

Article

The duration and correlates of addiction and treatment careers

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Received 18 February 2004; received in revised form 18 September 2004; accepted 28 October 2004

Abstract

While addiction is increasingly recognized as a chronic condition, little information is available on the actual duration of addiction and treatment careers. The purpose of this study was to estimate the duration and correlates of years between (a) first use and at least a year of abstinence and (b) first treatment admission and at least one year of abstinence. Data are from 1,271 of 1,326 (96%) people recruited from a stratified sequential sample of admissions to publicly funded treatment programs in a large metropolitan area. Participants were interviewed at 6, 18, 24, 36, 48, and 60 months post-intake. With an average age at the referent intake of 35 ($SD = 8$) years, the sample is 59% female, 87% African American, 7% Hispanic, and 5% white. The most common dependence diagnoses were for cocaine (64%), alcohol (44%), opioids (41%), and/or marijuana (14%). Using lifetime substance use and treatment histories collected at intake and subsequent treatment utilization recorded during follow-up interviews, we conducted survival analysis to estimate the time from first use and first treatment until people reported 12 months of abstinence or died (with people still using, in treatment, or dead at the last follow-up treated as right censored). During the three years after intake, 47% reached at least 12 months of abstinence. The median time from first to last use was 27 years. The median time from first treatment episode to last use was 9 years. Years to recovery were significantly longer for males, people starting use under the age of 21 (particularly those starting under the age of 15), people who had participated in treatment 3 or more times, and for people high in mental distress. The exploratory results suggest that multiple episodes of care over several years are the norm and that rather than thinking of multiple episodes in terms of “cumulative dosage,” it might be better thought of as further evidence of chronicity and that we need to develop and evaluate models of longer term recovery management. © 2005 Elsevier Inc. All rights reserved.

Keywords: Substance use disorder; Treatment; Chronicity; Survival analysis; Recovery

1. Introduction

Substance use dependence (particularly with multiple co-occurring psychiatric problems) is increasingly recognized as a chronic, relapsing condition that may last for decades and require multiple episodes of care over many years before reaching a sustained state of abstinence. Epidemiological studies of people with lifetime substance dependence suggest that 58% eventually enter sustained recovery (i.e., no symptoms for the past year)—a rate that is considerably better than the 39% average rate of recovery across

psychiatric disorders (Kessler, 1994; see also Dawson, 1996; McLellan, Lewis, O'Brien, & Kleber, 2000; Robins & Regier, 1991). Of the people with lifetime dependence who eventually achieved a state of sustained recovery, the majority did so after participating in treatment—ranging by substance from cannabis (43%) to cocaine (61%), alcohol (81%) and heroin (92%; Cunningham, Koski-Jannes, & Toneatto, 1999; Cunningham, Lin, Ross, & Walsh, 2000).

Longitudinal studies have repeatedly demonstrated that the treatment of substance use disorders (SUD) is associated with major reductions in substance use, related problems, and costs to society (e.g. Hser, Hoffman, Grella, & Anglin, 2001; Hubbard et al., 1989; Salomé, French, Scott, Foss, & Dennis, 2003; Scott, Foss, & Dennis, 2003; Sells, 1974; Simpson, Joe, & Brown, 1997, Simpson & Brown, 1999). However, these and other studies also demonstrated that after discharge, relapse and eventual re-admission are also

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fairly common and particularly prevalent when addiction is accompanied by one or more psychiatric problems (Godley, Godley, Dennis, Funk, & Passetti, 2002; Lash, Petersen, O'Connor, & Lehmann, 2001; McKay et al., 1997, 1998). In fact, of the people admitted to the U.S. public treatment system in 1999, 60% were re-entering treatment, including 23% for the second time, 13% third time, 7% fourth time, 4% fifth time, and 13% for sixth or subsequent times (Office of Applied Studies, 2000).

Retrospective and prospective treatment studies report that most participants initiate three to four episodes of treatment over multiple years before reaching a stable state of abstinence (Anglin, Hser, & Grella, 1997; Grella & Joshi, 1999; Hser, Anglin, Grella, Longshore, & Prendergast, 1997; Hser, Grella, Chou, & Anglin, 1998). To date, several studies have followed participants for 4 to 33 years after treatment (Anglin et al., 1997; Capodanno, Fram, Holden, & Targum, 1984; Croughan, Miller, Whitman, & Schober, 1981; DeLeon, 1984; Dole & Joseph, 1978; Duvall, Locke, & Brill, 1963; Gearing, 1974; Grella, Hser, & Hsieh, 2003; Hubbard et al., 1989; Judson, Ortiz, Crouse, Carney, & Goldstein, 1980; Maddox & Desmond, 1992; Simpson, Joe, & Lehman, 1986; Simpson et al., 1997; Simpson, Joe, & Broome, 2002; Simpson & Sells, 1990; Simpson & Brown, 1999; Vaillant, 1966). In each of these studies, 20% to 80% had been in treatment before the index episode of care; when measured, the majority had one or more psychiatric problems; the majority relapsed one or more times after being discharged; and, half or more were readmitted one or more times during follow-up (25–35% within the first 12 months). The long-term recovery rates ranged from one fifth to over half, varying by gender, race, age of first use, age of first intake, years to first treatment, prior treatment history, pattern of substance use, and extent of co-occurring psychiatric disorders. Unfortunately, most studies evaluated outcomes relative to the index episode of care only and examined only one or two of these factors. None of the studies estimated the duration of addiction (i.e., from first use to a year of abstinence) or treatment careers (i.e., from first admission to at least a year of abstinence) or estimated the impact of these factors simultaneously.

We are particularly interested in the complex impact of age of first use on substance use and treatment careers. Early onset of substance use (particularly under age 15) is associated with a higher rate of reporting symptoms of dependence both concurrently and even 20 years later, the progression to using multiple substances, and the onset of other psychiatric problems (Anthony & Petronis, 1995; Brunswick & Boyle, 1979; Buydens-Branchey, Branchey, & Noumair, 1989; Dennis, Babor, Roebuck, & Donaldson, 2002; Fleming, Kellam, & Brown, 1982; Grant, 1998; Hanna & Grant, 1999; Kandel, Yamaguchi, & Chen, 1992; Lynskey et al., 2003; Merrill, Kleber, Shwartz, Liu, & Lewis, 1999; Schuckit & Russell, 1983; Yamaguchi & Kandel, 1984). What is less clear from the literature is the extent to which early onset also leads to treatment initiation

at an earlier age, after the same number of elapsed years of substance use, or actually later than expected.

It is important to recognize that while retention or dosage may predict better outcomes for a given episode of care (for a review, see Simpson et al., 2002), multiple episodes of care can also be a marker for people who have not been responsive to prior treatment and hence have a worse prognosis. In the Drug Abuse Treatment Outcome Study (DATOS), for instance, the odds ratio for achieving cocaine abstinence when comparing those with prior treatment with first time admissions was 0.76 (i.e., those with prior treatment experience were less likely to remain abstinent; Hser, Joshi, Anglin, & Fletcher, 1999). Over a 5-year period, 54% of the clients with cocaine dependence in DATOS relapsed after their index episode of care (for over half, this was already a readmission) and 44% subsequently returned to treatment (an average of 2.6 years following discharge); A logistic regression analysis with a subset of 347 people who relapsed demonstrated that individuals who were African American and who had higher severity were more likely to re-enter treatment (Grella et al., 2003).

