A National Evaluation of Treatment Outcomes for Cocaine Dependence

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Background: This national study focused on posttreatment outcomes of community treatments of cocaine dependence. Relapse to weekly (or more frequent) cocaine use in the first year after discharge from 3 major treatment modalities was examined in relation to patient problem severity at admission to the treatment program and length of stay.

Methods: We studied 1605 cocaine-dependent patients from 11 cities located throughout the United States using a naturalistic, nonexperimental evaluation design. They were sequentially admitted from November 1991 to December 1993 to 55 community-based treatment programs in the national Drug Abuse Treatment Outcome Studies. Included were 542 patients admitted to 19 long-term residential programs, 458 patients admitted to 24 outpatient drug-free programs, and 605 patients admitted to 12 short-term inpatient programs.

Results: Of 1605 patients, 377 (23.5%) reported weekly cocaine use in the year following treatment (dropping from 73.1% in the year before admission). An additional 18.0% had returned to another drug treatment program. Higher severity of patient problems at program intake and shorter stays in treatment (<90 days) were related to higher cocaine relapse rates.

Conclusions: Patients with the most severe problems were more likely to enter long-term residential programs, and better outcomes were reported by those treated 90 days or longer. Dimensions of psychosocial problem severity and length of stay are, therefore, important considerations in the treatment of cocaine dependence. Cocaine relapse rates for patients with few problems at program intake were most favorable across all treatment conditions, but better outcomes for patients with medium- to high-level problems were dependent on longer treatment stays.

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Cocaine use has become the major illegal drug problem faced by community treatment programs. More than half (56.0%) of the 10,010 patients admitted from November 1991 to December 1993 to treatment programs in a national drug abuse treatment evaluation used cocaine weekly, including two thirds of patients entering residential programs. Cocaine use (either in smoked or injected form) was the primary drug problem reported by 36.0% of the 593,847 patients admitted for drug treatment across the United States during 1995. Although there are no clinically proven medications to treat cocaine users, several psychosocial interventions are in varying stages of design and field evaluation. These strategies are mainly based on operant or social learning principles, such as contingency management programs (sometimes combined with a broader community-based reinforcement component) that offer prizes or other incentives to reward positive behavioral changes. There also is an array of cognitive-behavioral programs for promoting conceptual restructuring and training in cognitive coping techniques in high-risk situations, as well as adaptations of supportive-expressive psychodynamic therapy. Most community treatment settings, however, rely on eclectic protocols that combine individual and group counseling with involvement in 12-step and other self-help groups.

In addition to the development and testing of new therapeutic strategies, the effectiveness of existing services for treating cocaine dependence needs to be examined. This requires a large-scale representative sampling of programs and patients to capture their diversity under naturalistic conditions. Variations in pa-
SUBJECTS AND METHODS

The DATOS treatment population included a total of 10,010 patients admitted sequentially to 96 drug treatment programs from 1991 to 1993 in 11 US cities—Chicago, Ill; Houston, Tex; Miami, Fla; Minneapolis, Minn; Newark, N.J; New Orleans, La; New York, NY; Phoenix, Ariz; Pittsburgh, Pa; Portland, Ore; and San Jose, Calif. All types of drug problems were represented among the 2774 patients admitted to 21 long-term residential (LTR) programs, 3122 patients admitted to 14 short-term inpatient (STI) programs, 2574 patients admitted to 32 outpatient drug-free (ODF) programs, and 1540 patients admitted to 29 outpatient methadone treatment programs. A stratified sampling plan (mainly designed to ensure adequate program representation and distributions of treatment retention) was used to select 4229 patients eligible for a follow-up interview 12 months after discharge. Altogether, 3147 (74.4%) patients were located; 2960 (70.1%) were successfully interviewed, 64 (1.5%) were dead, and 117 (2.8%) refused to be interviewed.

