized in a setting where interview access was denied. These exclusions left 1010 eligible patients, of whom 799 (79%) were located; 708 (70%) were interviewed, 40 (4%) had died, and 32 (3%) refused the interview. The 708 interviewees represented 73% of the eligible, living patients.

The 5-year follow-up interviews were conducted by the National Opinion Research Center of the University of Chicago (Chicago, Ill) under contract with the DATOS Coordinating Center. Trained professional interviewers recontacted patients approximately 5 years after they had left their index treatment episode. Interviews averaged 2 hours to complete and patients were compensated $15 for their time. Interview content focused primarily on drug use and other behaviors during the follow-up interval, with particular emphasis on the year immediately preceding the 5-year interview. Each interviewee was asked to provide a urine and hair specimen for drug testing. Compensation of $10 was provided for those biological samples.

MEASURES

The PSI was defined using variables from the 2-part intake interview that represented functional domains commonly related to treatment goals and outcome, similar to the domains assessed in the Addiction Severity Index.22 The PSI is a summed score of 7 problem areas at treatment intake, defined as follows:

1. Multiple drug use: self-reported use of any 3 or more drug categories in the year before intake.
2. Alcohol dependence: either a DSM-III-R diagnosis of alcohol dependence or self-reported daily consumption for 1 month or longer during the year before intake.
3. Criminal activity: being on probation/parole, awaiting trial, or having a case pending at intake, or being involved in illegal activities during the past year.
4. Unemployment: no work at a full-time job in the year before intake.
5. Low social support: having several family members or close friends who used illegal drugs or were incarcerated in the past year.

Continued on next page
5-YEAR OUTCOME MEASURES

Cocaine use was the primary outcome measure used for the study, represented by self-reported weekly use as well as urine and mental health indicators and level of treatment exposure are reexamined at 5 years. Five-year outcomes are compared by PSI (low, moderate, and high) scores as studied previously and by cumulative treatment exposure during DATOS.

6. Depression/anxiety: a DSM-III-R diagnosis of depression or anxiety, a score above the median on the Symptom Checklist 90 Depression (1.5) or Anxiety (1.0) scales, or self-reported suicidal ideation (ie, having attempted suicide or thought about killing self).

7. No insurance: having no private insurance (reflecting low socioeconomic resources).

Meeting an adequate threshold for length of time in drug treatment was indicated by spending 90 days or longer in LTR or ODF treatment, which was shown to be the average length of stay after which therapeutic effects of treatment began. Additional treatment following DATOS was also taken into account since more than 1 treatment episode is frequently needed during recovery, and treatment can have cumulative effects. Patients therefore were categorized as having (1) below-threshold treatment, defined as having spent fewer than 90 days in LTR or ODF treatment during DATOS (or fewer than 21 days if in STI programs) and also having no other reported treatment during the follow-up interval; (2) above-threshold treatment, defined as having spent at least 90 days in LTR or ODF treatment during DATOS (or 21 days if in STI) or having returned to treatment during the follow-up; and (3) current treatment at the time of the follow-up interview.

Six subgroups of patients were identified, based on PSI scores at intake and level of treatment exposure, and used to test combined relationships of these variables with 5-year outcomes. Patients assigned to the first group (low PSI scores, above-threshold treatment) had PSI scores below 4 and met the treatment threshold during DATOS or in the follow-up period; the second group (low PSI scores with below-threshold treatment) had a PSI score of less than 4 but treatment exposure was below threshold. Patients in the third group (moderate PSI scores, above-threshold treatment) had PSI scores of 4 or 5, while those in the fourth group (high PSI scores, above-threshold treatment) had PSI scores of 6 or 7; both had met the treatment threshold during DATOS or had returned to treatment afterwards. The fifth group, those with moderate-high PSI scores with below-threshold treatment, consisted of patients with PSI scores of 4 or higher and who left DATOS before meeting the treatment threshold and had no subsequent treatment. All patients in the current-treatment group at the 5-year follow-up were placed together in the sixth group, regardless of PSI score (60% had 4 or more problems) or prior treatment experience.

Comparisons of background variables for these groups showed that patients in the 2 groups with low PSI scores were older, more likely to be married, to have graduated school (or passed the general educational development test), to be employed, and to have a supportive social network (Table 1). In addition, they were less likely to be weekly users of alcohol or illegal drugs or to have a legal status and psychiatric problems before entering treatment in DATOS.