It is estimated that close to 80% of the people entering SUD treatment also present with one or more co-occurring psychiatric disorders (Brooner, King, Kidorf, Schmidt, & Bigelow, 1997; Enns, Swenson, McIntyre, Swinson, & Kennedy, 2001; Hien, Zimberg, Weisman, First, & Ackerman, 1997; Kaufman & Charney, 2000; Kessler et al., 1996; Krausz, Degkwitz, Kuhne, & Verthein, 1998; Mueser et al., 1990; Parikh & Lam, 2001; Razzouk, Bordin, & Jorge, 2000; Roberts & Koob, 1997; Ross, Glaser, & Germanson, 1988). Moreover, co-occurring psychiatric problems are associated with higher substance use severity, more intensive level of care placements, lower treatment participation, and worse outcomes (American Society of Addiction Medicine, 2001; Angst, Sellaro, & Ries, 2002; Booth, Russell, & Laughlin, 1992; Center for Substance Abuse Treatment, 2000; Drake, Mueser, Clark, & Wallach, 1996; Edwards et al., 1977; Enns et al., 2001; Forsythe, Griffiths, & Reiff, 1982; Gamma & Angst, 2001; Grella, 2003; Hasin et al., 1996a, 1996b; Kessler et al., 1994; Khantzian & Treece, 1985; McDermut, Mattia, & Zimmerman, 2001; McLellan, Luborsky, Woody, O'Brien, & Druley, 1983; Minkoff, 1989; National Institute on Alcohol Abuse and Alcoholism, 1997; National Institute on Drug Abuse, 1999; Rounsaville, Weissman, Crits-Christoph, Wilber, & Kleber, 1982; Rounsaville, Kosten, & Kleber, 1986; Schutte, Brennan, & Moos, 1994; Substance Abuse and Mental Health Services Administration, 2002; Woody, McLellan, Luborsky, & O'Brien, 1985). In spite of the high prevalence, co-occurring psychiatric problems are rarely comprehensively or systematically assessed in SUD treatment programs, so the literature is unclear as to whether greater severity is likely to improve outcomes (as treatment has more potential ability to help) or operates more as a marker of poor long-term prognosis.

The aim of this paper is to estimate the duration and correlates of (a) addiction careers (i.e., years between first use and at least a year of abstinence) and (b) treatment careers (i.e., years between first treatment admission and at least a year of abstinence). This will be done using a large heterogeneous sample and the findings will be discussed in terms of their implications for developing more effective treatment under a chronic care model.

2. Methods

2.1. Data source

A cohort of 1,326 adults were recruited between 1996 and 1998 from sequential admissions to a network of 22 service delivery units in 12 SUD treatment facilities operated by 10 agencies in a large metropolitan area in the United States, Chicago's west side (Scott, Muck, & Foss, 2000; Scott, Foss, & Sherman, 2003a, 2003b). Follow-up interviews were completed with 98% of the living participants at 6 months, 94% at 24 months, and 94% at 36 months (see Scott, Foss, & Dennis, 2003, for more on the background procedure for this study). Between intake and 36 months, 2.6% (35/1326) had died, leaving the sample size at $N = 1291$ (97%). Of the living participants, data from one or more follow-up interviews are available for this analysis on 1271 participants (98% of those living; 96% of total).

2.2. Community and treatment system

Participants were recruited from Illinois's Treatment Service Delivery Network 4, which draws over half of its participants from Chicago's west side. Representing an area of approximately 24 square miles, the residents in these communities are 60% African American, 26% Hispanic, 13% white, 1% other, 52% female, and 54% over the age of 25. These communities are some of the poorest in Chicago: 34% of the families have incomes below the poverty line (20% have incomes below one half of the poverty line) and rank between first and 25th in the city and state in terms of crime, infectious diseases (including syphilis, tuberculosis, and AIDS), low birth-weight babies (95 to 159 per 1000), and infant deaths (11 to 21 per 1000). Thus this is an area where poverty, drug use, crime, and health problems have great costs to both its residents and society as a whole.

The public-treatment system in Illinois is divided into geographically defined networks that are designed to (eventually) provide access to all levels of care within every network. The state has also mandated that all public providers (a) adopt a common electronic-record system with information on intake, services, and discharge (Office of Alcoholism and Substance Abuse, 2001), (b) use the Diagnostic and Statistical Manual version 4 (DSM-IV-TR; American Psychiatric Association, 2000) for diagnosis, and (c) use the Uniform Patient Placement Criteria version 2

(UPPC-2; ASAM, 2001). In 1996 and 1997 a stratified sample of 1,326 participants were recruited from 22 treatment units (10 outpatient drug-free programs, five intensive outpatient drug-free programs, three methadone maintenance programs, two short-term inpatient programs, one long-term inpatient program, and one halfway house) operated by 10 agencies in these communities/networks.

2.3. Participants

2.3.1. Eligibility and informed consent

To be eligible, participants had to: (a) be residents of Chicago or declare themselves homeless; (b) report alcohol or drug use in the past 6 months (or the 6 months before being in a controlled environment); (c) present for treatment at one of the publicly funded treatment programs in the study, and (d) be 18 years of age or older. Individuals who were seeking treatment as a result of a DUI Level 2 or higher conviction were also excluded because their treatment placement decisions were typically made outside the treatment system being studied (i.e., by a court officer). Informed and voluntary consent to participate was sought under the supervision of the state's and Chestnut's Institutional Review Board. Approximately 85% of all the individuals eligible to participate in the original study agreed to participate.

2.3.2. Characteristics

Participants were mostly African American (88%), female (59%) and in their 30s (48%). Most were unemployed (86%), did not complete high school (71%) and had never been married (65%). As for criminal justice involvement, 25% were on probation or parole at study intake. Over three fourths (76%) reported prior arrests and two thirds (66%) reported prior incarcerations. About 32% considered themselves homeless with 12% living on the street at intake. In terms of clinical characteristics, the average age of first substance use was 16.8 years of age, with most (68%) reporting 10 or more years of regular alcohol use to intoxication or regularly using a drug. In the month prior to intake, the most common substances used weekly were: cocaine (33%), heroin (31%), alcohol (27%) and marijuana (7%). Staff rated more than 94% as having some level of dependence: mild dependence (7.7%), moderate dependence (36.9%), or severe dependence (49.9%). At intake to the study, 54% had been in formal treatment before (26% three or more times) and another 13% had been to self-help or detox only. Many also met criteria for Major Depression (36%) or Generalized Anxiety Disorder (36%) and most had a history of physical (50%), emotional (36%) and/or sexual (22%) victimization.

2.4. Instruments

Self-reported data was collected with an augmented version (Scott, Dennis, Godley, & Foss, 1995) of the

Addiction Severity Index (ASI; McLellan et al., 1992). The augmented version (A-ASI) spells out the items and response sets in the ASI (which is semi-structured), includes the General Mental Distress Index (GMDI) from the Global Appraisal of Individual Needs (Dennis et al., 1995; Dennis, 1999), and doubles the number of questions in each content area (including questions on the age of first use, date of last use, treatment history, and current service utilization). Psychometric evaluation of A-ASI used in this sample demonstrated good internal consistency ($\alpha = .7$ or higher) and test-retest reliability ($r = 0.7$ or higher) for the ASI alcohol, drug and mental health composite score (see Scott, Foss, & Dennis, 2003). The GMDI is a more detailed symptom count of internal sources of distress (somatic, depressive, and anxiety-related disorders) with a higher internal consistency ($\alpha = .9$; see also Dennis, Scott, & Funk, 2003; Scott, Foss, & Dennis, 2003). As a predictor in this analysis, it has been categorized into low (0–3 symptoms), medium (4–6 symptoms) or high (7–21 symptoms) distress, a scheme that has good test-retest reliability (weighted $\kappa = .59$). Age of first use (the starting point for the first analysis presented here) demonstrated high test-retest reliability ($\rho = .87$). Past year abstinence from illicit drug use and alcohol intoxication (the end point for the analyses presented here) demonstrated high test-retest reliability ($\kappa = .92$) and was largely consistent with urine tests ($\kappa = .56$).

