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Journal of Substance Abuse Treatment 30 (2006) 219–226

Journal of Substance Abuse Treatment

A 12-year follow-up of a treated cocaine-dependent sample

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Received 12 May 2005; received in revised form 12 December 2005; accepted 18 December 2005

Abstract

The study examined long-term outcomes (mortality, substance use, mental health, employment, criminal involvement) among a cocaine-dependent sample. This 12-year follow-up study, conducted in 2002–2003, updates information obtained at intake and two face-to-face interviews conducted in 1990–1991 and 1991–1992 among 321 male cocaine-dependent veterans admitted to drug treatment in 1988–1989. At the 2002–2003 follow-up, 28 had died and 266 were interviewed. A mixed model examining the longitudinal relationships demonstrated that treatment was associated with lower levels of cocaine use over the 12-year follow-up period after entry into the index treatment and more stable recovery (i.e., continuously abstinent from cocaine for at least 5 years). Few measures at intake predicted stable recovery at follow-up: only being White (vs. being African American) and having greater confidence in ability to avoid cocaine use in high-risk situations. Individuals achieving stable recovery reported less psychiatric symptoms, criminal involvement, and unemployment during the year prior to the interview. Adverse outcomes were apparent for a significant number of cocaine-dependent users who continued to use cocaine for a long period.

Keywords: Addiction career; Cocaine; Mixed-model analysis

1. Introduction

Cocaine use continues to be a major social and medical problem in the United States. According to the 2002 National Survey on Drug Use and Health (Substance Abuse and Mental Health Services Administration, 2003a), an estimated 34 million Americans (14.4%) aged 12 years or older reported cocaine use at least once in their lifetime; among them, an estimated 2 million persons reported cocaine use in the past month. Cocaine is detected consistently in urine specimens from approximately one third of arrestees tested across the nation each year (National Institute of Justice, 2003). Furthermore, cocaine is the illegal drug mentioned most often in emergency department records (Substance Abuse and Mental Health Services Administration, 2003b). Although treatment for cocaine dependence has received considerable research attention in recent years (Crits-Christoph et al., 1999), the longitudinal phenomena of the processes of dependence on and recovery from this drug have yet to be adequately explicated. Notable exceptions are the most recent national evaluations of treatment for cocaine dependence, which showed that 58% of the patients reported cocaine use in the previous year at follow-up interviews conducted 5 years posttreatment (Simpson, Joe, & Broome, 2002).

This article presents findings from a 12-year follow-up study on a sample of 321 cocaine-dependent men originally admitted in 1988–1989 to their first treatment episode for cocaine dependence; subjects were previously interviewed at intake and in two follow-up interviews conducted in 1990–1991 and 1991–1992 (Khalsa, Paredes, Anglin, Potepan, & Potter, 1993). This article focuses on the patterns and consequences of cocaine use among these men over the more than 20 years of their pretreatment and posttreatment "addiction careers."

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0740-5472/06/$ – see front matter
doi:10.1016/j.jsat.2005.12.007

The concept of addiction careers (or drug use careers) refers to a longitudinal characterization of an individual's use of drugs over a lifetime. Once initiated, drug use often escalates to more severe levels, with repeated cycles of cessation and resumption occurring over extended periods (Frykholm, 1985; Hser, Anglin, Grella, Longshore, & Prendergrast, 1997; Hser, Anglin, & Powers, 1993; Maddux & Desmond, 1981; McGlothlin, Anglin, & Wilson, 1977; McLellan et al., 1992; McLellan, Woody, & Metzger, 1996; Senay, 1984; Simpson, Joe, Lehman, & Sells, 1986; Stephens, 1991; Valliant, 1996).

