

Special article

Prevalence and comorbidity of major internalizing and externalizing problems among adolescents and adults presenting to substance abuse treatment

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Abstract

As the field follows recommendations to introduce standardized assessments on substance, mental, and behavioral problems, a consistent picture has emerged that co-occurring disorders are common, that there is heterogeneity in the type of disorder, and that the pattern varies by age. This study examines the prevalence of self-reported substance use and mental health problems, the pattern of comorbidity, and how both vary by age among people presenting to substance abuse treatment. Data are from 4,930 adolescents and 1,956 adults admitted to substance abuse treatment in multisite studies who were assessed with the Global Appraisal of Individual Needs and categorized into five age groups: <15, 15–17, 18–25, 26–39, and 40+ years. Two thirds of clients had a co-occurring mental health problem in the year prior to treatment admission. Across all ages, clients self-reporting criteria for past-year substance dependence were more likely than those who did not to have other co-occurring mental health problems (odds ratios of 2.9 to 8.8). The prevalence and patterns of co-occurring mental health problems, however, varied by age. Young adults (ages 18–25) were found to be most vulnerable to co-occurring problems. © 2008 Elsevier Inc. All rights reserved.

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1. Introduction

Substance use disorders often occur in conjunction with a wide range of other mental and behavioral problems (Bukstein, Brent, & Kaminer, 1989; de Graaf, Bijl, Smit, Vollebergh, & Spijker, 2002; Grant et al., 2004; Kessler et al., 1997; Merikangas et al., 1998; Schuckit et al., 1997). The high rate of co-occurring disorder has challenged clinicians and treatment facilities to seek new approaches to better integrate substance abuse and mental health services into treatment regimens (Sacks, 2000). Recently, the Center for Substance Abuse Treatment (CSAT, 2005) published the

Substance Abuse Treatment for Persons with Co-occurring Disorders, Treatment Improvement Protocols (TIPs) Series 42 to serve as a guideline for treating clients with co-occurring disorders and recognized the high overlap of mental disorders among both substance abuse and mental health treatment clients. The purpose of the current study was to examine the prevalence of and co-occurrence with major internalizing and externalizing mental health problems in a treatment-seeking population of adolescent and adult substance users. Although co-occurrence of internalizing and externalizing problems is prevalent among substance users, we hypothesized that patterns of comorbidity would vary by age and by the dependence status within age.

The high co-occurrence of substance and mental health problems has been widely reported in adult nationally representative community studies using lifetime or past-year diagnosis with self-reports (Grant et al., 2004; Kessler, Chiu,

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Demler, & Walters, 2005). Community studies on adolescents also showed that the magnitude of risk for co-occurring disorders in adolescents was as high as that for adults, especially among those with substance abuse problems (Kandel et al., 1999). Such multiple co-occurring substance and mental health problems are a particularly prominent characteristic of those seeking help from either substance abuse or mental health services (Brooner, King, Kidorf, Schmidt, & Bigelow, 1997; Bukstein, Glancy, & Kaminer, 1992; Hien, Zimberg, Weisman, First, & Ackerman, 1997; Mueser et al., 1990; Ross, Glaser, & Germanson, 1988). Using a clinical population of adolescents from substance abuse treatment settings, Diamond et al. (2006) reported that 72% of adolescent marijuana users endorsed two or more psychiatric syndromes when entering treatment. Although attention-deficit hyperactivity disorder (ADHD) and conduct disorder (CD) were common among adolescent clients, depression and anxiety disorders were also relatively common in adolescents with conduct and substance use disorders (Crowley & Riggs, 1995; Grilo, Becker, Fehon, Edell, & McGlashan, 1996). In a case-control study of adolescents with alcohol dependence compared with community-dwelling adolescents without alcohol dependence, Clark et al. (1997) found that the most common form of psychopathology observed in alcohol-dependent adolescents included CD, ADHD, major depressive disorder, and posttraumatic stress disorder (PTSD).

Studies in the general population (Achenbach & Edelbrock, 1978; Krueger, 1999; Krueger, Caspi, Moffitt, & Silva, 1998; Vollebergh et al., 2001) and in treatment-based samples (Dennis, Dawud-Noursi, Muck, & McDermeit, 2003a) demonstrate the existence of three primary dimensions along which the symptoms of the more common mental disorders vary: (a) internalizing disorders (e.g., symptoms of depression, anxiety, somatic disorder, traumatic distress, suicide), (b) externalizing disorders (e.g., symptoms of attention deficit, hyperactivity, conduct, and other impulse control disorders), and (c) substance use disorders (e.g., symptoms of abuse, dependence, other substance-induced health or psychiatric problems). Although each disorder is unique, disorders that vary along the same dimensions often share more etiology, consequence, treatment, and outcomes with each other than with disorders in other dimensions. Thus, grouping disorders into internalizing, externalizing, and substance use disorders often helps to clarify their common pattern.