2.5. Measures

The analysis is based on the time between three key events: Age of first use of illicit drug use or alcohol intoxication (median of 16, inter-quartile range [IQR] of 14 to 18), age of first treatment (median of 31, IQR of 26 to 37), and age at achieving 1 or more years of abstinence after

initial use (median of 35, IQR of 31 to 40). Fig. 1 shows the distributions of these variables as well as the age at which the participants were enrolled in the study (i.e., their “index” episode of care). Note that age at achieving 1 or more years of abstinence was treated as right-censored for people who had not achieved, were still in treatment, or dead at the time of the last interview. These variables were then used to create the study’s two dependent variables:

- Duration of Substance Use Career (years). This was calculated as the age of the participant at the interview where they first reported one year of abstinence minus the age of first use.
- Duration of Treatment Career (years). This was calculated as the age of the participant at the interview where they first reported one year of abstinence minus the age at the first admission to a formal SUD treatment program (not including detoxification programs or self help meeting attendance only).

Thus for an individual who started using at age 15, first went to treatment at age 29, was recruited into the study at age 36 (during a third admission), and first achieved a year of abstinence at age 38, the duration of the substance use career would be $38 - 15 = 23$ years, and the duration of the treatment career would be $38 - 29 = 9$ years. If the same person never achieved a year of sobriety and the last observation was at age 39, then both variables would be included in the denominator (but not the numerator) in the years observed, but dropped from the age of the last observation on (i.e., right-censored). For substance use careers this would be $39 - 15 = 24$ years, and for treatment careers this would be $39 - 29 = 10$ years. Thus for each time period the estimate of the time to event is based on the

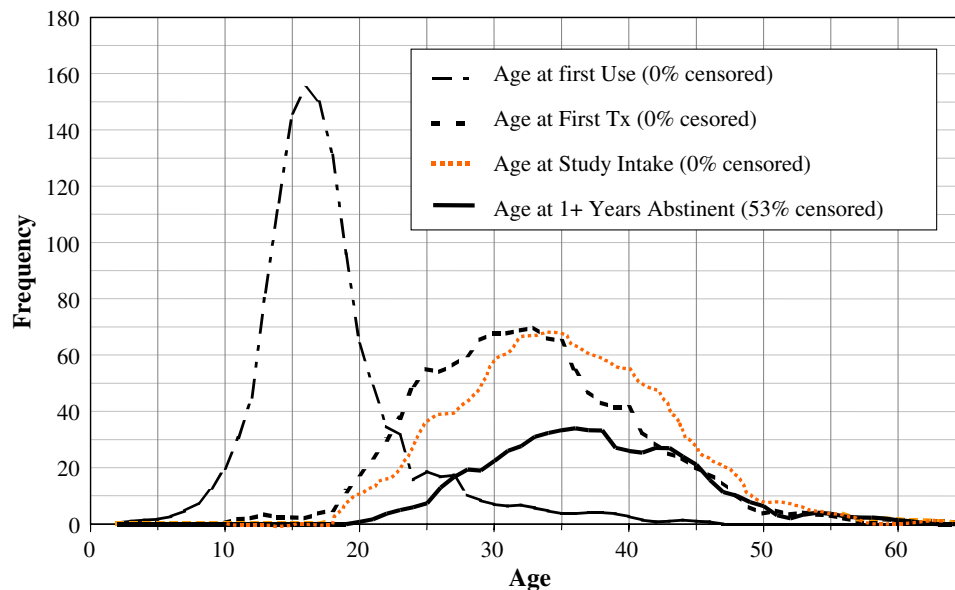


Fig. 1. Distributions of key variables.

people who have not yet had it or not yet been censored (discussed further below).

Predictor variables used in the analysis included gender, age of first use (categorized as under 15, 15–20, 21 or older), age of first treatment (categorized as under 24, 25 to 35, 36 or older), years from first use until first treatment admission (categorized as 0–9, 10–19, or 20+ years), treatment episodes prior to the index episode (categorized as none, 1–2, 3+), problem area (drugs, alcohol, or both) and severity on the GMDI; categorized as low for 0–3 symptoms, moderate for 4–6 symptoms, and high for 7–21 symptoms). Categorizations above were based on multiple criteria including established cut points (e.g., for GMDI), screens in the distributions (see Fig. 1), and the literature reviewed earlier.

2.6. Analysis procedures

Retrospective (age of first use to index admission) and prospective data (index admission to three years later) were combined to make observation periods of up to 30 years after their first use and up to 25 years after their first treatment admission. Cox Regression survival analysis (Cox & Oakes, 1984) was used to take into account differences in the amount of time observed and censoring (the event had not happened yet). Odds ratios significantly greater than 1.00 indicate that a given predictor is associated with shorter substance use or treatment careers before achieving a year of abstinence. Odds ratios significantly less than 1.00 indicated that a given predictor is associated with longer substance use or treatment careers before achieving a year of abstinence. For all the Cox Regression analyses, the percent of cases dropped because of missing data ranged from 0% to 5%. Table 1 shows that many of the predictors are correlated and reveals two important patterns. First, people who start using at a later age tend to access treatment sooner (after their initiation) while those who start at an earlier age tend to use substances for more years before accessing treatment. Second, people who start treatment at a later age tend to have longer substance use careers. To control for the correlations between the predictors, the analyses were done two ways: (1) testing the unconditional or univariate impact of each predictor on the survival curve and (2) testing the conditional or multivariate impact of each predictor on the

survival curve (which takes into account the value of other terms in the model/table).

3. Results

3.1. Addiction careers

Fig. 2 shows the estimated duration of addiction careers in terms of the years from first use to 1+ years of abstinence and is based on the Cox Regression, which controls for censored observations. The median duration (50% cumulative survival) of substance use careers was 27 years (interquartile range of 18 to 30+ years). Table 2 gives the median years from first use to 1 or more years of abstinence, along with the IQR or middle 50% for each of the predictors. The next set of columns report the results of the corresponding “unconditional” Cox Regression analysis (i.e., one predictor at a time) and includes the odds ratio for comparing the current row with the index row (odds=1.00) for each predictor (i.e. for gender, male is compared to female), its significance, and 95% confidence intervals. The third set of columns reports parallel information for the “conditional” Cox Regression analysis (i.e., the value is conditional on other predictors in the model/table). The unconditional analysis is important as the results can be compared to other findings commonly reported in the literature, while the conditional analysis controls for the intercorrelation of the predictors and is assumed to be the more accurate but less reported analysis.

In the unconditional analysis, *addiction careers* were significantly longer for subgroups of participants: (a) who were male, relative to those who were female (median career lengths of 29 vs. 25 years); (b) who started using under age 15 and who started using between the ages of 15 to 20, relative to participants who were 21 or older (median of 29 vs. 26 vs. 18 years); (c) who started treatment over age 36 and who started treatment between the ages of 25 to 35, relative to those who started treatment under age 24 (median of 32 vs. 23 vs. 20 years); (d) who used substances for 20 or more years before going to treatment the first time and who used substances for 10 to 19 years before going to treatment the first time, relative to those who used substances for 0 to 9 years before going to treatment for the

Table 1
Correlations of predictors

	Age of first use	Age of first treatment	Years till first treatment	Prior treatment	Substance problem	General mental distress
Gender	+ .146***	– .068*	– .182***	+ .092**	– .141***	+ .110***
Age of first use	–	+ .202***	– .316***	– .112***	– .181***	– .067*
Age of first treatment	–	–	+ .668***	– .167***	+ .030	+ .005
Years till first treatment	–	–	–	– .120***	+ .135***	+ .038
Prior treatment	–	–	–	–	+ .017	+ .114***
Substance problem	–	–	–	–	–	+ .063*

Note: Significance indicated by: * $p < .05$, ** $p < .01$, *** $p < .0001$.

