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.9 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 interview access (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 interviewed, 40 (4%) had died, and 26 (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, education, alcohol and drug use history, illegal involvement, and employment. In intake 2, assessment modules based on standard clinical instruments, such as the Diagnostic Interview Schedule,17 and the Symptom Checklist 90,18 were administered; a summed score of 7 problem areas at treatment intake, defined as having psychiatric impairment (48%).

MEASURES

The PSI9 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.

TYPES OF TREATMENT

Questionnaires completed by the program director and counseling supervisor served to describe the organizational structure, treatment protocol, policies, and staff at participating DATOS facilities.23 Long-term residential treatments were 24-hour residential facilities. They included traditional therapeutic communities that operated with a highly structured emphasis on social confrontation combined with isolation from the outside community (expected stays were for at least 6 months) and modified therapeutic communities that had less programmatic structure and shorter duration (4-6 months).21 Outpatient drug-free programs varied more widely in their therapeutic orientation and intensity levels. Individual and group supportive counseling was emphasized, along with brief reality therapy and practical problem solving; some provided individual psychotherapy, 12-step meetings, and cognitive-behavioral therapy. Planned length of stay was usually 6 months or longer (range, 3-12 months). Short-term inpatient (STI) treatments were based primarily on the 12-step model and provided intensive 24-hour exposure to the therapeutic milieu as an instrument of change. Supportive group counseling was used as well as lectures, work assignments, family counseling, and daily reading groups focusing on 12-step principles. The traditional 28-day inpatient duration for this modality was shortened in most programs during this study (owing to managed care and cost containment pressures), averaging 25 days but ranging from 4 to 55 days.

Additional treatments received during the 5-year follow-up were recorded in the follow-up interview, including type of program and total length of stay; 275 (39%) of 708 respondents had returned for 1 or more treatments, usually LTR or ODF. Their combined length of stay in these treatments averaged 36 weeks, exceeding the 90-day treatment threshold.

Study. The previous findings that drug use and criminality outcomes at 1 year after treatment discharge are related to problem severity at intake (represented by a composite of drug use, criminal involvement, social functioning,
6. Depression/anxiety: having 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.23-26 The literature does not indicate threshold effects of STI, but for the purpose of this study, 21 days was accepted as a representative minimum.9 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.27-29 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 be high school graduates (or to have 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.

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 dur-
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>
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</thead>
<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>$F_{2,794} = 3.77; P = .003$</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>$\chi^2 = 11.02; P = .05$</td>
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<tr>
<td>Race</td>
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<td></td>
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<td>$\chi^2_{10} = 14.59; P = .49$</td>
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<td>55</td>
<td>58</td>
<td>43</td>
<td>60</td>
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<td>56</td>
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<tr>
<td>White</td>
<td>31</td>
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<td>32</td>
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<td>Marital status</td>
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<td></td>
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<tr>
<td>Never married</td>
<td>38</td>
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<td>54</td>
<td>60</td>
<td>54</td>
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<td>49</td>
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<td>Married/divorced/widow</td>
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<td>40</td>
<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>$\chi^2 = 22.05; P &lt; .001$</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>$\chi^2 = 110.44; P &lt; .001$</td>
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<td>Legal status</td>
<td>30</td>
<td>21</td>
<td>56</td>
<td>58</td>
<td>56</td>
<td>52</td>
<td>46</td>
<td></td>
</tr>
<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></td>
</tr>
<tr>
<td>Treatment readiness,†</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>$F_{2,794} = 1.80; P = .12$</td>
</tr>
<tr>
<td>Degree of cocaine dependence</td>
<td>99</td>
<td>97</td>
<td>98</td>
<td>97</td>
<td>99</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM-III-R alcohol dependence</td>
<td>33</td>
<td>32</td>
<td>58</td>
<td>83</td>
<td>67</td>
<td>51</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>DSM-III-R psychiatric</td>
<td>32</td>
<td>35</td>
<td>55</td>
<td>69</td>
<td>51</td>
<td>56</td>
<td>48</td>
<td></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; 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 ($\alpha$ reliability = .71).