Furthermore, internalizing and externalizing disorders often have different trends: internalizing disorders usually onset over the life course and their cumulative prevalence generally increases with age, whereas externalizing disorders typically onset in childhood or adolescence and then decrease with age. Many of these externalizing disorders, however, persist into adulthood. For example, ADHD is a major childhood disorder that has recently drawn public attention because of the persistence of its symptoms into adult life (Kessler et al., 2005, 2006; Wender, Wolf, &

Wasserstein, 2001). Untreated ADHD might increase the risk for addictive vulnerability and clinical severity for adults with substance use problems (Levin, Evans, & Kleber, 1998; Wilson & Levin, 2001). Conduct disorder is another childhood disorder that has been largely ignored in adult psychiatry or viewed only in the framework of antisocial or borderline personality disorder. This is particularly critical in treatment and preventive intervention because CD often predates both substance use and other major mental disorders and continues to manifest symptoms with other disorders well into adulthood (Kim-Cohen et al., 2003).

Few studies have been able to examine the patterns of co-occurring mental health problems in a wide age range of adolescents and adults presenting to substance abuse treatment. Pooled data from individuals ranging in age from 12 to 65 were gathered from multiple treatment studies using the same assessment of client's self-reporting criteria for substance, internalizing, and externalizing problems. The specific aims of this data exploration were to examine the prevalence of these co-occurring problems and to investigate its relationship with substance dependence by age. We focused on people who self-reported criteria for past-year substance dependence because virtually all of the clients presenting to treatment met criteria for either a past-year abuse or dependence diagnosis. For co-occurring mental health problems, we examined separately for past-year internalizing and externalizing problems to observe whether their trends and association with substance dependence are different by age and from each other.

2. Materials and methods

2.1. Data source

Data were pooled from 77 substance abuse treatment studies funded by the Center for Substance Abuse Treatment, National Institute on Alcohol Abuse and Alcoholism, National Institute on Drug Abuse, Robert Wood Johnson Foundation, and Interventions Foundation. The studies were conducted in a variety of institutional settings, including across adolescent and adult levels of care, student assistance programs, criminal and juvenile justice agencies, mental health agencies, and child protective service and family service agencies. All data were collected as part of general clinical practice or specific research studies under their respective voluntary consent procedures with identifiers subsequently encrypted for research analysis. All research studies were conducted under the supervision of the institutional review boards for their respective institutions. Both practice and research studies were conducted with general consent under federal guidelines (42 CFR Part 2) that explicitly allow record abstraction for the purpose of program evaluation and development as long as the data are de-identified and kept confidential. Data obtained since the implementation of the Health Insurance Portability and

Accountability Act of 1996 were covered by formal data sharing agreements between Chestnut Health Systems and each of the participating agencies per 45 CFR Parts 160 and 164, Subparts A and E. Use of the data for secondary analysis by Chestnut Health Systems staff is under the supervision of Chestnut's institutional review board.

2.2. Study sample

The pooled multisite data included 4,930 adolescents and 1,956 adults admitted to substance abuse treatment with a complete assessment of the Global Appraisal of Individual Needs (GAIN) at treatment entry. Of these 6,886 clients, 66.9% were male, 45.4% were white, and the mean age was 20.1 (standard deviation [*SD*] = 9.1). Across the sites, clients from a variety of levels of care in substance abuse treatment

programs were recruited: short-, moderate-, and long-term residential treatment, intensive outpatient treatment, regular outpatient treatment, postresidential community treatment, methadone treatment, case management, and early intervention. The current study covered a broad range of clients across the life span with ages ranging from 12 to 65. Thus, to help analyze the relationship of comorbidity by age, we categorized clients into five age groups: <15 (*n* = 916, 13.3%), 15–17 (*n* = 4014, 58.3%), 18–25 (*n* = 676, 9.8%), 26–39 (*n* = 784, 11.4%), and 40+ (*n* = 496, 7.2%) years.

The clients' characteristics, current criminal justice involvement, past-year history of mental health and substance abuse treatment, family history of alcohol and substance use, history of victimization, and suicidal thoughts are presented by age groups in Table 1. Clients were predominantly male in all age groups, except in the 26–39

Table 1
Characteristics (%) for clients by age groups at intake interview (*n* = 6886)