SUBJECTS

The focus of the present study was the subgroup of 1648 cocaine-dependent patients who entered 19 LTR, 24 ODF, and 12 STI programs. More specifically, we selected all patients from these programs who completed intake and follow-up interviews; they also either met clinical criteria (DSM-III-R) for cocaine dependency, had 3-12 months of treatment retention, were selected to focus on primary treatments of cocaine use.

INTAKE ASSESSMENT

Following admission to a program, each patient gave written consent to participate in a 2-part intake interview, with sessions occurring approximately 1 week apart. The first interview addressed sociodemographic background and characteristics, alcohol and drug use history, involvement in illegal activities, and employment; measures of behavioral functioning focused primarily on the last year before admission. The second interview contained assessment modules for DSM-III-R lifetime diagnoses of depression, anxiety, and antisocial personality disorders using the Diagnostic Interview Schedule and the Composite International Diagnostic Interview. The Symptom Checklist 90 was also included. Interviews required an average of 90 minutes to complete and were administered by program research staff under the technical supervision of project field staff. Subjects were paid $10 for each intake interview.

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.

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 a shorter duration (4-6 months). Both types provided group and individual counseling, 12-step meetings, in-residence work as therapy, vocational training, peer support, and gradual reentry to the community and outside employment. Recovering paraprofessionals often served as the primary counselors, and they stressed the use of the social milieu to promote identity and lifestyle changes of patients.

Outpatient drug-free treatment 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. Treatment staff included psychologists, social workers, and recovering paraprofessionals. This study included only patients who entered these programs directly (ie, transfers from residential programs were excluded). Planned length of stay was usually 6 months or longer (range, 3-12 months), and more than half of the programs scheduled counseling sessions at least twice per week.

Short-term inpatient treatment programs 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 were lectures, work assignments, family counseling, and daily reading groups that focused on 12-step principles. Staff were a mix of medical personnel (physicians, physician assistants, and nurses) and counselors (including those in recovery). With the insurance of managed care and cost...
containment, the traditional 28-day inpatient duration in this modality was shortened in most programs, averaging 25 days but ranging from 4 to 55 days. Group sessions averaged twice per day, and individual sessions averaged 3 per week. Dispositions on discharge from a program often included referrals to an outpatient program.

FOLLOW-UP PROCEDURE

Trained interviewers recontacted patients selected for face-to-face follow-up interviews approximately 12 months after discharge. Interviews required an average of 90 minutes to complete and focused primarily on drug use and related behaviors during the past year (comparable to assessments at intake). Compensation was $15. For validation of self-reported drug use, 446 respondents were selected randomly for urinalysis. Specimens were obtained from 352 (78.9%), for which they were paid another $10. (The other 94 either refused, were not able to give an adequate specimen for testing, were interviewed in locations in which a specimen could not be provided, or the interviewer failed to bring a urine specimen collection kit.)

MEASURES

Problem Severity Index

An index of problem severity at intake was defined using variables representing functional domains commonly related to treatment goals and outcomes and that are assessed in the Addiction Severity Index.27 Seven indicators were scored to reflect “problems.” When the scores were summed, they defined the Problem Severity Index (PSI) score for each patient (ranging from 0-7). The indicators related to treatment goals and outcomes and that are assessed in the Addiction Severity Index.27 Seven indicators were scored to reflect “problems.” When the scores were summed, they defined the Problem Severity Index (PSI) score for each patient (ranging from 0-7). The indicators measured (self-reported use of any 3 or more drug categories in the year before intake), 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), criminally active (being on probation or parole, awaiting trial or case pending at program intake, or a period of weekly involvement in illegal activities during the past year), unemployed (never worked at a full-time job in the year before intake), low social support (having several family members or close friends who used illegal drugs or ones who were incarcerated in the past year), depression or 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), and no insurance (having no private insurance, which was statistically associated with no high school diploma and receiving Medicaid at the time of intake).