Although there is now an increasing acknowledgment by the scientific and medical communities that drug dependence can be a chronic disorder that is most accurately understood within the context of an individual's life course, the longitudinal processes of addiction and recovery have not been well studied. Follow-up studies on drug-addicted patients are often limited in the length of the follow-up periods to adequately elucidate the characteristics of drug use patterns and consequences over time (McKay& Weiss, 2001). In particular, for many drug abusers, stable cessation may be observable only in the long term. The few existing long-term follow-up studies have been based on heroin-addicted patients (Hser, Hoffman, Grella, & Anglin, 2001; Maddux & Desmond, 1981; Nurco, Balter, & Kinlock, 1994; O'Donnell, 1972; Simpson & Sells, 1990). It is unclear as yet whether similar long-term patterns apply to cocaine dependence because, with few exceptions, comparable data on cocaine use studied over many years are virtually nonexistent. The lengthy observation period covered in the present study provides a unique opportunity to examine cocaine-related issues that span an extended period of the life cycle.

In this article, unless otherwise indicated, we use *cocaine* to represent both powder cocaine and crack because both were used by our sample at different points in their use progression; all initiated with powder cocaine, but most changed to crack cocaine when they entered their first cocaine treatment. Finally, to examine correlates of long-term cocaine use and abstinence, we classified the subjects into two groups: the stable recovery group (those having been abstinent from cocaine use in the past 5 years) and the nonstable recovery group (those who reported any cocaine use during the past 5 years). We used 5 years as the cutoff point because previous studies on heroin-addicted patients have shown that 5 years of abstinence was a good indicator of stable recovery (Hser et al., 2001).

2. Materials and methods

2.1. Subjects

The sample consisted of 321 male veterans who were consecutively admitted to the West Los Angeles Veterans Affairs Medical Center for treatment of their cocaine dependence from 1988 through 1989. Patients with previous psychiatric treatment or an Axis I psychiatric diagnosis had been selected out by the hospital's triage system. All subjects met the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition* criteria for cocaine dependence. Subsequent to intake, the sample was interviewed in 1990–1991 (96.2% interview completion rate) and in 1991–1992 (87.5% interview completion rate). The present study, which was conducted from 2002 to 2003, had a 96.9% location rate (266 were interviewed; 28 were confirmed to be dead; 9 refused; and 8 were out of the country, too ill, or too mentally dysfunctional to be interviewed), with 10 subjects lost to follow-up. No difference was found between those interviewed and those alive but not interviewed in measures at baseline, including ethnicity, education, age, employment, cocaine use (age at first use, years of regular use), or criminal involvement (probation/parole, arrest, incarceration). Use of other drugs in the year before baseline, however, was higher among interviewed subjects than among those lost to follow-up, including marijuana (71% among interviewed vs. 44% among not interviewed), amphetamine (20% vs. none), and alcohol (83% vs. 62%).

2.2. Interview procedure

Face-to-face interviews were conducted. Fieldwork interviewers were trained research staff employed at the University of California, Los Angeles (UCLA). Most had bachelor's degrees or several years of experience in conducting research interviews in other studies of a similar nature. All participation, including the furnishing of urine samples, was voluntary under UCLA Institutional Review Board approval and a federal certificate of confidentiality. Most interviews took place in a private office at the UCLA. If incarcerated, subjects were interviewed in a private room of the jail or prison. Interviews also were conducted at the subject's home or in a public place if requested by the subject. The average interview required between 2 and 3 hours to administer. At the end of the interview, subjects were requested to provide a urine specimen if they were not incarcerated. At the 2002–2003 follow-up, 204 of the 254 nonincarcerated subjects provided a urine specimen, with 194 urinalysis results usable (10 urine specimens were insufficient for testing). The 50 people who failed to provide a urine sample were mostly (78%) interviewed outside the Los Angeles area.

Comparisons between subjects who provided urine specimens and those who did not showed no difference in baseline measures, including ethnicity, education, age, employment, cocaine use (age at first use, years of regular use), use of other drugs (marijuana, heroin, amphetamine, alcohol), or criminal involvement (probation/parole, incarceration). The only difference between the two groups was that the group that provided urine specimen had a higher

mean number of lifetime arrests at baseline (M = 3.0, SD = 6.0) than the group without urine (M = 1.7, SD = 2.2).