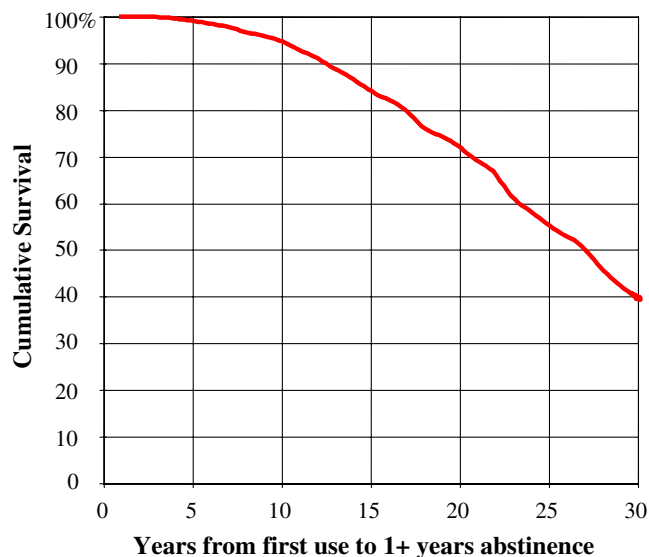


Fig. 2. Duration of substance use careers.

first time (median 35+ vs. 23 vs. 15 years); (e) with 3 or more treatment episodes prior to study intake, relative to those with no treatment to study intake (median of 31 vs. 24 years); (f) who needed treatment for both alcohol and drugs at study intake, relative to those who needed

treatment for drug use alone (median of 28 vs. 25 years); and (g) with high levels of mental distress at study intake, relative to those with low mental distress at study intake (29 vs. 25 years).

Because several predictors were correlated (see Table 1 in methods), the magnitude and in some cases the direction of the effects were different for the conditional analyses. Being male, early initiation, years to first treatment, prior treatment, and high mental distress were all still significant risk factors for longer substance use careers. After controlling for all of the variables in the model, having one or two episodes of prior treatment was also a significant risk factor. Presenting for both alcohol and drug problems was no longer significant (although still in the same direction). The most significant change, however, was in terms of the “age of first treatment admission”—with older ages going from being a predictor of longer addiction careers to being predictors of shorter addiction careers once years to first treatment and the other covariates were considered.

3.2. Treatment careers

Based on survival analysis, Fig. 3 shows the estimated duration of treatment careers in terms of the years from first

Table 2
Predictors of the years of individual “addiction careers”^a

	N	Years Median (IQR)	Unconditional		Conditional	
			Odds Ratio	95% CI	Odds Ratio	95% CI
Gender						
Female	770	25 (17, 32)	1.00		1.00	
Male	520	29 (20, 30+)	0.69***	(0.58, 0.81)	0.80*	(0.67, 0.97)
Age of first use						
Under 15	447	29 (22, 30+)	0.33***	(0.26, 0.42)	0.67**	(0.50, 0.89)
15 – 20	633	26 (17, 30+)	0.49***	(0.39, 0.61)	0.59**	(0.42, 0.83)
21+	210	18 (11, 31)	1.00		1.00	
Age of first treatment						
Under 24	242	20 (12, 30+)	1.00		1.00	
25 – 35	682	23 (17, 30)	0.77*	(0.62, 0.97)	1.60**	(1.14, 2.25)
36+	366	32 (26, 30+)	0.32***	(0.24, 0.41)	1.19	(0.73, 1.94)
Years till first treatment						
0 – 9	340	15 (10, 30)	1.00		1.00	
10 – 19	596	23 (18, 29)	0.47***	(0.38, 0.57)	0.32***	(0.23, 0.43)
20+	354	35+ (27, 30+)	0.13***	(0.10, 0.17)	0.08***	(0.05, 0.12)
Prior treatment						
None	444	24 (15, 30+)	1.00		1.00	
1 – 2	552	27 (18, 30+)	0.84	(0.70, 1.01)	0.51***	(0.42, 0.62)
3+	274	31 (22,30+)	0.59***	(0.46, 0.74)	0.28***	(0.21, 0.36)
Substance problem						
Drugs	426	25 (16, 30+)	1.00		1.00	
Alcohol	69	29 (17, 30+)	0.73	(0.51, 1.04)	0.91	(0.62, 1.31)
Both	742	28 (19, 30+)	0.77**	(0.64, 0.92)	0.89	(0.74, 1.08)
General mental distress						
Low	623	25 (17, 30+)	1.00		1.00	
Moderate	190	27 (17, 30+)	0.93	(0.73, 1.18)	0.82	(0.64, 1.05)
High	455	29 (21, 30+)	0.73**	(0.61, 0.88)	0.73**	(0.60, 0.89)

Significance indicated by: * $p < .05$, ** $p < .01$ *** $p < .001$.

IQR: Inter-quartile range (i.e., middle 50%).

^a Difference in age from first use of any illicit or alcohol to intoxication and one or more years of abstinence.

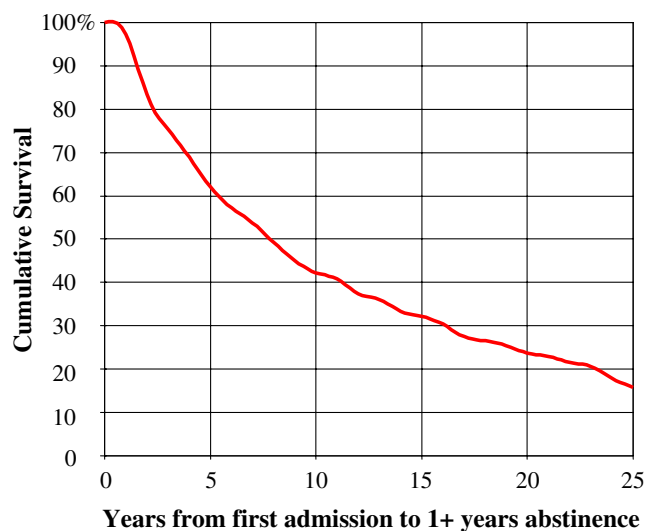


Fig. 3. Duration of treatment careers.

treatment admission to 1+ years of abstinence and is based on the Cox Regression, which controls for censored observations. The median treatment career duration was 9 years (inter-quartile range of 4 to 18 years). Table 3 presents the

information for this dependent variable parallel to Table 2. In the unconditional analysis, *treatment careers* were significantly longer for subgroups of participants: (a) who started using under age 15, relative to 21 or older (median career lengths of 10 vs. 7 years), (b) started treatment under the age of 24, relative to those starting treatment between the ages of 25 to 35 and relative to those starting treatment at age 36 or older (median of 16 vs. 9 vs. 7 years), (c) who used substances for 0 to 9 years before their first treatment admission, relative to those who used substances for 10 to 19 years before going to treatment for the first time (median 10 vs. 9 years); (d) with 3 or more treatment episodes prior to study intake and with one to two treatment episodes prior to study intake, relative to those with no treatment prior to study intake (median of 15 vs. 9 vs. 5 years); and (e) with high levels of mental distress at study intake, relative to those with low mental distress at study intake (11 vs. 8 years).