Characteristic	Age <15 (<i>n</i> = 916)	Age 15–17 (<i>n</i> = 4014)	Age 18–25 (<i>n</i> = 676)	Age 26–39 (<i>n</i> = 784)	Age 40+ (<i>n</i> = 496)
Age, mean (SD)	13.6 (0.6)	16.0 (0.8)	20.1 (2.4)	32.8 (3.9)	45.1 (4.6)
Male	66.3	74.2	61.3	40.4	58.2
Race–ethnicity					
African American	19.6	17.8	27.0	59.4	69.3
Caucasian	39.8	50.2	55.1	33.2	23.4
Hispanic	14.6	11.2	5.5	2.7	1.8
Other	26.0	20.8	12.4	4.7	5.5
Marital status					
Married	0.2	0.5	6.0	17.1	17.3
Separated/Divorced/Widow	0.1	0.1	4.3	22.5	43.2
Never	99.7	99.4	89.7	60.4	39.5
Level of care					
Outpatient treatment	71.2	68.1	55.4	37.1	36.5
Residential treatment	28.8	31.9	44.6	62.9	63.5
Have kids under age 21	0.5	3.7	34.8	81.5	61.4
Current criminal justice involvement	60.0	72.0	71.4	45.5	43.9
Age of first substance use					
<10	10.5	8.9	7.7	7.3	6.1
10–14	89.5	72.2	51.0	34.2	30.9
15–18	—	18.9	34.2	31.2	31.7
18+	—	—	7.1	27.3	31.3
Years of substance use					
<1	16.9	4.5	0.4	0.3	0.0
1–4	74.2	71.3	32.2	3.1	0.0
5–9	8.4	22.6	51.1	7.3	2.0
10–19	0.5	1.6	16.3	51.8	6.9
20+	—	—	—	37.5	91.1
Received mental health treatment in past year	31.8	29.7	23.5	21.9	23.4
Received substance abuse treatment in past year	22.8	35.3	42.5	36.7	28.0
Family history of problems with alcohol use	69.3	71.7	71.5	71.2	70.4
Family history of problems with drug use	58.6	61.0	59.4	61.0	54.6
Family history of psychological problems	34.9	39.7	42.3	35.8	30.3
History of being victimized	57.1	64.2	69.7	73.8	75.2
Self-mutilation in past year	20.0	17.0	10.6	2.2	4.2
Suicidal thoughts in past year	15.5	14.8	17.7	21.4	22.1

Note. *p* < .05 for each comparison of characteristics by age groups. For cell numbers less than 10 observations, Fisher's exact test was applied. — indicates not applicable.

age group in which the majority was female (59.6%). African Americans represented less than a third of adolescents and young adults (age <26), but the majority of the adult groups (ages 26–39 and age 40+). Among youth less than 15 years old, 4 (0.5%) were teenage parents, and 143 (3.7%) aged 15–17 had at least one child. Current criminal justice involvement was high across all age groups (43.9–72%). The majority of clients started using substances prior to age 18 and, as expected, the total years of substance use goes up with age. For youth under age 15, 83.1% reported using substances for more than 1 year. For adults, 67.4% in age group 18–25 and 96.6% in age group 26–39 reported using substances for more than 5 years. Among those over age 40, 98% endorsed using substances for more than 10 years.

About a third of adolescents and a fifth of adults reported receiving mental health treatment in the year prior to intake assessment. For substance abuse treatment, young adults ages 18–25 endorsed receiving more treatment than others in the past year (42.5%). Family history of alcohol drinking, drug use, and psychological problems was common among our sample. Across all age groups, about 70% or more reported a family history of problems with alcohol use, and more than half of the clients had a family history of problems with drug use. In this substance-abusing, treatment-seeking population, being victimized and self-mutilated and having suicidal thoughts were prevalent.

2.3. Measures

Participants' characteristics and self-reports of diagnostic impressions were obtained from the GAIN (Dennis, Titus, White, Unsicker, & Hodgkins, 2003b), a standardized bio-psycho-social assessment developed to apply in both research and clinical settings to support diagnosis, treatment planning and placement, outcome evaluation, and economic analysis. Trained interviewers conducted an interview with the GAIN with each participant at treatment intake. The GAIN's substance and mental health scales have excellent (.9 or higher) internal consistency coefficient (α) on the main dimensional scales and good internal consistency (.7 or higher) on their subscales (Dennis et al., 2003a; Dennis, Chan, & Funk, 2006). In a discriminant analysis using the GAIN to predict independent and blind staff psychiatric diagnoses, the kappa (κ) values were 1.00 for ADHD, 0.85 for mood disorders, 0.82 for CD/oppositional defiant disorder, 0.69 for adjustment disorder, 0.91 for absence of a non-substance-use diagnosis, and 0.65 for other primary disorders across these conditions (Shane, Jasiukaitis, & Green, 2003). However, because the current study is focused on the symptoms of mental health problems that clients endorsed (vs. a formal diagnosis by a clinician), here the term "problem" is used instead of disorder or diagnosis.

For study purposes, self-reported past-year symptoms for several major *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric*

Association, 2000) diagnoses have been grouped as (a) substance use problems: dependence and abuse, (b) internalizing problems: depression, generalized anxiety, traumatic distress (e.g., posttraumatic stress, acute stress, and disorders of extreme stress not otherwise specified [such as those resulting from child maltreatment]), and (c) externalizing problems: ADHD and conduct problems. The main text of the questions can be obtained from www.chestnut.org/li/gain. A brief summary of the main measures applied in the current study is presented below.