Treatment Retention

Patients in each of the 3 modalities were classified as having short-term or long-term retention. For LTR and ODF treatments, the retention threshold for long-term groups was set at 90 days because this length of stay is commonly predictive of better outcomes.28-30 Overall, 69.0% of the LTR sample in the follow-up study stayed in treatment for at least 90 days, as did 71.6% of the ODF sample. The literature does not indicate threshold effects for retention in STI programs, but, based on program experience, we accepted 21 days as a representative minimum expectation (69.6% of the patients in STI programs exceeded this criterion). In all 3 modalities, therefore, about 30% were in the short-term retention group, and 70% were in the long-term group.

Outcome Measures

The primary outcome measure was cocaine use in the year after discharge from DATOS treatments, based on self-reported weekly use and the results of a urinalysis at follow-up. Urinalysis results from the randomly selected sub-sample of 352 interviewees showed that 33.0% were positive for cocaine metabolites compared with 50.0% who self-reported that they had used cocaine in the year before follow-up. Only 8.8% of these respondents denied cocaine use but also had urine specimens that tested positive. The overall accuracy of self-report data, therefore, appeared acceptable, and this rate did not differ significantly across patient subgroups defined by pretreatment problem severity, treatment retention, or modality.

STATISTICAL ANALYSIS

Three-way models with unequal cells for analysis of variance (ANOVA) and analysis of covariance were used to examine the effects of treatment modality (LTR, ODF, and STI), PSI scores (low, medium, and high), treatment retention (short and long term), and their interactions on cocaine use, with a 2-tailed α probability level of .05. Because of the unequal cell sizes, least-square means were used in these tests. In the ANOVA, the least-square means are adjusted for the unequal sample size in the cells. Significant main effects or interactions were followed with post hoc Student t tests, again with the α set at .05. Effect sizes (ESs) were computed to show the magnitude of group differences.

RESULTS

PRETREATMENT

Demographic and pretreatment characteristics (Table 1) show that the average patient was 32 years of age, male (65.3%), and African American (58.1%) or white (32.1%), with little variation across the 3 modalities. Legal involvement (ie, being on parole, probation, or awaiting trial at treatment admission) was highest (64.0%) for LTR patients, compared with 55.5% for ODF patients and only 25.1% for STI patients. More than half of the sample had been in drug treatment before DATOS, including 49.5% of the patients admitted to STI programs and 60.0% to 61.6% of the patients admitted to ODF and LTR programs, respectively.

Each of the PSI indicators showed that patients in LTR programs were more likely to have problems than...
patients in either ODF or STI programs. Only for alcohol dependence were there no significant group differences. Scores on the PSI were 0 for 1.8% of the total sample, 1 for 5.4%, 2 for 12.3%, 3 for 21.7%, 4 for 25.5%, 5 for 19.7%, 6 for 10.3%, and 7 for 3.3%. For analysis, scores were combined to form 3 categories of problem severity (Table 1): 0 to 3 represented problems of low severity (41.2%), 4 to 5 represented those of medium severity (45.2%), and 6 to 7 represented problems of high severity (13.6%). As predicted, patient problem levels differed significantly among modalities (χ² = 133.11; P < .001). The group with low-level problems accounted for 25.5% of patients in LTR treatment, 43.2% of patients in ODF treatment, and 53.7% of patients in STI treatment (F[1,1002] = 50.59; P < .001). The group with high-level problems accounted for 24.2% of patients in LTR treatment vs 10.7% of patients in ODF treatment and 6.4% of patients in STI treatment (F[1,1002] = 42.54; P < .001). Thus, the most troubled patients were most likely to enter LTR programs.