Because these predictors were correlated (see Table 1 in methods), the magnitude and sometimes the direction of the effects were different for the conditional analyses. Starting treatment under age 24, prior treatment, and high mental distress were all still significant risk factors for longer substance use careers. After controlling for all of the variables in the model for predicting the length of treatment

Table 3
Predictors of the years of individual “treatment careers”^a

	N	Years Median (IQR)	Unconditional		Conditional	
			Odds Ratio	95% C.I.	Odds Ratio	95% C.I.
Gender						
Female	764	9 (4, 17)	1.00		1.00	
Male	507	10 (4, 23)	0.94	(0.79, 1.11)	0.95	(0.79, 1.14)
Age of first use						
Under 15	442	10 (5, 19)	0.77*	(0.60, 0.99)	1.11	(0.84, 1.48)
15 – 20	625	9 (4, 19)	0.90	(0.71, 1.14)	1.18	(0.84, 1.66)
21+	204	7 (4, 18)	1.00		1.00	
Age of first treatment						
Under 24	239	16 (5, 30+)	1.00		1.00	
25 – 35	676	9 (4, 16)	1.70***	(1.35, 2.14)	1.84***	(1.33, 2.53)
36+	356	7 (4, 13)	1.79***	(1.36, 2.34)	2.16**	(1.35, 3.46)
Years till first treatment						
0 – 9	339	10 (4, 30+)	1.00		1.00	
10 – 19	582	9 (4, 16)	1.33**	(1.09, 1.62)	0.89	(0.67, 1.18)
20+	350	9 (4, 13)	1.21	(0.95, 1.55)	0.64*	(0.41, 0.98)
Prior treatment						
None	429	5 (3, 20)	1.00		1.00	
1 – 2	552	9 (5, 15)	0.51***	(0.41, 0.62)	0.52***	(0.42, 0.65)
3+	274	15 (7, 26)	0.29***	(0.23, 0.38)	0.31***	(0.24, 0.41)
Substance problem						
Drugs	420	9 (4, 16)	1.00		1.00	
Alcohol	67	8 (4, 25)	1.01	(0.68, 1.49)	0.95	(0.64, 1.42)
Both	736	10 (4, 18)	0.98	(0.82, 1.18)	1.01	(0.84, 1.22)
General mental distress						
Low	609	8 (4, 15)	1.00		1.00	
Moderate	190	9 (4, 30+)	0.87	(0.68, 1.11)	0.90	(0.70, 1.16)
High	454	11 (5, 24)	0.75**	(0.62, 0.90)	0.82*	(0.68, 0.99)

Significance indicated by: * $p < .05$, ** $p < .01$, *** $p < .001$.

IQR: Inter-quartile range (i.e., middle 50%).

^a Difference in age from first treatment admission and one or more years of abstinence.

careers, age of first use was no longer a significant predictor and the direction of the years of use to first treatment reversed so that more years of use before the first admission was associated with longer treatment careers.

4. Discussion

4.1. Reprise of key points

This study uses evidence from a large and heterogeneous sample to demonstrate that both substance use and treatment careers typically involve multiple years (27 and 9 years respectively) and episodes of care (three to four). This suggests that we might be able to improve the overall and long-term effectiveness of treatment by shifting the field's focus from short-term outcomes to longitudinal analyses of the longer term course of substance use, treatment over multiple episodes of care, and the cycle of transitioning from relapse to treatment re-entry and recovery. This paper also examined the predictors of career length.

As expected, age of first use was associated with longer substance use careers, longer histories of use before entering treatment, and longer treatment careers. However, conditional analyses controlling for the years of use before first treatment reduced this association for substance use career length and eliminated it for treatment career length. This finding suggests that while we want to delay the on-set of substance use through prevention as much as possible, outcomes are also likely to improve if we can proactively detect and intervene with people sooner in their substance use careers.

Consistent with the emerging literature on outcomes across episodes of care, we found that multiple admissions and/or co-occurring disorders are likely to have a worse prognosis (i.e., longer) for subsequent substance use and treatment careers. This suggests that there may be a need for separate treatment tracks that focus more on subgroups with these characteristics. It also suggests that controlling for them in analyses (whether as covariates or through subgroup analysis) may help to improve the sensitivity of treatment outcome research.

4.2. Implications for the field

The finding that substance use is a chronic condition, where multiple treatment admissions over many years is the norm, is consistent with prior literature reviewed earlier. Combined with the exploratory results predicting the duration of addiction and treatment careers, these findings suggest a need for a paradigm shift in how the field thinks about multiple episodes of care. Currently, people often think in terms of two extremes. On the one hand, some people think of the transition to recovery as an almost random coming together of motivation and events and advocate having only repeated exposure to brief interven-

tions. The problem with this is that meta-analyses suggest that such interventions have minimal long-term benefits (e.g., Moyer, Finney, Swearingen, & Vergun, 2002). On the other hand, others argue for an understanding of multiple episodes in terms of "cumulative dosage" (e.g., Simpson et al., 2002). Such analyses, however, generally do not take into account prior treatment history. The results presented here (which do take into account prior treatment history) suggest that repeated episodes of care are better thought of as further evidence of chronicity (i.e., a history of relapse after prior treatments predicts higher risk of relapse for the next episode). This is not completely at odds with the earlier work. Thus, brief interventions may indeed be very appropriate for initiating change or even treatment (re)entry but do not sustain long-term recovery in a chronic population. Similarly, for a given level of treatment history and current need, those who get more treatment or treatment sooner are indeed likely to do better. This suggests the need for developing and evaluating approaches that focus more on continuing care (e.g., Godley et al., 2002; McKay, 2001) and long-term recovery management (e.g., Dennis, Scott, & Funk, 2003).

A second important point was that multiple substance use and other psychiatric disorders were the norm. Again, this is consistent with the literature reviewed earlier and several recent works advocating that the field shift to focusing on multiple substance use (Rounsaville et al., 2003) and multimorbidity (Substance Abuse and Mental Health Services Administration [SAMHSA], 2002) since they are actually the norms of our population. This also suggests that for a chronic population there is also the need to focus on integration with the health-care system (e.g., Watkins, Pincus, Tanielian, & Lloyd, 2003; Weisner, Mertens, Parthasarathy, Moore, & Lu, 2001), mental-health system (SAMHSA, 2002; Mertens et al., 2003) and criminal-justice system (Scott et al., 2003; Zanis et al., 2003).

4.3. Limitations and steps to address them in the future

There are several potential limitations of this study. First, our estimates of duration may be biased by the 3-year period of "prospective" observation; though people were at different points in their addiction and treatment careers during this period—a longer period might have given a more stable estimate. It will be important to see whether these findings hold as we continue following this cohort out to 10 years after the study intake as part of our grant from the National Institute on Drug Abuse. Second, survival analysis can also be sensitive to which observations are treated as "censored." While people who continue to use clearly fit, we also included those still (or back) in treatment, those who were incarcerated, and those who died. This is less than 10% of the data at 3 years and does not impact the estimates here. But the number who have died is expected grow from 2% at 3 years (presented here) to over 20% at 10 years (on which we are in the process of

collecting data). In subsequent analyses it will be important to reexamine the sensitivity of these decisions. Third, by rescaling data by age, we have de facto assumed no “cohort” effects (e.g., a difference in starting use during the 1970s vs. 1980s regardless of age). Addressing this will require replication with other cohorts/studies. Fourth, while exploratory longitudinal analyses can help guide program planning, it is also important to recognize their limits for inferring causality. We are therefore also conducting experimental studies with interventions designed to shorten substance use and treatment careers (e.g., Dennis et al., 2003). Fifth, the data here also relied entirely on self-report. We are currently in the process of obtaining state treatment history records and additional urine test data to validate both use and treatment further. Sixth, several of the variables (e.g., prior treatment episodes, mental distress) were collected at study intake—potentially years after the first treatment admission—and thus, may be vulnerable to recall bias. As more prospective longitudinal data is available, the confound between these variables and the outcomes will decrease and we may be able to look at their stability over time. Seventh, our sample was limited to an inner city and predominately African American sample. Given earlier findings by Grella and colleagues (2003) that suggest that African Americans may be more likely to reenter treatment, there is a need to replicate these findings in more diverse samples. Finally, the outcomes here focus solely on substance use; in the future we hope to add analyses of remission according to DSM-IV and address the small percent (2–7%) whose abstinence was forced through incarceration.