Substance use problems were based on the GAIN's Substance Problem Scale, which assesses recency symptoms (past month, 2–12 months, more than a year ago, never) related to substance abuse and dependence as well as two screening items for substance-induced problems. For each abuse and dependence symptom endorsed, recency information was then collected on the following specific substance(s) that the participant thought caused the endorsed symptoms: alcohol, amphetamine, cannabis, cocaine (including crack), hallucinogens, inhalants, opioids (including heroin), phencyclidine (PCP), sedatives, and other drug use (e.g., over-the-counter drugs). Clients were asked about all abuse and dependence symptoms, which avoids the problem raised with some measures that skip out of dependence questions if there are no abuse symptoms endorsed (Hasin, Hatzenbuehler, Smith, & Grant, 2005). Past-year dependence was defined as three or more of the seven dependence symptoms self-reported as occurring during the 12 months preceding the intake assessment. A past-year abuse required that the individual endorse one or more of the abuse symptoms occurring in the past year, but not qualify for a dependence diagnosis.

Internalizing problems were based on the GAIN's Internal Mental Distress Scale. The past-year internalizing problems were composed of symptoms related to depression, anxiety, and traumatic distress. For past-year depression, endorsement of at least 2 weeks of depressed mood or loss of interest accompanied by four or more symptom items occurring in the past year prior to treatment entry were required. Past-year anxiety was characterized by at least three or more of the symptoms related to excessive anxiety and worry that persisted for at least 6 months prior to entering treatment. Any past-year traumatic distress was defined as 5 or more of 13 symptoms on the GAIN's Traumatic Stress Scale (TSS), which is a count of past-year symptoms related to PTSD, acute stress disorder, or other disorders of extreme stress such as childhood maltreatment or complex combinations of multiple past and current traumas. The TSS is based on the Mississippi Scale for PTSD that has proven useful for identifying problems after combat exposure, natural disaster, interpersonal violence, and maltreatment (Hyer, Davis, Boudewyns, & Woods, 1991; Stevens, Murphy, & McKnight, 2003). We have used the general form here because most clients were reporting symptoms related to multiple current and past traumas and the most common single one was child maltreatment, which the national

guidelines suggest does not fit well into the technical definition of PTSD per se (Foa, Keane, & Friedman, 2000).

Externalizing problems were based on the GAIN's Behavioral Complexity Scale. To help evaluate the extent to which self-reported symptoms of ADHD and CD problems persist into adulthood, we relaxed the age-onset constraint from the diagnostic criteria and administered the same questions to all clients. A past-year ADHD required clients to endorse six or more symptoms in the past 12 months preceding intake related to (a) inattention, (b) hyperactivity/

impulsivity, or (c) both inattentive and hyperactive type. A past-year CD required three or more symptoms in the past 12 months preceding the intake assessment.

2.4. Statistical analysis

Past-year prevalence and comorbidity of problems were examined by using cross-tabulations. We then reported prevalence and comorbidity by age groups and by past-year dependence status. A chi-square test was used to examine

Table 2
Prevalence (%) of past-year substance use problems and co-occurring mental health problems by age groups

Disorders	Age <15	Age 15–17	Age 18–25	Age 26–39	Age 40+
Any substance use problems ^{a*}	71.6	82.3	80.0	87.4	87.1
Substance abuse	26.9	27.6	18.3	8.3	9.7
Substance dependence	44.7	54.7	61.7	79.1	77.4
Alcohol use*	21.7	27.8	38.9	37.3	44.0
Alcohol abuse	13.9	18.1	17.3	10.0	13.1
Alcohol dependence	7.8	9.7	21.6	27.3	30.9
Amphetamine use*	2.2	3.9	7.6	3.6	0.6
Amphetamine abuse	0.4	1.3	3.0	0.8	0.0
Amphetamine dependence	1.8	2.6	4.6	2.8	0.6
Cannabis use*	41.6	44.8	40.8	13.3	6.6
Cannabis abuse	18.1	18.5	15.1	5.5	3.6
Cannabis dependence	23.5	26.3	25.7	7.8	3.0
Cocaine use*	2.2	3.6	22.8	62.9	58.5
Cocaine abuse	1.2	1.6	3.7	8.3	7.1
Cocaine dependence	1.0	2.0	19.1	54.6	51.4
Hallucinogen use*	1.3	3.1	3.1	0.5	0.0
Hallucinogen abuse	0.7	2.0	2.1	0.4	0.0
Hallucinogen dependence	0.6	1.1	1.0	0.1	0.0
Inhalant use*	1.6	0.5	0.5	0.1	0.0
Inhalant abuse	1.0	0.3	0.2	0.0	0.0
Inhalant dependence	0.6	0.2	0.3	0.1	0.0
Opioid use*	0.7	2.4	9.6	19.9	21.8
Opioid abuse	0.4	0.9	1.0	2.2	2.8
Opioid dependence	0.3	1.5	8.6	17.7	19.0
PCP use	0.3	0.5	0.5	0.2	0.2
PCP abuse	0.3	0.3	0.2	0.1	0.0
PCP dependence	0.0	0.2	0.3	0.1	0.2
Sedative use*	1.2	1.4	2.7	1.6	0.4
Sedative abuse	0.9	0.9	1.5	0.3	0.4
Sedative dependence	0.3	0.5	1.2	1.3	0.0
Other drug use disorder-NOS*	12.8	11.4	10.6	6.5	4.8
Other abuse	11.0	9.5	5.0	1.8	1.6
Other dependence	1.8	1.9	4.6	4.7	3.2
Polysubstance dependence ^{b*}	16.1	21.4	7.5	0.0	0.4
Any co-occurring mental health problems*	75.6	73.0	67.4	71.0	69.3
Any internalizing problems*	48.4	52.6	60.5	69.4	67.9
Depression	32.7	36.2	41.8	56.1	56.2
Anxiety	14.3	17.2	32.4	46.7	45.7
Traumatic distress	36.7	39.1	50.4	48.8	46.9
Any externalizing problems*	67.7	63.4	48.7	39.9	36.4
ADHD	48.2	45.3	39.0	30.6	31.1
Conduct problems	58.6	55.7	39.7	31.1	25.4
Both internalizing and externalizing problems*	40.4	42.9	41.8	38.3	35.0