STATISTICAL ANALYSES

Repeated-measures analysis of variance was used to assess changes over time and analysis of variance was used to test differences among the PSI groups in follow-up outcomes. Overall differences among the groups, classified by PSI score and treatment exposure, were tested by logistic regression analysis. Within the logistic regressions, planned contrasts were conducted to compare (1) patients with low PSI scores who had above-threshold treatment vs those with below-threshold treatment exposure, (2) all patients with low PSI scores vs other patients with below-threshold treatment, (3) patients with moderate vs high PSI scores (all above the treatment threshold), (4) patients with moderate PSI scores with above-threshold treatment vs patients with moderate-high PSI scores with below-threshold treatment, and (5) patients with high PSI scores with above-threshold treatment vs patients with moderate-high PSI scores with below-threshold treatment. These analyses were conducted with SAS software (SAS Institute, Cary, NC) and used a type I error rate of 5% (2-tailed test). A Bonferroni adjustment for the contrast analyses resulted in an adjusted error rate of 1.2%.
ing the follow-up (forming 6 subgroups). Patients with low PSI scores at intake were expected to have the most favorable 5-year outcomes regardless of their participation in formal treatment; for patients with higher PSI scores, outcomes were expected to depend on treatment exposure.

### RESULTS

#### CHANGES OVER TIME

The omnibus tests from DATOS intake to follow-up at years 1 and 5 show that there were highly significant changes over time in the outcomes, including cocaine use, heroin use, alcohol use, and arrests (Table 2). Posthoc analyses comparing intake with year 1 show that large and significant decreases occurred for each outcome. The differences between year 1 and year 5 were comparatively small, although the 4% increase for weekly cocaine use and the 3% increase for weekly heroin use were statistically significant (differences for daily alcohol use and arrests were not).

#### PATIENTS IN TREATMENT AT FOLLOW-UP

One hundred seventeen (almost 17%) patients were in treatment at the 5-year follow-up. These patients were more likely to have high PSI scores (F1,704 = 11.86; P < .001; 30% vs 15%) and were less likely to have met the treatment threshold during DATOS (F1,704 = 4.53; P < .03; 18% vs 27%). A significant interaction (F1,704 = 4.74; P < .03) indicated that the relationship between below-threshold treatment in DATOS and being in treatment at the 5-year follow-up was stronger for patients with higher PSI scores. For example, patients with high PSI scores and below-threshold treatment were about twice as likely to be in treatment at follow-up than those with high PSI scores with above-threshold treatment in DATOS (39% vs 20%).

#### PROBLEM SEVERITY INDEX

Because 1-year outcomes were related to PSI scores at intake, the long-term prediction of this index was reassessed using 5-year outcomes. Comparisons were made among the patients with low PSI, moderate PSI, and high PSI scores and the patients in treatment at follow-up. Patients with high PSI scores were more likely to return to treatment following DATOS (48% vs 37%, x2 = 4.38; P < .04). Significant differences among the 4 groups were found for self-reported weekly cocaine use (F3,704 = 16.06; P < .001), self-reported weekly heroin use (F3,704 = 17.22; P < .001), self-reported daily alcohol use (F3,704 = 6.83; P < .001), any arrest (F3,704 = 8.26; P < .001), and psychiatric symptoms (F3,704 = 10.03; P < .001). Planned contrasts found the group with low PSI scores to have generally significantly better outcomes than either the group with high PSI scores or the group currently in treatment.

#### PSI SCORE AND TREATMENT EXPOSURE

Analyses of overall differences among the 6 groups defined jointly by PSI scores and treatment experiences were

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Table 1. Patient Background Variables for Groups Defined by Problem Severity and Treatment Experiences*