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 ($F_{1,794} = 11.86; P < .001; 30\% vs 15\%$) and were less likely to have met the treatment threshold during DATOS ($F_{1,794} = 4.53; P < .03; 18\% vs 27\%$). A significant interaction ($F_{1,794} = 4.74; P < .03$) 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 readdressed 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\%, $\chi^2 = 4.38; P = .04$). Significant differences among the 4 groups were found for self-reported weekly cocaine use ($F_{3,794} = 16.06; P < .001$), self-reported weekly heroin use ($F_{3,794} = 17.22; P < .001$), self-reported daily alcohol use ($F_{3,794} = 6.83; P < .001$), any arrest ($F_{3,794} = 8.26; P < .001$), and psychiatric symptoms ($F_{3,794} = 10.03; P < .001$). 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...
Table 2. Drug Use and Criminality Outcomes From Intake to 5-Year Follow-up*

<table>
<thead>
<tr>
<th></th>
<th>Intake</th>
<th>Year 1</th>
<th>Year 5</th>
<th>Overall F Test†</th>
<th>Intake vs Year 1</th>
<th>Year 1 vs Year 5</th>
<th>Intake vs Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocaine use (weekly)</td>
<td>69</td>
<td>21</td>
<td>25</td>
<td>295.33</td>
<td>514.52</td>
<td>4.57</td>
<td>432.49</td>
</tr>
<tr>
<td>Heroin use (weekly)</td>
<td>11</td>
<td>3</td>
<td>6</td>
<td>20.40</td>
<td>40.82</td>
<td>7.77</td>
<td>15.22</td>
</tr>
<tr>
<td>Alcohol use (daily)</td>
<td>22</td>
<td>6</td>
<td>8</td>
<td>45.79</td>
<td>88.16</td>
<td>2.26</td>
<td>64.61</td>
</tr>
<tr>
<td>Illegal activity (any)</td>
<td>40</td>
<td>16</td>
<td>25</td>
<td>65.19</td>
<td>129.55</td>
<td>23.49</td>
<td>41.42</td>
</tr>
<tr>
<td>Arrests (any)</td>
<td>34</td>
<td>22</td>
<td>18</td>
<td>29.23</td>
<td>34.38</td>
<td>2.67</td>
<td>55.23</td>
</tr>
</tbody>
</table>

*Data are given as percentages of patients unless otherwise indicated. Low Problem Severity Index (PSI) indicates scores of 0 to 3 at admission; moderate PSI, scores of 4 to 6 at admission; high PSI scores of 7 to 9 at admission; above-threshold treatment threshold (AT), 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 through 5.

†All comparisons had significant F tests (P<.05) except changes in alcohol use and arrests between year 1 and year 5.

Table 3. 5-Year Follow-up Outcomes by Problem Severity and Treatment Exposure Groups*

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>Low PSI/AT (N = 190)</th>
<th>Low PSI/BT (N = 62)</th>
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<th>Current Treatment (N = 117)</th>
<th>Total (N = 708)</th>
<th>Statistical Tests</th>
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</thead>
<tbody>
<tr>
<td>Intake (weekly)</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Intake</td>
<td>65</td>
<td>66</td>
<td>69</td>
<td>72</td>
<td>70</td>
<td>77</td>
<td>69</td>
<td>χ² = 5.25; P = .39</td>
</tr>
<tr>
<td>Year 5</td>
<td>16</td>
<td>11</td>
<td>23</td>
<td>21</td>
<td>33</td>
<td>47</td>
<td>25</td>
<td>χ² = 44.70; P &lt; .001</td>
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<tr>
<td>Heroin use (weekly)</td>
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</tr>
<tr>
<td>Intake</td>
<td>4</td>
<td>5</td>
<td>12</td>
<td>27</td>
<td>9</td>
<td>16</td>
<td>11</td>
<td>χ² = 43.43; P &lt; .001</td>
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<tr>
<td>Year 5</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>21</td>
<td>6</td>
<td>χ² = 35.25; P = .39</td>
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<tr>
<td>Alcohol use (daily)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>14</td>
<td>11</td>
<td>21</td>
<td>49</td>
<td>37</td>
<td>20</td>
<td>22</td>
<td>χ² = 49.28; P &lt; .001</td>
</tr>
<tr>
<td>Year 5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>14</td>
<td>11</td>
<td>16</td>
<td>8</td>
<td>χ² = 18.20; P = .003</td>
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<tr>
<td>Arrests (any)</td>
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<td></td>
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<tr>
<td>Intake</td>
<td>22</td>
<td>16</td>
<td>40</td>
<td>53</td>
<td>33</td>
<td>41</td>
<td>34</td>
<td>χ² = 36.61; P &lt; .001</td>
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<tr>
<td>Year 5</td>
<td>9</td>
<td>10</td>
<td>19</td>
<td>28</td>
<td>30</td>
<td>26</td>
<td>18</td>
<td>χ² = 24.82; P &lt; .001</td>
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<td>Psychiatric symptoms</td>
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<tr>
<td>Intake</td>
<td>46</td>
<td>53</td>
<td>68</td>
<td>92</td>
<td>77</td>
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<td>62</td>
<td>χ² = 59.91; P &lt; .001</td>
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<td>Year 5</td>
<td>26</td>
<td>23</td>
<td>27</td>
<td>44</td>
<td>39</td>
<td>50</td>
<td>33</td>
<td>χ² = 30.93; P &lt; .001</td>
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<td>Cocaine in urine (n = 599)</td>
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<td>Year 5</td>
<td>24</td>
<td>27</td>
<td>25</td>
<td>19</td>
<td>46</td>
<td>27</td>
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<td>χ² = 11.11; P &lt; .05</td>
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<tr>
<td>Cocaine in hair (n = 546)</td>
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<td>Year 5</td>
<td>38</td>
<td>43</td>
<td>38</td>
<td>36</td>
<td>57</td>
<td>54</td>
<td>42</td>
<td>χ² = 12.18; P &lt; .03</td>
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</table>