Note. All of the cross tabulation comparisons of defined problems by age groups were statistically significant. For cell numbers less than 10 observations, Fisher's exact test was applied.

^a For each substance-specific use problem, abuse and dependence are mutually exclusive.

^b Consistent with *DSM-IV*, polysubstance dependence included those who endorsed dependence symptoms related to three or more substances use in the past year, but did not meet dependence criteria for any single substance.

* $p < .05$.

Table 3

Prevalence (%) and odds ratio of the association of past-year dependent status relative to the nondependent status with past-year co-occurring mental health problems^a

Past-year substance use problem	Past-year co-occurring mental health problems				
	Age <15	Age 15–17	Age 18–25	Age 26–39	Age 40+
	Any co-occurring mental health problems				
Dependence	89.9	88.1	84.1	78.7	77.9
No dependence	63.9	54.6	40.3	41.7	39.6
OR (95% CI)	4.8 (3.3, 7.1)	5.9 (5.0, 7.0)	7.7 (5.4, 11.3)	5.8 (3.9, 8.6)	5.3 (3.3, 8.5)
	Any internalizing problems				
Dependence	69.2	69.8	76.7	77.1	76.3
No dependence	31.4	31.8	34.5	40.5	38.7
OR (95% CI)	5.0 (3.7, 6.8)	4.9 (4.3, 5.7)	6.0 (4.2, 8.5)	5.6 (3.8, 8.2)	5.1 (3.2, 8.2)
	Depression				
Dependence	52.7	52.7	55.5	64.0	66.4
No dependence	16.5	16.2	19.5	25.9	25.8
OR (95% CI)	5.6 (4.1, 7.8)	5.6 (4.8, 6.6)	4.6 (3.2, 6.7)	5.7 (3.8, 8.6)	6.5 (3.9, 10.8)
	Anxiety				
Dependence	24.6	26.1	44.7	51.9	53.1
No dependence	6.0	6.3	12.4	27.0	19.8
OR (95% CI)	4.6 (3.0, 7.2)	4.9 (4.0, 6.1)	5.2 (3.3, 8.0)	3.4 (2.2, 5.0)	5.0 (2.9, 8.4)
	Traumatic distress				
Dependence	50.6	51.5	63.7	54.2	52.9
No dependence	25.2	23.9	28.9	28.4	26.1
OR (95% CI)	2.9 (2.2, 3.9)	3.3 (2.9, 3.8)	4.0 (2.8, 5.6)	3.3 (2.2, 4.8)	3.2 (2.0, 5.2)
	Any externalizing problems				
Dependence	81.3	79.5	66.6	45.5	44.0
No dependence	56.6	43.8	19.8	18.5	9.9
OR (95% CI)	3.2 (2.4, 4.4)	4.8 (4.2, 5.5)	8.4 (5.7, 12.2)	4.3 (2.8, 6.8)	7.1 (3.7, 13.7)
	ADHD				
Dependence	63.6	61.0	54.7	34.5	38.0
No dependence	35.7	26.2	13.3	16.1	8.1
OR (95% CI)	3.0 (2.2, 3.9)	4.2 (3.6, 4.8)	7.9 (5.2, 12.0)	3.1 (1.9, 4.9)	7.3 (3.5, 15.1)
	Conduct problems				
Dependence	74.2	72.2	55.5	37.0	30.7
No dependence	45.9	35.9	14.0	8.6	7.2
OR (95% CI)	3.4 (2.5, 4.5)	4.5 (3.9, 5.1)	8.2 (5.4, 12.4)	7.4 (4.0, 13.5)	5.2 (2.4, 11.1)
	Having both internalizing and externalizing problems				
Dependence	60.7	61.1	59.1	43.9	42.4
No dependence	24.1	21.0	14.0	17.2	9.0
OR (95% CI)	4.8 (3.6, 6.6)	5.7 (4.9, 6.6)	8.8 (5.8, 13.2)	4.5 (2.8, 7.1)	7.4 (3.7, 14.7)