The Natural History Interview protocol was adapted from Nurco, Bonito, Lerner, and Balter (1975) and has been previously applied to drug-abusing populations of a similar nature (Hser et al., 1993, 2001). Interview questionnaires covered information on subjects' demographic characteristics, family history, drug use history, employment, criminal behavior, and criminal justice status history. Subjects were made aware that the interviewer already knew their official history of criminal activity and legal status from information obtained independently from California criminal justice system records.

Urinalyses were conducted to detect recent use of cocaine/crack and other drugs (e.g., morphine, cannabis, phencyclidine, barbiturates, benzodiazepines, amphetamines). Among those providing urine specimens, the rate of positive urine tests was 22.3% for cocaine, 3.6% for heroin, 2.0% for amphetamine/methamphetamine, and 18.8% for marijuana. The congruence between self-reported current cocaine/crack use (in the previous 7 days) and urinalysis results among those who provided a urine specimen was 88.0%. Four individuals reported use but their urine test results were negative (i.e., 2.7% false positive), and 19 denied use but had positive urine test results (i.e., 9.9% false negative).

2.3. Measures

The database contains admission and interview information, data from official record archives (e.g., criminal justice system, death certificates for those deceased), and urinalysis results. The Natural History Instrument was administered at baseline and follow-up interviews. Interview questionnaires covered information on participants' background characteristics, history of drug use, health, mental health, employment, treatment, and legal system involvement. The information were retrospectively recalled in a chronological sequence for their entire addiction career, which covered across the interviews from 1 year prior to first cocaine use to the time of the 2002–2003 interview. For the present study, substance use measures (e.g., for tobacco, alcohol, marijuana, methamphetamine, cocaine, and heroin) included ages of onset of first and regular use and current and past intensity of use. Numbers of months per year on cocaine use and treatment participation were based on the natural history data for a period covering 5 years prior to the index treatment to 12 years afterward.

Mental health or psychological distress was measured by the Hopkins Symptom Check List (HSCL-58; Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974) at each interview. The HSCL measures current psychiatric symptoms rated on a scale of 1 to 4, with 4 indicating greater problem severity. Scores are calculated for five underlying symptom dimensions: depression, anxiety, somatization, obsessive compulsivity, and interpersonal sensitivity. Disability was elicited by a question about "any physical disabilities that interfered with or prevented one from holding a job."

The cocaine resistance confidence scale was based on the Situational Confidence Questionnaire and the Drug-Taking Confidence Questionnaire (Annis & Graham, 1988; Annis & Martin, 1985) to assess how confident the respondents were that they could resist the urge to use cocaine in a variety of high-risk situations. The rating scale is from 0 to 100 at an incremental interval of 20.

Death certificate data were used to classify causes of death by the underlying cause of death as coded in accordance with the *International Classification of Disease, Ninth Revision* (World Health Organization, 1977).

2.4. Statistical analyses

Descriptive statistics were conducted for sample characteristics and statuses. A multivariate survival analysis was conducted to predict mortality via simultaneously considered multiple measures taken at intake conducted approximately 12 years earlier. Adjusted hazard ratios (HRs) with 95% confidence intervals (CIs) were estimated. Using the SAS Proc Mixed function, we conducted a mixed-model analysis to examine treatment effects on longitudinal patterns of cocaine use. This analysis covered the cocaine use career beginning at baseline (initial treatment entry) and extending to 12 years afterward. Separate regression analyses were conducted by use of measures at intake to predict stable recovery from cocaine, or any illicit drug or daily alcohol, for the total sample and years of cocaine abstinence among the nonstable recovery group. Unless otherwise indicated, the significance level (two tailed) was set at $p < .05$.