*Data are given as percentage 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), 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 through 4 following discharge; current treatment, being in treatment at the follow-up interview; and weekly drug use, weekly or more frequent use in the year prior to the interview.

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 χ² = 10.68; P = .001; 15% vs 33%; odds ratio [OR], 2.91; 95% confidence interval [CI], 1.31-5.58), cocaine-positive urine (Wald χ² = 6.87; P = .009; 25% vs 46%; OR, 2.57; 95% CI, 1.34-4.94), any arrest (Wald χ² = 13.29; P < .001; 10% vs 30%; OR, 4.04; 95% CI, 1.99-8.18), and psychiatric symptoms (Wald χ² = 4.45; P = .04; 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 daily alcohol use (Wald χ² = 6.20; P = .01; 5% vs 14%; OR, 3.23; 95% CI, 1.28-8.11) and psychiatric symptoms (Wald
Noteworthy were the fourth and fifth contrasts, in which the groups with moderate and high PSI scores, both with above-threshold treatment, were each compared with the group with moderate PSI scores with below-threshold treatment. For the fourth contrast, the group with moderate PSI scores with above-threshold treatment had lower percentages of urine specimens positive for cocaine (Wald χ² = 7.27; P = .007; 25% vs 46%; OR, 2.15; 95% CI, 1.28-3.74) and hair specimens positive for cocaine (Wald χ² = 4.47; P = .03; 38% vs 57%; OR, 2.18; 95% CI, 1.06-4.49) than the group with moderate-high PSI scores with below-threshold treatment. Similarly, the fifth contrast showed that patients from the high PSI group with above-threshold treatment also had significantly lower rates of cocaine use at follow-up than the group with moderate-high PSI scores with below-threshold treatment, including lower percentages of urine specimens positive for cocaine (Wald χ² = 8.77; P = .003; 19% vs 46%; OR, 3.60; 95% CI, 1.34-8.39) and hair specimens positive for cocaine (Wald χ² = 3.93; P = .05; 36% vs 57%; OR, 2.36; 95% CI, 1.01-5.53).

Overall, the ORs indicate that patients with above-threshold treatment were about 2 times less likely than those with below-threshold treatment to have used cocaine; this magnitude of OR together with high percentage point differences represent a medium effect size.32

**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 1.9 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.34 Additionally, 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.2

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,3 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.28,35-40 In addition, previous treatment experiences of patients,41 as well as program policies, services, and orientation32 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,41 particularly motivation to quit and the influence of treatment and family support. Similar data were collected in the 3-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,34 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-

rived from long-term naturalistic studies), treatment can be made more effective. By assimilating evidence from ex-

ploratory studies of representative treatment samples, broader treatment and recovery models can be formulated to address the high attrition and treatment of cocaine-

dependent patients. 44

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