**POSTTREATMENT ASSESSMENT**

Table 2 summarizes the significant overall improvements found in the 5 drug use measures (multivariate F[4,1141] = 331.52; P < .001) and the other 3 social functioning measures (multivariate F[3,1335] = 335.13; P < .001) after treatment. Individual post hoc ANOVA repeated-measures analyses showed that changes in the scores of all but 3 of the 36 tests were statistically significant (P < .001). They were defined by patient descriptions given in the intake and follow-up interviews about behaviors in the preceding year. Daily cocaine use was usually interpreted to mean daily use for at least a month of the last year, and any use of crack, marijuana, or heroin meant any level of occasional to regular use of other drugs. We focused primarily on weekly (including daily) cocaine use in the year following treatment and how it was related to treatment modality, patient problem severity at admission to treatment, and treatment retention. Overall, the rate of at least weekly cocaine use dropped from 73% before treatment to 23% during the follow-up.

### Self-reported Cocaine Use

A 3-way ANOVA with unequal cell sizes for self-reported cocaine use (Table 3) showed that 2 of the main effects were significant; these were the length of time in treatment (F[1,1357] = 20.27; P < .001; ES = 0.34) and PSI scores (F[1,1357] = 13.26; P < .001; ES = 0.10). The overall percentage of weekly cocaine users at follow-up was significantly larger for short-term patients (35%) than for long-term patients (21%). In addition, comparisons of PSI subgroups showed that patients with low problem severity had significantly lower weekly cocaine rates (20%) than those with medium (32%) (t = 4.98; P < .001; ES = 0.30) and high (32%) (t = 2.74; P < .006; ES = 0.29) problem severity. The interaction between treatment modality and retention, however, was significant (F[1,1357] = 3.42; P < .03; ES = 0.09), as was the interaction between PSI and treatment retention (F[1,1357] = 4.58; P < .01; ES = 0.21). More important, there was a significant 3-way interaction for treatment modality vs PSI score vs retention (F[1,1357] = 2.45; P < .04; ES = 0.16). Thus, a series of tests for simple effects was performed.

The significant interaction between treatment modality and retention resulted from long-term patients reporting significantly lower rates of weekly cocaine use than short-term patients in LTR programs (15% vs 39%) (t = 6.00; P < .001; ES = 0.58). This difference closely approached significance in patients in ODF programs as well (19% vs 30%) (t = 1.91; P < .06; ES = 0.26), but not in those in STI programs (28% for long-term treatment vs 35% for short-term treatment) (t = 1.14; P < .25; ES = 0.17). For the significant PSI scores (low, medium, and high) by retention interaction, outcomes for patients in short-term treatment differed across the 3 PSI groups (21.9%, 44.0%, and 36.7% respectively; F[2,697] = 12.33; P < .001; ES = 0.23). Among those in long-term treatments, however, the 3 PSI groups did not differ (16.8%, 20.5%, and 22.6% respectively; F[2,1120] = 1.68; P < .19; ES = 0.05).

To help interpret the significant 3-way interaction, treatment modality and retention were examined within each level of PSI scores (Figure). The weekly use of cocaine was higher among short-term than among long-term patients in the medium- (44.0% vs 20.5%; F[1,710] = 43.69; P < .001; ES = 0.54) and high- (36.7% vs 22.6%; F[1,215] = 4.54; P < .03; ES = 0.32) problem severity

### Table 1. Patient Characteristics at Admission to Treatment

<table>
<thead>
<tr>
<th>Patient Variable</th>
<th>Treatment Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LTR (n = 542)</td>
</tr>
<tr>
<td>Age, mean (SD), y†</td>
<td>31 (6.5)</td>
</tr>
<tr>
<td>Male†</td>
<td>64</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>56</td>
</tr>
<tr>
<td>White</td>
<td>33</td>
</tr>
<tr>
<td>Hispanic</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
</tr>
<tr>
<td>Legal involvement†</td>
<td>64</td>
</tr>
<tr>
<td>Any previous drug</td>
<td>62</td>
</tr>
</tbody>
</table>

*Values are given as percentages unless otherwise indicated. LTR indicates long-term residential; ODF, outpatient drug-free; and STI, short-term inpatient.