3. Results

3.1. Mortality

There were 28 deaths over the 12-year follow-up period. The most common causes of death were drug overdose (6 cases or 22.2%; mostly narcotic, morphine, or cocaine) and infectious disease (22.2%; mostly AIDS). The next most common causes of death were accidents and violence (4 cases or 14.8%) and cardiovascular disease (14.8%). Three deaths were caused by lung disease or pulmonary circulation, and two each for liver disease and cancer. Mean age at death was approximately 45 years.

We examined predictors of death by use of survival analysis (Table 1). Significant predictors of death included older age (>40 years old) at first cocaine treatment (HR = 2.40, 95% CI = 1.03–5.61, $p < .05$) and regular heroin use (HR = 3.22, 95% CI = 1.33–7.81, $p < .05$). Other risk factors, including years of cocaine use, use by injection, alcohol use, cigarette smoking, and arrest history, were not significantly related to mortality.

Table 1
Survival analysis predicting mortality

Predictor	Adjusted HR[a] (95% CI)
Race/ethnicity (ref = African American)	
White	1.68 (0.61–4.65)
Hispanic	2.24 (0.61–8.29)
Age at initial treatment entry (ref = <40 years)*	2.40 (1.03–5.61)
Employment at intake	0.48 (0.21–1.09)
Years since first cocaine use (ref = <10 years)	0.85 (0.33–2.19)
Heroin regular use*	3.22 (1.33–7.81)
Injection	1.41 (0.54–3.74)
Daily alcohol use	0.44 (0.16–1.22)
Heavy cigarette smoking (ref = <20 cigarettes/day)	0.97 (0.39–2.41)
No. of lifetime arrests (ref = 0)	
1–2	1.15 (0.41–3.19)
≥3	0.85 (0.27–2.71)

[a] Controlling for other predictors included in the survival analysis.
* $p < .05$.

3.2. Baseline characteristics among subjects interviewed

Of the 266 interviewed subjects, 67.6% were African American, 24.5% were White, and 7.9% were Hispanic. Approximately 86% had 12 or more years of schooling. At intake, 60.8% reported employment, and the group reported a mean 6.8 (*SD* = 4.4) years of regular cocaine use and a mean 2.6 (*SD* = 5.2) lifetime arrests. The group's mean (*SD*) mental health scores as measured by SCL were 1.9 (*SD* = 0.6) in depression, 1.6 (*SD* = 0.6) in anxiety, 1.6 (*SD* = 0.5) in somatization, 1.8 (*SD* = 0.6) in obsessive compulsivity, and 1.9 (*SD* = 0.7) in interpersonal sensitivity.

3.3. Longitudinal patterns of treatment and cocaine use

We examined patterns of cocaine use and treatment among the 266 subjects interviewed. The group's mean age (*SD*) for initiation of cocaine use was 25.4 (*SD* = 6.4) years. Approximately 72% snorted or inhaled powder cocaine initially. Within 3 years, half of the sample became crack users. By the time of their first cocaine treatment entry, almost all subjects were using crack cocaine. The mean age (*SD*) at admission to cocaine treatment in 1988–1989 was 35.5 (*SD* = 6.1) years and that at the latest follow-up was 48.2 (*SD* = 6.1) years. At the latest follow-up in 2002–2003, the mean (*SD*) number of years of cocaine use (i.e., years between initiation and last use) was 17.0 (*SD* = 7.9) years. The mean number of relapses after treatment was 3.3 times (*SD* = 2.8, range = 0–15).

In Fig. 1, we graphically show the longitudinal patterns of cocaine use and treatment (number of months engaging in the activity during the specific year) for a period of 18 years before the latest interview (including 5 years before initial treatment entry and 12 years afterward). As a group, use of cocaine was at a high level prior to treatment entry, reduced dramatically upon treatment entry, slightly increased over the next few months, and remained fairly stable afterward. In contrast, treatment participation dropped gradually over the 3 months after the index treatment and remained at a fairly low level thereafter.