4.4. Conclusion

This study helps to demonstrate the need to develop and use a new paradigm for evaluating substance use treatment—one that accounts for the chronic cycle of relapse, treatment re-admission, and recovery over multiple years and episodes of care. We are already in the process of extending our longitudinal work with this cohort and plan to continue conducting experimental studies of interventions designed to alter this cycle.

Acknowledgments

Preparation of this manuscript was supported by funding from the Center for Substance Abuse Treatment (CSAT), Substance Abuse and Mental Health Services Administration, Department of Health and Human Services Contract No. 270-97-7011 (Persistent Effects of Treatment Studies). The content of this publication does not necessarily reflect the views or policies of the Department of Health and Human Services, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government. We wish to thank the participants and

staffs of the participating treatment agencies, Christine Grella and Herman Diefenhaus for comments on the draft, and Melissa Ives and Kelli Wright for their assistance in preparing the manuscript. The opinions expressed here are those of the authors and are not official opinions of any federal or state governments.

References

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- American Society of Addiction Medicine (ASAM). (2001). *Patient placement criteria for the treatment for substance-related disorders* (2nd ed.). Chevy Chase, MD: Author.
- Anglin, M. D., Hser, Y. I., & Grella, C. E. (1997). Drug addiction and treatment careers among clients in the Drug Abuse Treatment Outcome Study (DATOS). *Psychology of Addictive Behaviors, 11*, 308–323.
- Angst, J., Sellaro, R., & Ries, M. K. (2002). Multimorbidity of psychiatric disorders as an indicator of clinical severity. *European Archives of Psychiatry and Clinical Neuroscience, 252*, 147–154.
- Anthony, J. C., & Petronis, K. R. (1995). Early-onset drug use and risk of later drug problems. *Drug and Alcohol Dependence, 40*, 9–15.
- Booth, B. M., Russell, D. W., Laughlin, P. R. (1992). *Psychiatric comorbidity and health care utilization after alcoholism treatment*. Paper presented at the Annual Research Society of Alcoholism, San Francisco, CA.
- Bronner, R. K., King, V. L., Kidorf, M., Schmidt, C. W., & Bigelow, G. E. (1997). Psychiatric and substance use comorbidity among treatment-seeking opioid abusers. *Archives of General Psychiatry, 54*, 71–80.
- Brunswick, A. F., & Boyle, J. M. (1979). Patterns of drug involvement: developmental and secular influences on age at initiation. *Youth & Society, 11*, 139–162.
- Buydens-Branchey, L., Branchey, M. H., & Noumair, D. (1989). Age of alcoholism onset: I. Relationship to psychopathology. *Archives of General Psychiatry, 46*, 225–230.
- Capodanno, A. E., Fram, D. H., Holden, R., & Targum, S. D. (1984). The outpatient treatment of heroin addicts with methadone: A two- to five-year follow-up study. *The Psychiatric Hospital, 15*, 25–30.
- Center for Substance Abuse Treatment. (2000). *Changing the conversation: The National Treatment Plan initiative*. Rockville, MD: U.S. Department of Health and Human Services.
- Cox, D. R., & Oakes, D. O. (1984). *The analysis of survival data*. London: Chapman and Hall.
- Croughan, J. L., Miller, J. P., Whitman, B. Y., & Schober, J. G. (1981). Alcoholism and alcohol dependence in narcotic addicts: A prospective study with a five-year follow-up. *American Journal of Drug and Alcohol Abuse, 8*, 85–94.
- Cunningham, J. A., Koski-Jannes, A., & Toneatto, T. (1999). Why do people stop their drug use? Results from a general population sample. *Contemporary Drug Problems, 26*, 695–710.
- Cunningham, J. A., Lin, E., Ross, H. E., & Walsh, G. W. (2000). Factors associated with untreated remissions from alcohol abuse or dependence. *Addictive Behaviors, 25*, 317–321.
- Dawson, D. A. (1996). Correlates of past-year status among treated and untreated persons with former alcohol dependence: United States, 1992. *Alcoholism: Clinical and Experimental Research, 20*, 771–779.
- DeLeon, G. (1984). *The therapeutic community: Study of effectiveness*. Rockville, MD: U.S. Department of Health and Human Services.
- Dennis, M. L. (1999). *Global Appraisal of Individual Needs (GAIN): Administration guide for the GAIN and related measures (Version 1299)*. Bloomington, IL: Chestnut Health Systems.
- Dennis, M. L., Babor, T., Roebuck, M. C., & Donaldson, J. (2002). Changing the focus: The case for recognizing and treating marijuana use disorders. *Addiction, 97* (Suppl. 1), S4–S15.