^a Odds ratios were adjusted for sex and race-ethnicity.

differences in prevalence of disorders across age groups and dependence status. For cell numbers less than 10 observations, Fisher's exact test was applied. To test our hypothesis and examine the relative strength of the association between substance dependence and co-occurring mental health problems across age groups, we fit a logistic regression model with the presence of substance dependence as the exploratory variable and the presence of a co-occurring mental health problem as the response variable for each age group with sex and race-ethnicity held constant in the model.

3. Results

3.1. Prevalence of past-year substance use and mental health problems

Table 2 summarizes the past-year prevalence estimates of substance use and internalizing and externalizing problems by age groups. Overall, rates of substance dependence outnumbered abuse in all age groups, but went up with age. The prevalence of a specific substance use problem varied

by age groups: cocaine and opioid use were more prevalent in adults than in adolescents, whereas cannabis, polysubstance, and other drug use not otherwise specified (NOS) were more common in adolescents and young adults.

With regard to substance use patterns, the most prevalent substance-specific use problem among adolescents under age 15 was cannabis (41.6%), followed by alcohol (21.7%), polysubstance dependence (16.1%) and other drug use NOS (12.8%). A similar substance use pattern was also observed for adolescents ages 15 to 17. For young adults (age 18–25), the most prevalent substance use problems were cannabis (40.8%) and alcohol (38.9%), followed by cocaine (22.8%), other drug use NOS (10.6%), opioid (9.6%), and polysubstance dependence (7.5%). For adults ages 26–39, the prevalence of a cocaine use problem (62.9%) far outnumbered the prevalence of other substance use problems, followed by alcohol (37.3%), opioid (19.9%), cannabis (13.3%), and other drug use NOS (6.5%). For adults at age 40 or older, the most prevalent substance use problem was cocaine use (58.5%), followed by alcohol (44%) and opioid (21.8%). For both adolescent and adult clients, amphetamine, hallucinogens, inhalants, and sedative use problems were less prevalent. For example, rates of an amphetamine use problem were 2.2% in young adolescents under age 15, 3.9% in adolescents ages 15–17, 7.6% in young adults ages 18–25, 3.6% in adults ages 26–39, and 0.6% in adults over age 40. Among all specific substance use problems, PCP use was the least prevalent problem observed.

Overall, two thirds of clients presenting to substance abuse treatment in each age group had at least one mental health problem. The rates of internalizing problems generally increased with age. About one third of adolescents and half of adults endorsed depressive symptoms in the year prior to entering substance abuse treatment. Anxiety was prevalent among adults over age 25. In contrast, the rates of externalizing problems generally decreased with age: going from two thirds of adolescent groups to one third of the oldest group. Approximately half of adolescents under 15 had ADHD and about one third of adults met criteria for ADHD. It was estimated that half of adolescents and one third of adults met criteria for CD. The co-occurrence of manifesting both internalizing and externalizing behaviors was high among our dependent clients. More than 40% of adolescents and young adults endorsed symptoms for both internalizing and externalizing problems, and about 38% of adults ages 26–39 and 35% of adults ages 40 or more had both internalizing and externalizing problems in the year prior to entering treatment.

3.2. Comorbidity of past-year substance dependence with mental health problems

Table 3 presents the prevalence of past-year internalizing and externalizing problems by past-year substance dependence status, and the association between past-year substance dependence and each past-year internalizing and external-

izing problem expressed as an odds ratio (OR). These ORs represent the likelihood of having the specified co-occurring mental health problem for those with past-year substance dependence compared to those without substance dependence. Values greater than 1 suggest increased likelihood, and less than 1.00 suggest reduced likelihood. Across all age groups, rates of co-occurring mental health problem were higher among clients with past-year substance dependence than those without. All of the co-occurring problems were positively associated with substance dependence across ages such that having dependence was associated with higher rates of having each co-occurring problem (ORs = 2.9–8.8). The trends and strength of association, however, varied by age.