Using the mixed-model analysis, we examined the relationship between cocaine use and treatment during the 12-year follow-up period (after initial treatment entry; see results in Table 2), with several measures taken at intake as covariates. Specifically, the number of months of cocaine use in each year decreased significantly over the 12-year observational period and was negatively related to the number of months in treatment that year. A higher rate of decrease in cocaine use over time was significantly associated with a greater number of months in treatment.

Several covariates were also significantly related to cocaine use trajectories. Compared with African Americans, Whites were less likely to use cocaine and Hispanics demonstrated a higher rate of decreased cocaine use over time. Those who reported daily alcohol use at intake were significantly more likely to use cocaine. Individuals indicating a greater confidence of avoiding cocaine use at intake demonstrated less cocaine use over the follow-up period.

3.4. Stable long-term recovery

Slightly more than one half (51.9%) had achieved stable recovery by maintaining abstinence from cocaine for more

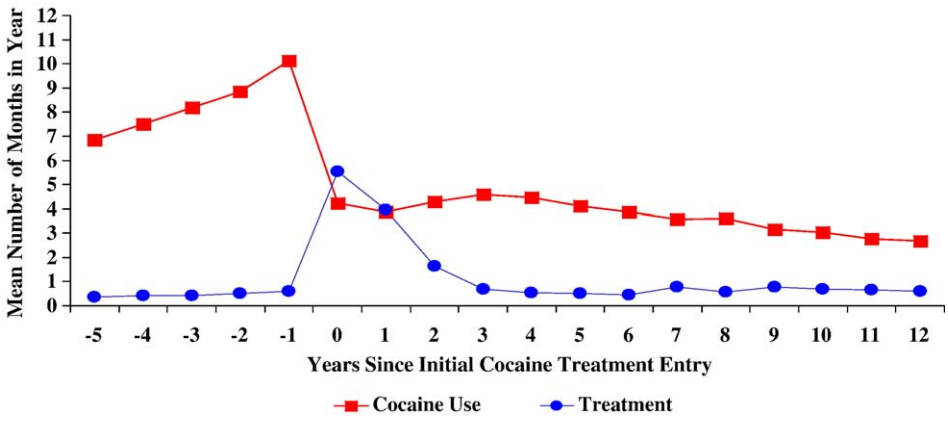

Fig. 1. Months of cocaine use and treatment over time.

Table 2
Mixed-model analysis predicting cocaine use over 12 years posttreatment admission

Variables	Coefficient (*SE*)
Intercept	8.02 (1.21)**
Time (year)	−0.29 (0.10)**
Time × time (year × year)	0.008 (0.007)
In treatment (months/year)	−0.26 (0.03)**
Time × In treatment	−0.02 (0.005)**
Ethnicity (ref = African American)	
White	−1.47 (0.49)**
Hispanic	0.52 (0.74)
Time × White	−0.06 (0.05)
Time × Hispanic	−0.22 (0.08)**
Age at initial treatment entry (ref = ≤29 years)	
30–39	0.80 (0.54)
≥40	0.76 (0.62)
Employed	−0.25 (0.37)
Age at first cocaine use (ref = <18 years)	0.96 (0.79)
Years of regular cocaine use	0.01 (0.04)
Polydrug use (ref = $n \leq 3$ drugs)	0.07 (0.50)
Daily alcohol use	1.10 (0.40)**
No. of arrests in lifetime (ref = 0)	
1–2	−0.09 (0.42)
≥3	0.34 (0.50)
Drug dealing	−0.61 (0.46)
Depression score	−0.19 (0.37)
Cocaine resistance confidence scale	−0.04 (0.01)**

* $p < .05$.
** $p < .01$.

than 5 years (i.e., the stable recovery group). The mean number of years of being continuously cocaine abstinent prior to the latest interview was 11.2 (*SD* = 2.6) years for the stable recovery group and 0.69 (*SD* = 1.2) years for the nonstable recovery group. Examination of baseline measures comparing the two groups showed no difference in age (at first cocaine use and at the initial treatment entry), years of regular cocaine use, polydrug use, number of arrests, employment, and mental health (data not shown). However, the nonstable recovery group had significantly more African Americans (75.6%) and fewer Whites (15.8%) compared with the stable recovery group (60.1% and 32.6%, respectively). The stable recovery group also scored significantly higher (*M* = 74, *SD* = 24) in the cocaine resistance confidence scale than the nonstable recovery group (*M* = 70, *SD* = 23) at intake.