- Dennis, M. L., Dawud-Noursi, S., Muck, R. D., & McDermeit, M. (2003). The need for developing and evaluating adolescent treatment models. In S. J. Stevens, & A. R. Morral (Eds.), *Adolescent drug treatment in the United States: Exemplary models from a National Evaluation Study* (pp. 3–34). Binghamton, NY: Haworth Press.
- Dennis, M. L., Rourke, K. M., Lucas, R. L., Zien, C., Clayton, K. J., Harris, K. M., Caddell, J. M., Cavanaugh, B. R., & Fleischman, D. (1995). *Global Appraisal of Individual Needs (GAIN): Resource manual*. Research Triangle Park, NC: Research Triangle Institute.
- Dennis, M. L., Scott, C. K., & Funk, R. (2003). An experimental evaluation of recovery management checkups (RMC) for people with chronic substance use disorders. *Evaluation and Program Planning*, 26, 339–352.
- Dole, V. P., & Joseph, H. (1978). Long-term outcome of patients treated with methadone maintenance. *Annals of the New York Academy of Sciences*, 31, 181–189.
- Drake, R. E., Mueser, K. T., Clark, R. E., & Wallach, M. A. (1996). The course, treatment, and outcome of substance disorder in persons with severe mental illness. *American Journal of Orthopsychiatry*, 66, 42–51.
- Duvall, H. J., Locke, B. Z., & Brill, L. (1963). Follow-up study of narcotic addicts five years after hospitalization. *Public Health Reports*, 78, 185–193.
- Edwards, G., Orford, J., Egert, S., Guthrie, S., Hawker, A., Hensman, C., Mitcheson, M., Oppenheimer, E., & Taylor, C. (1977). Alcoholism: A controlled trial of “treatment” and “advice”. *Journal of Studies on Alcohol*, 38, 1004–1031.
- Enns, M. W., Swenson, J. R., McIntyre, R. S., Swinson, R. P., & Kennedy, S. H. (2001). Clinical guidelines for the treatment of depressive disorders. VII. Comorbidity. *Canadian Journal of Psychiatry*, 46 (Suppl. 1), 77S–90S.
- Fleming, J. P., Kellam, S. G., & Brown, C. H. (1982). Early predictors of age at first use of alcohol, marijuana, and cigarettes. *Drug and Alcohol Dependence*, 9, 285–303.
- Forsythe, A. B., Griffiths, B., & Reiff, S. (1982). Comparison of utilization of medical services by alcoholics and non-alcoholics. *American Journal of Public Health*, 72, 600–602.
- Gamma, A., & Angst, J. (2001). Concurrent psychiatric comorbidity and multimorbidity in a community study: Gender differences and quality of life. *European Archives of Psychiatry and Clinical Neuroscience*, 251 (Suppl. 2), II43–II46.
- Gearing, F. R. (1974). Methadone maintenance treatment five years later—where are they now? *American Journal of Public Health*, 64, 44–50.
- Godley, M. D., Godley, S. H., Dennis, M. L., Funk, R., & Passetti, L. (2002). Preliminary outcomes from the assertive continuing care experiment for adolescents discharged from residential treatment. *Journal of Substance Abuse Treatment*, 23, 21–32.
- Grant, B. F. (1998). Age of smoking onset and its association with alcohol consumption and DSM-IV alcohol abuse and dependence: Results from the National Longitudinal Alcohol Epidemiologic Survey. *Journal of Substance Use*, 10, 59–73.
- Grella, C. E. (2003). Effects of gender and diagnosis on addiction history, treatment utilization, and psychosocial functioning among a dually diagnosed sample in drug treatment. *Journal of Psychoactive Drugs*, 35, 169–179.
- Grella, C. E., Hser, Y., & Hsieh, S. (2003). Predictors of drug treatment re-entry following relapse to cocaine use in DATOS. *Journal of Substance Abuse Treatment*, 25, 145–154.
- Grella, C. E., & Joshi, V. (1999). Gender differences in drug treatment careers among clients in the national drug abuse treatment outcome study. *American Journal of Drug and Alcohol Abuse*, 25, 385–406.
- Hanna, E. Z., & Grant, B. F. (1999). Parallels to early onset alcohol use in the relationship of early onset smoking with drug use and DSM-IV and depressive disorders: Findings from the National Longitudinal Epidemiologic Survey. *Alcoholism: Clinical and Experimental Research*, 23, 513–522.
- Hasin, D. S., Tsai, W., Endicott, J., Mueller, T. I., Coryell, W., & Keller, M. (1996a). The effects of major depression on alcoholism: Five year course. *American Journal on Addictions*, 5, 144–155.
- Hasin, D. S., Tsai, W., Endicott, J., Mueller, T. I., Coryell, W., & Keller, M. (1996b). Five-year course of major depression: Effects of comorbid alcoholism. *Journal of Affective Disorders*, 41, 63–70.
- Hien, D., Zimberg, S., Weisman, S., First, M., & Ackerman, S. (1997). Dual diagnosis subtypes in urban substance abuse and mental health clinics. *Psychiatric Services*, 48, 1058–1063.
- Hser, Y. I., Anglin, M. D., Grella, C., Longshore, D., & Prendergast, M. L. (1997). Drug treatment careers: A conceptual framework and existing research findings. *Journal of Substance Abuse Treatment*, 14, 543–558.
- Hser, Y. I., Grella, C. E., Chou, C. P., & Anglin, M. D. (1998). Relationships between drug treatment careers and outcomes: Findings from the National Drug Abuse Treatment Outcome Study. *Evaluation Review*, 22, 496–519.
- Hser, Y., Hoffman, V., Grella, C. E., & Anglin, M. D. (2001). A 33-year follow-up of narcotics addicts. *Archives of General Psychiatry*, 58, 503–508.
- Hser, Y. I., Joshi, V., Anglin, M. D., & Fletcher, B. (1999). Predicting post-treatment cocaine abstinence: What works for first-time admissions and treatment repeaters. *American Journal of Public Health*, 89, 666–671.
- Hubbard, R. L., Marsden, M. E., Rachal, J. V., Harwood, H. J., Cavanaugh, E. R., & Ginzburg, H. M. (1989). *Drug abuse treatment: A national study of effectiveness*. Chapel Hill, NC: University of North Carolina Press.
- Judson, B., Ortiz, S., Crouse, L., Carney, T. M., & Goldstein, A. (1980). A follow-up study of heroin addicts five years after first admission to a methadone treatment program. *Drug and Alcohol Dependence*, 6, 295–313.
- Kandel, D. B., Yamaguchi, K., & Chen, K. (1992). Stages of progression in drug involvement from adolescence to adulthood: Further evidence for the gateway theory. *Journal of Studies on Alcohol*, 53, 447–457.
- Kaufman, J., & Charney, D. (2000). Comorbidity of mood and anxiety disorders. *Depression and Anxiety*, 12 (Suppl. 1), 69–76.
- Kessler, R. C. (1994). The National Comorbidity Survey of the United States. *International Review of Psychiatry*, 6, 365–376.
- Kessler, R. C., McGonagle, K. A., Shanyang, Z., Nelson, C. B., Hughes, M., Eshleman, S., Hans-Ulrich, W., & Kendler, K. S. (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States. *Archives of General Psychiatry*, 51, 8–19.
- Kessler, R. C., Nelson, C. B., McGonagle, K. A., Edlund, M. J., Frank, R. G., & Leaf, P. (1996). The epidemiology of co-occurring addictive and mental disorders: Implications for prevention and service utilization. *American Journal of Orthopsychiatry*, 66, 17–31.
- Khantzian, E. J., & Treece, C. (1985). DSM-II psychiatric diagnosis of narcotic addicts: Recent findings. *Archives of General Psychiatry*, 42, 1067–1071.
- Krausz, M., Degkwitz, P., Kuhne, A., & Verthein, U. (1998). Comorbidity of opiate dependence and mental disorders. *Addictive Behaviors*, 23, 767–783.
- Lash, S. J., Petersen, G. E., O'Connor Jr., E. A., & Lehmann, L. P. (2001). Social reinforcement of substance abuse aftercare group therapy attendance. *Journal of Substance Abuse Treatment*, 20, 3–8.
- Lynskey, M. T., Heath, A. C., Bucholz, K. K., Slutske, W. S., Madden, P. A. F., Nelson, E. C., Statham, D. J., & Martin, N. G. (2003). Escalation of drug use in early-onset cannabis users vs. co-twin controls. *Journal of the American Medical Association*, 289, 427–433.
- Maddox, J. F., & Desmond, D. P. (1992). Ten-year follow-up after admission to methadone maintenance. *American Journal of Drug and Alcohol Abuse*, 18, 289–303.
- McDermut, W., Mattia, J., & Zimmerman, M. (2001). Comorbidity burden and its impact on psychosocial morbidity in depressed outpatients. *Journal of Affective Disorders*, 65, 289–295.
- McKay, J. R. (2001). Effectiveness of continuing care interventions for substance abusers: Implications for the study of long-term effects. *Evaluation Review*, 25, 211–232.
- McKay, J. R., Alterman, A. I., Cacciola, J. S., Rutherford, M. R., O'Brien,