Among dependent adolescents under age 15, about 90% had at least one mental health problem in the past year. More specifically, 69.2% were identified as having at least one internalizing problem and 81.3% as having at least one externalizing problem. Dependent youth were at a fivefold elevated likelihood of having an internalizing problem compared with those who were not past-year dependent (OR = 5.0, 95% confident interval [CI] = 3.7–6.8). CD (74.2%), ADHD (63.6%), depression (52.7%), and traumatic distress (50.6%) were the most prevalent co-occurring problems among those dependent youth under age 15. The estimated ORs of comorbidity were 3.4 (95% CI = 2.4–4.5) for CD, 3.0 (95% CI = 2.2–3.9) for ADHD, 5.6 (95% CI = 4.1–7.8) for depression, and 2.9 (95% CI = 2.2–3.9) for traumatic distress. The rate of anxiety among young dependents was 24.6% and the estimated OR of dependents relative to nondependents with anxiety was 4.6 (95% CI = 3.0–7.2). It is estimated that about 61% of young dependents had both internalizing and externalizing problems. A similar comorbidity pattern was observed for adolescents ages 15–17, in which the externalizing problems were the most prevalent co-occurring problems; yet, the estimated risks were greater for having both internalizing and externalizing behaviors than each problem alone.

Unlike high co-occurrence of externalizing problems discovered among adolescents, dependent adults endorsed more symptoms of internalizing problems. Using young adults between ages 18 and 25 as an example, we identified 76.7% and 66.6% as having at least one internalizing problem and at least one externalizing problem, respectively. The strength of association between substance dependence and co-occurring problems remained strong; dependent clients were six times more likely to have an internalizing problem (95% CI = 4.2–8.5) and 8.4 times more likely to have an externalizing problem (95% CI = 5.7–12.2) than nondependent clients. Traumatic distress (63.7%), depression (55.5%), CD (55.5%), and ADHD (54.7) were the most prevalent co-occurring problems among dependent clients between ages 18 and 25. The estimated ORs for those with dependence relative to those without were 4.0 (95% CI = 2.8–5.6) for traumatic stress, 4.6 (95% CI = 3.2–6.7) for depression, 8.2 (95% CI = 5.4–

12.4) for CD, and 7.9 (95% CI = 5.2–12.0) for ADHD. These young dependent adults were found to be at the most elevated risk for having both internalizing and externalizing problems compared to those in other age groups (OR = 8.8, 95% CI = 5.8–13.2). Among adults age 40 or older, the strongest association between substance dependence and co-occurring problems was ADHD (OR = 7.3, 95% CI = 3.5–15.1), followed by anxiety (OR = 6.5, 95% CI = 3.9–10.8) and CD (OR = 5.2, 95% CI = 2.4–11.1), although with wider confidence intervals. Overall, the findings with respect to comorbidity between substance dependence and co-occurring problems indicated that, for adolescents, the magnitude of comorbidity with substance dependence was greater for internalizing problems, whereas it was greater for externalizing problems for adults. Both young adults and older adults were at relatively elevated risk for having both internalizing and externalizing problems prior to treatment entry.

4. Discussion

4.1. Summary of findings

In these analyses of a relatively large data set of a treatment-seeking population, the evidence supports that co-occurring mental health problems are the norm for both adolescents and adults in treatment, with 78–90% endorsing an internalizing or externalizing problem and 42–61% endorsing both. The patterns of substance use and mental health problems with which clients present to substance abuse treatment are heterogeneous and vary by age. Within each age group, there was an association between the severity of substance use and each of the co-occurring mental health problems. In addition, consistently across all age groups those with substance dependence were at increased likelihood of having co-occurring problems compared to those who reported abuse or were in partial remission.

The high rate of co-occurring problems observed in the current study is consistent with prior research showing that clients presenting to treatment are likely to have multiple diagnoses (Bukstein et al., 1992; Robins & Regier, 1991; Whitmore et al., 1997). In particular, the current study demonstrates that internalizing and externalizing problems are common in all age groups; however, the prevalence of internalizing problems increased with the age of the subgroup but the prevalence of externalizing problems did not. Whereas internalizing problems were less common than externalizing problems in the two adolescent groups, their association with substance dependence was strong and similar to the associations for the externalizing problems more commonly found in these age groups. Conversely, whereas externalizing problems were less common than internalizing problems in the two older adult groups, the association with substance dependence remains as strong or stronger than internalizing problems. Furthermore, these