Logistic regression analyses were conducted by use of intake measures to predict stable recovery from cocaine and from any illicit drug use or daily alcohol use. In addition, the same set of predictors was used in a multiple regression analysis predicting years of continuous cocaine abstinence among individuals in the nonstable recovery group. As shown in Table 3, few intake measures predicted stable recovery status or years of abstinence among those in the nonstable recovery group. Being White (relative to being African American; odds ratio [OR] = 3.17) and having greater confidence in resisting cocaine use at intake were significantly related to achieving stable recovery from cocaine use. No intake measure predicted stable recovery from all illicit drugs or daily drinking. Among the nonstable recovery group, being White was associated with more years of continuous abstinence from cocaine prior to the latest follow-up interview.

At the 12-year follow-up interview in 2002–2003, the nonstable recovery group also reported higher rates of disability, psychological distress (e.g., depression, anxiety, obsessive compulsivity, interpersonal sensitivity), cigarette smoking, daily alcohol drinking, marijuana use, and criminal involvement as well as lower rates of employment

Table 3
Results of regression analyses

Predictors	Stable recovery from cocaine[a] [OR (95% CI)]	Stable recovery from any illicit drug or daily alcohol[a] [OR (95% CI)]	Years of cocaine abstinence[b] [coefficient (*SE*)]
Ethnicity (ref = African American)			
White	3.17** (1.62–6.23)	1.20 (0.63–2.28)	0.74* (0.36)
Hispanic	1.10 (0.43–2.81)	1.36 (0.53–3.51)	0.47 (0.42)
Age at initial treatment entry (ref = ≤29 years)			
30–39	1.02 (0.47–2.19)	1.27 (0.58–2.75)	−0.12 (0.35)
≥40	1.18 (0.49–2.86)	1.45 (0.60–3.54)	−0.32 (0.41)
Employed	1.12 (0.66–1.91)	0.96 (0.57–1.62)	0.22 (0.25)
Age at first cocaine use (ref = <18 years)	0.68 (0.22–2.09)	0.77 (0.25–2.40)	−0.81 (0.52)
Years of regular cocaine use	1.00 (0.94–1.06)	1.03 (0.97–1.10)	0.02 (0.03)
Polydrug use (ref = $n \leq 3$ drugs)	1.01 (0.50–2.02)	1.01 (0.50–2.04)	0.08 (0.31)
Daily alcohol use	0.81 (0.46–1.42)	0.69 (0.39–1.21)	−0.03 (0.25)
No. of arrests in lifetime (ref = 0)			
1–2	0.77 (0.43–1.40)	0.94 (0.52–1.69)	0.28 (0.28)
≥3	0.63 (0.31–1.29)	0.50 (0.25–1.04)	0.26 (0.31)
Drug dealing	0.77 (0.40–1.48)	0.77 (0.40–1.48)	−0.13 (0.28)
Depression score	1.53 (0.91–2.60)	1.64 (0.97–2.77)	−0.23 (0.25)
Cocaine resistance confidence scale	1.01* (1.00–1.02)	1.00 (0.99–1.01)	0.01 (0.01)

[a] Logistic regression analysis based on all interviewed subjects ($N = 266$).
[b] Multiple regression analysis based on individuals in the nonstable recovery group ($n = 128$).
* $p < .05$.
** $p < .01$.