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>Low PSI/AT (n = 190)</th>
<th>Low PSI/BT (n = 62)</th>
<th>Moderate PSI/AT (n = 210)</th>
<th>High PSI/AT (n = 72)</th>
<th>Moderate-High PSI/BT (n = 57)</th>
<th>Current Treatment (n = 117)</th>
<th>Total (N = 708)</th>
<th>Statistical Tests</th>
</tr>
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<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>33 (6.9)</td>
<td>35 (8.7)</td>
<td>32 (6.4)</td>
<td>32 (6.2)</td>
<td>31 (5.5)</td>
<td>32 (7.0)</td>
<td>33 (6.8)</td>
<td>F5,704 = 3.77; P = .003</td>
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<tr>
<td>Male</td>
<td>70</td>
<td>74</td>
<td>59</td>
<td>56</td>
<td>61</td>
<td>66</td>
<td>64</td>
<td>x2 = 11.02; P = .05</td>
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<tr>
<td>Race</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>x2 = 14.59; P = .49</td>
</tr>
<tr>
<td>African American</td>
<td>55</td>
<td>55</td>
<td>58</td>
<td>43</td>
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<td>White</td>
<td>31</td>
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<td>Marital status</td>
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<td>Never married</td>
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<td>50</td>
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<td>Married/divorced/widow</td>
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<td>27</td>
<td>19</td>
<td>28</td>
<td>34</td>
<td>31</td>
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<td>High school/GED education</td>
<td>83</td>
<td>84</td>
<td>68</td>
<td>65</td>
<td>63</td>
<td>72</td>
<td>73</td>
<td>x2 = 22.05; P &lt; .001</td>
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<tr>
<td>Employed</td>
<td>86</td>
<td>82</td>
<td>52</td>
<td>26</td>
<td>53</td>
<td>50</td>
<td>61</td>
<td>x2 = 110.44; P &lt; .001</td>
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<td>Legal status</td>
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<td>56</td>
<td>58</td>
<td>56</td>
<td>52</td>
<td>46</td>
<td>x2 = 52.57; P &lt; .001</td>
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<tr>
<td>Psychiatric symptoms</td>
<td>46</td>
<td>53</td>
<td>68</td>
<td>92</td>
<td>77</td>
<td>58</td>
<td>62</td>
<td>x2 = 59.91; P &lt; .001</td>
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<tr>
<td>Treatment readiness,† Mean (SD)</td>
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<tr>
<td>DSM-IV-R cocaine dependence</td>
<td>2.75 (0.31)</td>
<td>2.80 (0.23)</td>
<td>2.73 (0.32)</td>
<td>2.72 (0.34)</td>
<td>2.71 (0.41)</td>
<td>2.81 (0.23)</td>
<td>2.75 (0.31)</td>
<td>F5,699 = 1.80; P = .12</td>
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<td>DSM-III-R alcohol dependence</td>
<td>99</td>
<td>97</td>
<td>98</td>
<td>97</td>
<td>98</td>
<td>99</td>
<td>98</td>
<td>x2 = 2.63; P = .76</td>
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<td>DSM-III-R psychiatric</td>
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<td>35</td>
<td>55</td>
<td>69</td>
<td>51</td>
<td>56</td>
<td>48</td>
<td>x2 = 4.40; P &lt; .001</td>
</tr>
</tbody>
</table>

*Data are given as percentage of patients unless otherwise indicated. Low Problem Severity Index (PSI) indicates scores of 0 to 3 at admission; moderate PSI, scores of 4 to 5 at admission; high PSI, scores of 6 to 7 at admission; above-treatment threshold (AT) indicates a stay of 90 or more days in index long-term residential (LTR) or outpatient drug-free (ODF) treatment, 21 or more days in index short-term inpatient (STI) treatment, or additional treatment in years 1 through 4 following discharge; below treatment threshold (BT), a stay of 1 to 89 days in LTR or ODF treatment, 1 to 20 days in STI treatment, and no additional treatment in years 1 to 4 following discharge; current treatment, being in treatment at the follow-up interview; weekly drug use, weekly or more frequent use in the year prior to the interview; and GED, general educational development.

†An 8-item motivation scale based on 3-point Likert ratings (1-3) of willingness to participate in treatment to make behavioral changes (α reliability = .71).
significant for all outcome criteria (Table 3); these included self-reported weekly cocaine use (Wald $\chi^2 = 44.70$; $P < .001$), cocaine-positive urine (Wald $\chi^2 = 11.11$; $P = .005$), cocaine-positive hair (Wald $\chi^2 = 12.18$; $P = .03$), self-reported daily heroin use (Wald $\chi^2 = 35.25$; $P < .001$), self-reported daily alcohol use (Wald $\chi^2 = 18.20$; $P = .003$), any arrest (Wald $\chi^2 = 24.82$; $P < .001$), and psychiatric symptoms (Wald $\chi^2 = 30.93$; $P < .001$).

The first contrast tested differences between the group with low PSI scores with above-threshold treatment vs the group with low PSI scores with below-threshold treatment; no significant differences were found in the 5-year follow-up outcomes. For the second contrast, significant differences were confirmed, as expected, showing that the groups with low PSI scores had better outcomes than the group with moderate-high PSI scores and below-threshold treatment on self-reported cocaine use (Wald $\chi^2 = 10.68$; $P = .001$; 15% vs 33%; odds ratio [OR], 2.91; 95% confidence interval [CI], 1.31-5.58), cocaine-positive urine (Wald $\chi^2 = 6.87$; $P = .009$; 25% vs 46%; OR, 2.57; 95% CI, 1.34-4.94), any arrest (Wald $\chi^2 = 13.29$; $P < .001$; 10% vs 30%; OR, 4.04; 95% CI, 1.99-8.18), and psychiatric symptoms (Wald $\chi^2 = 4.45$; $P = .03$; 25% vs 39%; OR, 1.89; 95% CI, 1.03-3.45).