- C. P., & Koppenhaver, J. (1997). Group counseling versus individualized relapse prevention aftercare following intensive outpatient treatment for cocaine dependence: Initial results. *Journal of Consulting and Clinical Psychology, 65*, 778–788.
- McKay, J. R., McLellan, A. T., Alterman, A. I., Cacciola, J. S., Rutherford, M. J., & O'Brien, C. P. (1998). Predictors of participation in aftercare sessions and self-help groups following completion of intensive outpatient treatment for substance abuse. *Journal of Studies on Alcohol, 59*, 152–162.
- McLellan, A. T., Kushner, H., Metzger, D., Peters, R., Smith, I., Grissom, G., Pettinati, H., & Argeriou, M. (1992). The fifth edition of the Addiction Severity Index. *Journal of Substance Abuse Treatment, 9*, 199–213.
- McLellan, A. T., Lewis, D. C., O'Brien, C. P., & Kleber, H. D. (2000). Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. *Journal of the American Medical Association, 284*, 1689–1695.
- McLellan, A. T., Luborsky, L., Woody, G. E., O'Brien, C. P., & Druley, K. A. (1983). Prediction response to alcohol and drug abuse treatments. *Archives of General Psychiatry, 40*, 620–628.
- Merrill, J. C., Kleber, H. D., Shwartz, M., Liu, H., & Lewis, S. R. (1999). Cigarettes, alcohol, marijuana, other risk behaviors, and American youth. *Drug and Alcohol Dependence, 56*, 205–212.
- Mertens, J. R., Lu, Y. W., Parthasarathy, S., Moore, C., & Weisner, C. M. (2003). Medical and psychiatric conditions of alcohol and drug treatment patients in an HMO: comparison with matched controls. *Archives of Internal Medicine, 163* (20), 2511–2517.
- Minkoff, K. (1989). An integrated treatment model for dual diagnosis of psychosis and addiction. *Hospital and Community Psychiatry, 40*, 1031–1036.
- Moyer, A., Finney, J. W., Swearingen, C. E., & Vergun, P. (2002). Brief intervention for alcohol problems: A meta-analysis review of controlled investigations in treatment-seeking and non-treatment-seeking populations. *Addiction, 97*, 279–292.
- Mueser, K. T., Yarnold, P. R., Levinson, D. F., Singh, H., Bellack, A. S., Kee, K., Morrison, R. L., & Yadalam, K. G. (1990). Prevalence of substance abuse in schizophrenia: Demographic and clinical correlates. *Schizophrenia Bulletin, 16*, 31–56.
- National Institute on Alcohol Abuse and Alcoholism (NIAAA). (1997). *Improving the delivery of alcohol treatment and prevention services* (executive summary). Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.
- National Institute on Drug Abuse (NIDA). (1999). *Principles of drug addiction treatment: A research-based guide* (NIH Publication No. 00–4180). Rockville, MD: National Institute on Drug Abuse. Available: <http://165.112.78.61/PODAT/PODATindex.html>
- Office of Alcoholism and Substance Abuse. (2001). *DARTS for FY 2002: A users manual for substance abuse treatment counselors & computer entry personnel*. Springfield, IL: Office of Alcoholism and Substance Abuse.
- Office of Applied Studies. (2000). *National Household Survey on Drug Abuse: Main Findings 1998*. Rockville, MD: Substance Abuse and Mental Health Services Administration.
- Parikh, S. V., & Lam, R. W. (2001). Clinical guidelines for the treatment of depressive disorders, I. Definitions, prevalence, and health burden. *Canadian Journal of Psychiatry, 46* (Suppl. 1), 13S–20S.
- Razzouk, D., Bordin, I. A., & Jorge, M. R. (2000). Comorbidity and global functioning (DSM-III-R Axis V) in a Brazilian sample of cocaine users. *Substance Use and Misuse, 35*, 1307–1315.
- Roberts, A., & Koob, G. (1997). The neurobiology of addiction. An overview. *Alcohol Health and Research World, 21*, 101–106.
- Robins, L. N., & Regier, D. A. (1991). *Psychiatric disorders in America*. New York: MacMillan.
- Ross, H. E., Glaser, F. B., & Germanson, T. (1988). The prevalence of psychiatric disorders in patients with alcohol and other drug problems. *Archives of General Psychiatry, 45*, 1023–1031.
- Rounsaville, B. J., Kosten, T. R., & Kleber, H. D. (1986). Long-term changes in current psychiatric diagnoses of treated opiate addicts. *Comprehensive Psychiatry, 27*, 480–498.
- Rounsaville, B. J., Petry, N. M., & Carroll, K. M. (2003). Single versus multiple drug focus in substance abuse clinical trials research. *Drug and Alcohol Dependence, 70*, 117–125.
- Rounsaville, B. J., Weissman, M. M., Crits-Christoph, K., Wilber, C., & Kleber, H. D. (1982). Diagnosis and symptoms of depression in opiate addicts. *Archives of General Psychiatry, 39*, 151–156.
- Salomé, H. J., French, M. T., Scott, C. K., Foss, M. A., & Dennis, M. L. (2003). Investigating variation in the costs and benefits of addiction treatment: Econometric analysis of the Chicago Target Cities Project. *Evaluation and Program Planning, 26*, 325–338.
- Substance Abuse and Mental Health Services Administration. (2002). Report to Congress on the prevention and treatment of co-occurring substance abuse disorders and mental disorder. Washington, DC: Author.
- Schuckit, M. A., & Russell, J. W. (1983). Clinical importance of age at first drink in a group of young men. *American Journal of Psychiatry, 140*, 1221–1223.
- Schutte, K. K., Brennan, P. L., & Moos, R. H. (1994). Remission of late-life drinking problems: A 4-year follow-up. *Alcoholism: Clinical and Experimental Research, 18*, 835–844.
- Scott, C. K., Dennis, M. L., Godley, M. D., & Foss, M. A. (1995). Intake augmented-Addiction Severity Index (I-ASI). (Instrument developed under CSAT Grant No. 5–U95–T100664). Chicago: Chestnut Health Systems.
- Scott, C. K., Foss, M. A., & Dennis, M. L. (2003). Factors influencing initial and longer-term responses to substance abuse treatment: A path analysis. *Evaluation and Program Planning, 26*, 287–295.
- Scott, C. K., Foss, M. A., & Sherman, R. E. (2003a). Effects of centralized intake on participant satisfaction with treatment and ancillary services. In R. C. Stephens, C. K. Scott, & R. D. Muck (Eds.), *Clinical assessment and substance abuse treatment: The Target Cities Experience* (pp. 149–164). Albany, NY: State University of New York Press.
- Scott, C. K., Foss, M. A., & Sherman, R. E. (2003b). Outcomes before and after implementing centralized intake services. In R. C. Stephens, C. K. Scott, & R. D. Muck (Eds.), *Clinical assessment and substance abuse treatment: The Target Cities Experience* (pp. 7–15). Albany, NY: State University of New York Press.
- Scott, C. K., Muck, R. D., & Foss, M. A. (2000). The impact of centralized intake on access to treatment and satisfaction with intake procedures. In J. A. Levy, R. C. Stephens, & D. C. McBride (Eds.), *Advances in medical sociology, Vol. 7: Emergent issues in the field of drug abuse* (pp. 131–150). Stamford, CT: JAI Press.
- Sells, S. B. (1974). *Effectiveness of drug abuse treatment: Evaluation of treatments* (pp. 131–150). Cambridge, MA: Ballinger.
- Simpson, D. D., & Brown, B. (Eds.). (1999). Special issue: Treatment process and outcome studies from DATOS. *Drug and Alcohol Dependence, 57* (2).
- Simpson, D. D., Joe, G. W., & Broome, K. M. (2002). A national 5-year follow-up of treatment outcomes for cocaine dependence. *Archives of General Psychiatry, 59*, 538–544.
- Simpson, D. D., Joe, G. W., & Brown, B. S. (1997). Treatment retention and follow-up outcomes in the Drug Abuse Treatment Outcome Study (DATOS). *Psychology of Addictive Behaviors, 11*, 294–307.
- Simpson, D. D., Joe, G. W., & Lehman, W. E. K. (1986). *Addiction careers: Summary of studies based on the DARP 12-year follow-up*. Washington, DC: U.S. Government Printing Office.
- Simpson, D. D., & Sells, S. B. (Eds.). (1990). *Opioid addiction and treatment: A 12-year follow-up*. Malabar, FL: Krieger Publishing Co.
- Vaillant, G. E. (1966). A twelve-year follow-up of New York City addicts: I. The relation of treatment outcome. *American Journal of Psychiatry, 122*, 727–737.
- Watkins, K., Pincus, H. A., Tanielian, T. L., & Lloyd, J. (2003). Using the chronic care model to improve treatment of alcohol use disorders in primary care settings. *Journal of Studies on Alcohol, 64*, 209–218.

- Weisner, C., Mertens, J., Parthasarathy, S., Moore, C., & Lu, Y. (2001). Integrating primary medical care with addiction treatment: A randomized controlled trial. *Journal of the American Medical Association*, 286, 1715–1723.
- Woody, G. E., McLellan, A. T., Luborsky, L., & O'Brien, C. P. (1985). Sociopathy and psychotherapy outcome. *Archives of General Psychiatry*, 42, 1081–1086.
- Yamaguchi, K., & Kandel, D. B. (1984). Patterns of drug use from adolescence to young adulthood: III. Predictors of progression. *American Journal of Public Health*, 74, 673–681.
- Zanis, D. A., Mulvaney, F., Coviello, D., Alterman, A. I., Savitz, B., & Thompson, W. (2003). The effectiveness of early parole to substance abuse treatment facilities on 24-month criminal recidivism. *Journal of Drug Issues*, 33, 223–236.