Table 4
Status at 2002–2003

	Total (N = 266) [mean (SD) or %]	Stable recovery group (n = 138) [mean (SD) or %]	Nonstable recovery group (n = 128) [mean (SD) or %]
Disability (%)*	31.4	24.3	39.1
Mental health [mean (SD)]			
Depression*	1.5 (0.6)	1.4 (0.5)	1.7 (0.6)
Anxiety*	1.3 (0.5)	1.2 (0.5)	1.5 (0.5)
Somatization	1.5 (0.5)	1.5 (0.5)	1.5 (0.5)
Obsessive–compulsive*	1.6 (0.7)	1.5 (0.6)	1.7 (0.7)
Interpersonal sensitivity*	1.6 (0.6)	1.4 (0.5)	1.7 (0.6)
Any substance use (past year, %)			
Tobacco*	59.4	42.8	77.3
Daily alcohol use*	15.0	8.7	21.9
Marijuana[a]*	42.5	26.1	60.2
Cocaine/Crack[a]*	35.7	0.0	74.2
Heroin[a]	4.1	5.8	2.3
Amphetamine[a]	7.9	5.1	10.9
Current employment status (%)*			
Employed	64.3	78.3	49.2
Retired	3.0	2.2	3.9
Unemployed due to disability	21.1	14.5	28.1
Unemployed	11.7	5.1	18.8
Criminal justice involvement (%)*			
Arrests in past year*	20.3	8.0	33.6
Incarcerated in past year*	14.3	7.3	21.9

[a] Adjusted up by positive urinalysis.
* $p < .05$.

(Table 4). However, some stable recovery individuals still reported use of heroin and amphetamine, and almost half used tobacco, one quarter used marijuana, and 9% used alcohol daily in the year before the interview.

4. Discussion

Research on long-term patterns and consequences of drug use have primarily focused on heroin addiction; less is known about cocaine. The present article is the first to report such long-term, large-sample results with follow-ups of 321 cocaine-dependent patients 12 years after their first cocaine treatment. Several issues that are particularly related to long-term patterns and consequences of cocaine use are discussed below.

Approximately 12 years after their initial treatment, 8.7% of our sample had died. The average annual mortality rate of approximately 0.7% in our sample appears to be comparable with that of the general male population (~1.0% for African American men and 0.5% for White men aged between 45 and 54 years; U.S. Department of Health and Human Services, 2000). This rate is also comparable with the 8% mortality rate for a cocaine sample during the 11-year follow-up by Murphy, Reinarman, and Walforf (1989), slightly lower compared with previously reported annual rates of at least 1% to 2% for alcohol and other drug-abusing populations (see review by Hser, 2002), but much lower than the 18.5% over a 5-year follow-up of a crack-dependent sample in Brazil (Ribeiro, Dunn, Laranjeira, & Sesso, 2004). The lower rate in our sample in contrast to that in other user populations could be due to the fairly high functioning (e.g., more educated and employed) of our sample and/or because access to Veterans Affairs medical facilities and services has helped maintain them in relatively good health (Yang, Hser, & Huang, submitted).

Of the 266 subjects interviewed in 2002–2003, the examination of their longitudinal patterns of cocaine use and treatment demonstrated that treatment participation was associated with reduced cocaine use over time. Furthermore, slightly more than half had achieved stable recovery, maintaining abstinence from cocaine for more than 5 years, although many of them continued to use other substances. Few intake measures predicted stable recovery (discussed below), but supplemental analysis (data not shown) indicated that the stable recovery group responded more favorably than the nonstable recovery group soon after treatment entry (e.g., 4.5 fewer months of use during the first year of treatment entry) and continued such improvement in subsequent years. In contrast, the nonstable recovery group reduced cocaine use initially, rebounded somewhat in the next 2 years, and then showed little change over the subsequent 10 years. Although the present analyses used 5 years of abstinence as an indicator of stable recovery, most of the nonstable recovery group (74%) reported use of cocaine in the year prior to the last interview.