**Table 2** summarizes the significant overall improvements found in the 5 drug use measures (multivariate F[4,1141] = 331.52; P < .001) and the other 3 social functioning measures (multivariate F[3,1335] = 335.13; P < .001) after treatment. Individual post hoc ANOVA repeated-measures analyses showed that changes in the scores of all but 3 of the 36 tests were statistically significant (P < .001). They were defined by patient descriptions given in the intake and follow-up interviews about behaviors in the preceding year. Daily cocaine use was usually interpreted to mean daily use for at least a month of the last year, and any use of crack, marijuana, or heroin meant any level of occasional to regular use of other drugs. We focused primarily on weekly (including daily) cocaine use in the year following treatment and how it was related to treatment modality, patient problem severity at admission to treatment, and treatment retention. Overall, the rate of at least weekly cocaine use dropped from 73% before treatment to 23% during the follow-up.

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groups but not for those in the low-problem severity group (21.9% vs 16.8%; F1,655 = 2.51; P = .12; ES = 0.13). Further examination showed that for medium-severity problems, differences between modalities for short-term patients were not significant (42%, 43%, and 47%, for LTR, ODF, and STI, respectively; F2,204 = 0.16; P = .86; ES = 0.04); among long-term patients with medium-severity problems, however, cocaine relapse rates were significantly higher for those in STI programs (25%) than ODF programs (15%) (t = 2.26; P < .03; ES = 0.25). Results were similar for the high-problem severity group in that differences between modalities for long-term patients were significant (15% [13/89], 29% [11/38], and 38% [12/32] for LTR, ODF, and STI, respectively; F2,156 = 4.23; P < .02; ES = 0.23) but not for short-term patients (38% [16/42], 27% [3/11], and 43% [3/7] for LTR, ODF, and STI, respectively; F2,57 = 0.27; P > .76; ES = 0.10). Post hoc t tests showed that long-term, high-problem patients in LTR programs (15%) had significantly fewer weekly cocaine users than the long-term, high-problem patients in STI programs (38%) (t = 2.69; P < .008; ES = 0.56). and the differences between those in LTR and ODF programs (29%) approached significance (t = 1.79; P < .07; ES = 0.35).

### Table 2. Changes From Year Before to Year After Treatment (in Percentages)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before (n)</th>
<th>After (n)</th>
<th>Before (n)</th>
<th>After (n)</th>
<th>Before (n)</th>
<th>After (n)</th>
<th>Before (n)</th>
<th>After (n)</th>
<th>Total (N = 1546)</th>
<th>Before (n)</th>
<th>After (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocaine use (daily)</td>
<td>49 (521)</td>
<td>12 (439)</td>
<td>28 (439)</td>
<td>9 (439)</td>
<td>45 (586)</td>
<td>8 (586)</td>
<td>41 (9)</td>
<td>9 (9)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Crack use (any)</td>
<td>67 (521)</td>
<td>27 (439)</td>
<td>52 (439)</td>
<td>24 (439)</td>
<td>77 (586)</td>
<td>35 (586)</td>
<td>67 (9)</td>
<td>29 (9)</td>
<td></td>
<td></td>
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<tr>
<td>Marijuana use (any)</td>
<td>55 (521)</td>
<td>29 (439)</td>
<td>46 (439)</td>
<td>25 (439)</td>
<td>65 (586)</td>
<td>29 (586)</td>
<td>56 (9)</td>
<td>28 (9)</td>
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<tr>
<td>Heroin use (any)</td>
<td>20 (521)</td>
<td>8 (439)</td>
<td>10 (439)</td>
<td>5 (439)</td>
<td>11 (586)</td>
<td>5 (586)</td>
<td>14 (9)</td>
<td>6 (9)</td>
<td></td>
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</tr>
<tr>
<td>Injected with needles</td>
<td>19 (521)</td>
<td>8 (439)</td>
<td>8 (439)</td>
<td>4 (439)</td>
<td>11 (586)</td>
<td>4 (586)</td>
<td>13 (9)</td>
<td>6 (9)</td>
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<tr>
<td>Alcohol use ≥3 d/wk</td>
<td>42 (521)</td>
<td>16 (439)</td>
<td>34 (439)</td>
<td>16 (439)</td>
<td>45 (586)</td>
<td>15 (586)</td>
<td>41 (9)</td>
<td>16 (9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criminal activity to buy drugs</td>
<td>58 (521)</td>
<td>21 (439)</td>
<td>29 (439)</td>
<td>13 (439)</td>
<td>40 (586)</td>
<td>13 (586)</td>
<td>43 (9)</td>
<td>16 (9)</td>
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<tr>
<td>Jailed (≥1 times)†</td>
<td>79 (521)</td>
<td>35 (439)</td>
<td>73 (439)</td>
<td>28 (439)</td>
<td>53 (586)</td>
<td>20 (586)</td>
<td>67 (9)</td>
<td>27 (9)</td>
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<tr>
<td>Unemployed (at full-time job)</td>
<td>59 (521)</td>
<td>44 (439)</td>
<td>51 (439)</td>
<td>45 (439)</td>
<td>33 (586)</td>
<td>37 (586)</td>
<td>47 (9)</td>
<td>42 (9)</td>
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</table>