For the third contrast (comparing the groups with moderate and high PSI scores who had above-threshold treatment), the group with moderate PSI scores reported lower rates than the group with high PSI scores for alcohol use (Wald $\chi^2 = 6.20$; $P = .01$; 5% vs 14%; OR, 3.23; 95% CI, 1.28-8.11) and psychiatric symptoms (Wald $\chi^2 = 12.18$; $P < .03$).
COMMENT

This study shows that pretreatment PSI score and level of treatment exposure continue to be related to outcomes, even during an extended (5-year) follow-up period. The pattern of outcomes at year 5 was consistent with those reported at year 1. Namely, cocaine-dependent patients with comparatively less severe problems at intake generally had the most favorable outcomes, regardless of their treatment exposure (Table 3). They were more likely to be older and to have better social functioning (ie, in marriage, education, employment, and psychiatric comorbidity), less criminal involvement, and fewer drug problems (ie, on alcohol and heroin use). Thus, long or intensive treatment was not required (or cost-effective). In contrast, patients who were in treatment at follow-up had the worst outcomes (except on urine tests positive for cocaine metabolites, which showed more limited recent use of cocaine). These patients typically had greater background problems and left their DATOS treatment before reaching threshold tenure.

The remaining 3 groups of patients with moderate-to-high-level problems when admitted to treatment in DATOS served to test hypotheses concerning the relationship of outcomes with adequate treatment exposure for individuals with more severe backgrounds. Patients whose treatment exposure never reached therapeutic thresholds had significantly higher cocaine relapse rates (ie, 46% had cocaine metabolites in their urine and 57% in their hair)—each about 20% higher than for the 2 groups with above-threshold treatment (Table 3). The group of patients with high PSI scores and above-threshold treatment showed remarkable improvements on all outcome measures over time. For instance, their rate of pretreatment weekly heroin use dropped 20% at follow-up (from 27% to 7%), daily alcohol use dropped 35% (from 49% to 14%), arrests dropped 25% (from 53% to 28%), and psychiatric symptoms dropped 48% (from 92% to 44%). These improvements were statistically significant and the magnitude of their ORs (which were in the 2.0 range) suggests that they are clinically meaningful as well.

These findings reiterate the importance of compliance with treatment. Although our earlier study found that a substantial percentage (30%) of this sample dropped out of their DATOS treatment prior to the critical retention threshold, the rate is comparable with medical disorders such as diabetes, hypertension, and asthma. Additional high relapse rates common to all of these disorders are directly associated with poor treatment engagement. Although there are other influences involving genetic and psychosocial factors, treatment engagement is more easily addressed.

Drug testing of urine and hair samples helped address the question commonly raised about the overall credibility of follow-up interview results. Of those who denied using “any” cocaine at follow-up, we found that only 5% had biological evidence to the contrary (and 93% of the patients who had cocaine in their urine also had cocaine in their hair). Although biological specimens were not collected from all interviewees (and 21% of the targeted follow-up sample could not be located for the study), the response rates and evidence for credibility of findings compare favorably with other large-scale drug treatment outcome studies.

Under the conditions of a naturalistic design, patients in this study were free to choose their own course of treatment involvement. While such designs limit interpretations about treatment efficacy, they allow for studying the dynamic course of treatment stages and outcomes in the “real world.” Clinical studies have provided evidence for the efficacy of several behavioral interventions for cocaine dependence, but naturalistic evaluations of treatment experience and recovery show how patient background, treatment engagement, and outcomes are related. For example, PSI score, motivation, and readiness are associated with therapeutic engagement (measured both behaviorally and cognitively), and these factors are related to subsequent behavioral and cognitive improvements during treatment, retention, and better posttreatment outcomes. In addition, previous treatment experiences of patients, as well as program policies, services, and orientation can affect therapeutic engagement and outcomes.

Studies of retrospective recall have also demonstrated their usefulness in long-term (12-year) follow-up studies of patients treated for heroin addiction by identifying reasons for initiation, relapse, and quitting drug use, particularly motivation to quit and the influence of treatment and family support. Similar data were collected in the 5-year follow-up interviews reported in this study, and while analyses are still in progress, preliminary findings are the same as those from patients addicted to heroin in regard to the importance attributed to motivation, treatment, and family support.

As McLellan and associates point out, there are numerous clinical trials based on 6- to 12-month outcome evaluations that indicate that addiction treatments are effective. Clinical trials and naturalistic studies complement each other. By combining clinical evidence for the efficacy of behavioral treatments for cocaine use with knowl-
edge about factors that help guide decisions by patients to enter and engage in treatment at therapeutic levels (de-


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35. General Accounting Office. Treatment of Hard Core Cocaine Users (GAO/HEHS-

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41. Substance Abuse and Mental Health Services Administration. Summary of Find-

42. Substance Abuse and Mental Health Services Administration. Summary of Find-

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