It seems that some individuals immediately responded to treatment and were able to maintain cocaine abstinence after treatment, whereas others did not. Nevertheless, despite the continuing high level of cocaine use by the nonstable recovery group, their treatment involvement remained at a minimum level. These results suggest that factors facilitating treatment use and shaping these diverse outcome trajectories need to be further examined so that effective strategies promoting early cessation can be developed.

Only ethnicity and confidence in resisting cocaine at intake were predictive of subsequent cocaine use or stable recovery from cocaine use. It is not immediately clear why African Americans in our sample had lower rates of cocaine abstinence. Prior studies on health disparity have suggested that African Americans may lack access to appropriate care, which leads to poorer health outcome; we have addressed this issue in a separate article (Yang, Hser, & Huang, submitted) that specifically examines the role of race in these diverse outcomes.

The present study found that confidence in resisting cocaine use measured at intake was predictive of subsequent cocaine abstinence but was not predictive of abstinence from all substances. Thus, individuals with

greater expectations of personal efficacy in successfully coping with high-risk situations for cocaine use were more likely to remain abstinent from cocaine use, although such self-efficacy did not seem to have generalized to the abuse of other drugs. It is not clear why some individuals reported greater confidence in their ability to avoid using cocaine in high-risk situations as few intake measures including their cocaine use histories varied. Nevertheless, this finding is consistent with the relapse prevention model (Annis, 1986; Marlatt & Gordon, 1985) and suggests that coping skills training that increases self-efficacy may facilitate recovery from cocaine dependence.

Adverse consequences of cocaine abuse have been reported in many studies (for a summary, see National Institute on Drug Abuse, 1999); in our sample, most of the adverse consequences associated with chronic cocaine use appear to be in the areas of social functioning and mental health. Individuals who continued to use cocaine reported greater levels of depression and anxiety, criminal involvement, reliance on public assistance, and unemployment, although they were similar to the stable recovery group in all these aspects at the baseline. Although it remains challenging to predict in advance who will achieve long-term success, negative outcomes associated with chronic cocaine use are apparent for cocaine-dependent users who continued use for a long period.

Our study has several limitations. The sample does not include women, and subjects from Veterans Affairs treatment programs in California may not be necessarily reflective of the more commonly studied populations of inner-city crack users or in other parts of the country. Comparisons between our sample and those admitted to the general community-based treatment programs in California at similar periods showed that our sample included higher percentages of African Americans (68% vs. 50%), were more educated (86% vs. 66%, at least 12 years), and were employed (61% vs. 12%). Therefore, research findings of the present study may not be applicable to cocaine/crack abusers who are women and/or of a more disadvantaged socioeconomic status; replications of the present study in other samples are needed.

Despite these limitations, the present study reveals important findings on long-term patterns and consequences of cocaine use that are not easily discernable in short-term studies. Prior studies have shown that for many substance-dependent users, several episodes of treatment may be necessary before stable recovery can be achieved (Anglin et al., 1997; Hser et al., 1997). The present study demonstrated that over the 12-year follow-up period since treatment entry, the cocaine-dependent sample had many episodes of relapse (range = 0–15, $M = 3.3$, $SD = 2.8$), even among those who eventually achieved stable recovery (range = 0–9, $M = 1.6$, $SD = 2.6$). It is not unexpected that individuals unable to achieve stable recovery had more psychiatric problems, criminal justice involvement, and unemployment problems. Effective strategies are needed to engage or reengage these cocaine-dependent users in treatment to reduce their cocaine use and related problems (Dennis, Scott, & Funk, 2003; McLellan, McKay, Forman, Cacciola, & Kemp, 2005).

Acknowledgments

This study was supported in part by Grants DA13594 and P30-DA016383 (Dr. Hser) and by Independent Scientist Awards K02DA00139 (Dr. Hser) and K05DA00146 (Dr. Anglin) from the National Institute on Drug Abuse (Bethesda, MD).

We thank the staff of the UCLA Integrated Substance Abuse Programs for data collection, data analysis, and manuscript preparation.

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