*Daily” and “any” use of drugs, drinking 3 or more times per week, criminal activity or confinement, and unemployment on a full-time job referred to any month in the 1-year periods before treatment and after discharge from treatment. LTR indicates long-term residential; ODF, outpatient drug-free; and STI, short-term inpatient.

†All values of changes after treatment were significant (P < .001), except those for “Injected with needles” for patients in ODF treatment and for “Unemployed (at full-time job)” for patients in ODF and STI treatment.

### Table 3. Weekly Cocaine Use in Year After Treatment, by Modality, Patient Problem Severity, and Treatment Retention*

<table>
<thead>
<tr>
<th>Treatment Program</th>
<th>LTR (n = 521)</th>
<th>ODF (n = 439)</th>
<th>STI (n = 586)</th>
<th>ANOVA Results</th>
<th>P</th>
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<tr>
<td>Combined Retention Groups</td>
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<tr>
<td>Total sample</td>
<td>24 (542)</td>
<td>20 (468)</td>
<td>26 (605)</td>
<td>F2,1602 = 2.60</td>
<td>.08</td>
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<tr>
<td>Treatment retention (× modality)</td>
<td></td>
<td></td>
<td></td>
<td>F2,1602 = 5.60</td>
<td>.004</td>
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<tr>
<td>Short term</td>
<td>40 (168)</td>
<td>30 (130)</td>
<td>29 (184)</td>
<td>F2,1602 = 2.62</td>
<td>.07</td>
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<tr>
<td>Long term</td>
<td>17 (374)</td>
<td>16 (328)</td>
<td>24 (421)</td>
<td>F2,1602 = 5.29</td>
<td>.005</td>
</tr>
<tr>
<td>PSI score (× modality)</td>
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<td></td>
<td></td>
<td>F1,1602 = 1.11</td>
<td>.35</td>
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<tr>
<td>Low (0-3)</td>
<td>20 (138)</td>
<td>15 (198)</td>
<td>20 (325)</td>
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<td></td>
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<tr>
<td>Medium (4-5)</td>
<td>27 (273)</td>
<td>22 (211)</td>
<td>32 (241)</td>
<td></td>
<td></td>
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<tr>
<td>High (6-7)</td>
<td>22 (131)</td>
<td>29 (49)</td>
<td>39 (39)</td>
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Short-Term Retention Groups

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<thead>
<tr>
<th>PSI groups</th>
<th>Low (90)</th>
<th>Medium (159)</th>
<th>High (89)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSI groups</td>
<td>10</td>
<td>13 (135)</td>
<td>22 (221)</td>
</tr>
<tr>
<td>PSI groups</td>
<td>42</td>
<td>43 (56)</td>
<td>47 (73)</td>
</tr>
<tr>
<td>PSI groups</td>
<td>38</td>
<td>27 (11)</td>
<td>43 (7)</td>
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Long-Term Retention Groups

| PSI groups | Low (90) | Medium (159) | High (89) |
| PSI groups | 10       | 13 (135)    | 22 (221) |
| PSI groups | 21       | 15 (165)    | 25 (168) |
| PSI groups | 15       | 29 (38)     | 38 (32)  |

*Weekly cocaine use indicates weekly or more frequent use in 1 or more months of the year following discharge from treatment in the various programs. Treatment retention was categorized as short term (1-89 days in long-term residential [LTR] and outpatient drug-free [ODF] programs, and 1-20 days in short-term inpatient [STI] programs) or long term (≥90 days in LTR and ODF programs and ≥21 days in STI programs). ANOVA indicates analysis of variance. Problem Severity Index (PSI) scores range from 0 (no problem) to 7 (all 7 problems).
as were interactions involving treatment modality and PSI score (F_{2,336} = 3.36; P < .04; ES = 0.14).

The treatment modality–retention interaction indicated that cocaine detection rates differed between modalities for the long-term but not the short-term patients. Post hoc comparisons showed that in long-term patients in LTR programs, significantly fewer urinalyses (15% [9/59]) were positive for cocaine than in those (42% [46/109]) in STI programs (t = 3.59; P < .004; ES = 0.58) and in patients (31% [22/70]) in ODF programs (t = 1.97; P < .05; ES = 0.35). For the modality–PSI score interaction, post hoc tests revealed significant modality differences among the patients with combined medium to high problem severity but not in those with low problem severity. Thus, among patients with medium and high problem severity, those in STI programs (46% [36/78]) had a significantly higher rate of urinalyses positive for cocaine at follow-up than those in LTR programs (21% [17/80]) (t = 3.36; P < .001; ES = 0.54), and they were marginally higher than those in ODF programs (31% [15/49]) (t = 1.83; P < .07; ES = 0.20).

**Return to Treatment During Follow-up**

Returning to treatment during follow-up could potentially influence a patient's relapse to cocaine use, of course, and thereby moderate the findings reported above. Furthermore, STI programs were short and frequently expected their patients to continue participating in some form of less-intensive program following discharge from the program. During the 1-year follow-up, 26.5% of the total sample reentered another treatment program (29.5% of patients in LTR programs, 23.6% of programs in ODF programs, and 26.0% of patients in STI patients). An analysis of treatment readmission rates in a 3-way ANOVA indicated that there were no significant effects related to treatment modality, PSI scores, or retention (or their interactions). Self-reported weekly cocaine use at follow-up, however, was significantly correlated with return to treatment (r = 0.12; P < .001), so we reanalyzed the 3-way ANOVA model for cocaine relapse as an analysis of covariance using return to treatment as the covariate. Return to treatment was a statistically significant predictor of weekly cocaine use, but the results of the other factors and their interactions in the model remained essentially unchanged from those reported earlier. Combining these measures showed that 41.5% of the total sample had either used cocaine weekly or returned to treatment during the 1-year follow-up.

**Urinalyses for Cocaine**

Parallel analyses were conducted for urinalysis results on cocaine use at follow-up (n = 352). Because of small sample sizes, we had to combine the patients with medium- and high-level problems into a single group; however, we still could not carry out the 3-way ANOVA for treatment modality vs PSI score vs retention (half of these cells had ≤20 patients). We, therefore, performed 2-way ANOVAs and, consistent with the self-reported data reported above, found that interactions involving treatment modality and retention were significant (F_{2,336} = 4.26; P < .02; ES = 0.16),
discharge from treatment. Treatment-retention effects have long been considered to be incremental, but it takes at least 3 months to achieve more positive behavioral change for cocaine-dependent patients with moderate to severe problems at intake. These findings argue against uniform efforts to cut back treatments to ever-shorter durations.

As expected, LTR programs (primarily therapeutic communities) usually treated patients with more severe problems than the patients in STI and ODF programs. Categories of patients with low, medium, and high problem severity were, therefore, examined separately in relation to treatment experiences. Patients with low-level problems had the lowest cocaine relapse rates at follow-up, averaging 15% to 20% in the 3 treatment modalities. For patients with medium-level problems, longer retention groups in each modality (defined as at least 90 days in LTR and ODF programs and 21 days in STI programs) reported less than half as many relapses as short-term groups, even among the more poorly performing patients in STI programs. Longer retention also was related to positive outcomes for patients with high problem severity; notably, only 15% (13/89) of those 90 days or longer in an LTR program relapsed to weekly cocaine use compared with 29% (11/38) of long-term patients in ODF programs and 38% (12/32) in STI programs. Comparable benefits of long-term intensive cocaine treatment for severe problems are also supported by studies using randomized assignments.

A fourth of the sample reported that they returned to treatment during the 1-year follow-up, but the percentages did not vary significantly by treatment modality, retention, or patient problems. When we entered return to treatment as a covariate, it did not alter the pattern of our previous findings for cocaine relapse rates. Thus, readmission to treatment did not confound our results for cocaine relapse, but the findings indicate that those leaving short-term residential treatment did not access further treatment according to program recommendations.

Like most of its kind, this field-based longitudinal study failed to locate and interview all the patients targeted for follow-up. Nevertheless, the conventional threshold of about 70% for an acceptable relocate rate was exceeded, and there was no evidence of sampling bias when follow-up respondents and nonrespondents in DATOS were compared. Reliability of self-report data is another area of common concern for large-scale treatment evaluations. Urine specimens collected from a random subsample in this study indicated that self-reported drug use was reasonably accurate and not biased systematically across the subgroups we compared. Parallel analyses of self-report and urinalysis data yielded the same outcome findings. Because some patients were not located for follow-up, and 9% of those who were interviewed underreported their use of cocaine, the actual cocaine use relapse rates are likely to be 10% to 20% higher than the estimates obtained in this study. The finding that 26.3% of the sample reentered treatment during the follow-up period also complicates such estimates. For example, combining measures of weekly cocaine use with return to treatment shows that 41.5% had evidence of further drug-related problems. Our basic findings rest on comparative outcomes, however, rather than the accuracy of relapse estimates per se.

The treatment of cocaine dependence as generally practiced in a sample of typical community programs appears to be increasingly effective when delivered in a graduated response to problem severity. Patients with more severe problems at intake were more likely to benefit from longer care in residential services, affirming the importance of maintaining long-term intensive care as a treatment option. For patients with medium-level problems, outpatient programs that lasted 90 days or more seem to be similarly effective—and are less expensive. These findings support the value of carefully assessing patient needs at intake and matching services to types of problems.

National multisite and multimodality naturalistic evaluations like this one have the benefit of representing patients and services in the real world, thereby permitting research findings to have high external validity and generalization of findings. On the other hand, they usually face limitations through the lack of controlled exposure to treatment and types of programs that patients enter. By incorporating stronger biological markers for patient outcomes; records of treatment services; and assessments of patient motivation, relations with treatment staff, and program participation, further improvements in field-based evaluations of treatment outcomes and assessments of cost-effectiveness are possible. The foundations for this research come from similar national evaluations in each of the past 2 decades, collectively providing comprehensive and consistent evidence of the conditions under which treatment works best and the extent to which new therapeutic strategies are being incorporated into community treatment systems. They are unique in their ability to provide information about the manner in which treatment is typically provided and its effectiveness.

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