study findings lend support to the growing literature suggesting that comorbidity is associated with the more severe form of substance use (Brooner et al., 1997; Bukstein et al., 1992; Grella, Hser, Joshi, Rounds-Bryant, 2001; Whitmore et al., 1997). This case holds for both adolescent and adult clients. Clark, Kirisci, and Tarter (1998) found that males with adolescent-onset substance use disorder had an accelerated progression from first substance exposure to the development of dependence and were at an increased likelihood of having secondary dependencies, disruptive behavior disorder, and depression as compared to adult-onset cases. Studies on adults also demonstrated that manifesting a disorder early in life might precipitate the course of psychopathology in other disorders, although these studies ascertained no consistent temporal relationship in terms of primary versus secondary onset for substance use and mental disorders (Compton, Cottler, Phelps, Ben-Abdallah, & Spitznagel, 2000; Hasin & Grant, 2002; Kessler et al., 1997; Merikangas et al., 1998; Newman, Moffitt, Caspi, Magdol, & Silva, 1996; Prescott, Aggen, & Kendler, 2000; Schuckit et al., 1997). Our findings of the magnitude of comorbidity between substance dependence and co-occurring problems are similar to but stronger than findings from community studies (Grant et al., 2004; de Graff et al., 2002; Swendsen et al., 1999). This difference is likely to contribute to the high level of substance use severity and treatment-seeking characteristics presented in our sample. Moreover, the rates here are higher than what is reported by most publicly funded treatment programs as part of Treatment Episode Data Set (Office of Applied Studies [OAS], 2005) because that system and many other programs do not include systematic measures of mental health problems.

With a substantial number of dependent adults suffering from ADHD and CD, the current study indicates a possible continuing vulnerability in adults to these two problems. In line with recent efforts to extend the use of ADHD and CD diagnoses to adults (Kessler et al., 2006; Levin et al., 1998; Kalbag & Levin, 2005; Nock, Kazdin, Hiripi, & Kessler, 2006), the study findings demonstrate that although the prevalence of these problems is lower than that of internalizing problems, they were still experienced by over a third of the adult clients in treatment and were associated with the more severe form of substance use. One should keep in mind that the high rate of ADHD and CD observed in our adult sample is partially due to the relaxation of the age-onset constraint, which is a prominent feature of the chronic and longitudinal course of symptoms of ADHD and CD. Although many dependent adults endorsed problems with hyperactivity, inattention, impulsivity, and aggression at treatment entry, it is likely that their endorsed symptoms are secondary to the acute substance use that brought them to treatment. In addition, these endorsed problems may be substance induced or the result of other disorders such as bipolar or psychosis disorders. Nonetheless, these self-reported externalizing problems are present in our adolescent and adult samples, and the study findings suggest that

these co-occurring problems are related to the severity of substance use and that the strength of this association is stronger for adult dependents, especially for young adults. Although this research points to the prevalence of the problem and its close association with substance use severity, further work is needed to elucidate the nature and course of these co-occurring problems.

4.2. Limitations

Several limitations in the current study should be noted. First, we relied on diagnostic impressions from standardized interviews with the GAIN; such diagnostic impressions do not fully match the diagnosis made by clinicians. It is important to recognize that the GAIN was optimized to provide dimensional measures of functioning in the year before intake based on self-report. Although these measures are based on symptoms from *DSM-IV*, they vary from it in some potentially important ways including not using an age of onset criteria on externalizing problems like ADHD and CD, and not limiting PTSD or acute stress disorder to a single event. More work is needed to examine how well the GAIN maps onto the clinical diagnoses and how the GAIN might be improved through new questions and statistical algorithms to better predict final clinical decisions. Second, the GAIN focuses only on a subset of common problems; more detailed assessment of other disorders such as social phobia, personality disorder, psychotic disorders, and pathological gambling was not available, but would presumably further increase the estimates of prevalence and association. These disorders are likely to be present to varying degrees and are worthy of future research. Third, the data were drawn from intake assessments when participants entered treatment; thus, the cross-sectional nature of the data limits the examination of temporal relationship and is likely to confound the trend of substance use by birth cohort according to the historical waves of marijuana, cocaine, and opioid initiation that are known to exist (Dennis, Babor, Roebuck, & Donaldson, 2002). Fourth, this study used data pooled from multiple individual studies. Although the sample was large, it is not a random sample of people in treatment and not nationally representative. In particular, relative to the public treatment admission data (OAS, 2005), the rates of minorities and women in our adult sample are much higher than expected, and these differences might confound with our age variable and had to be controlled in the analysis. For future research on co-occurring problems, a representative study of clients from treatment settings is warranted.

4.3. Implications

Findings from the current study have several important implications for assessment and treatment. First, a standardized and efficient assessment tool for mental disorder screening to identify substance users suffering from multiple

disorders is essential to aid treatment and intervention efforts and assist with necessary mental health treatment referral and services. It is recommended that individuals admitted to substance abuse treatment be assessed for co-occurring problems. Early identification of mental health symptoms in a substance abuse treatment program might lead to more comprehensive treatment, better outcome, and prevention of the onset of secondary disorders. Secondly, the high rates of comorbidity suggest the potential utility of providing integrated substance abuse and mental health services in the same program.

High comorbidity represents a small proportion of the people in the general population, but accounts for the majority of individuals with severe impairment. Complications of co-occurring problems on treatment outcome is well documented. The presence of high odds of depression and anxiety among relatively young, dependent youth, and ADHD and conduct problems among young adults and older adults deserves great attention for early identification and appropriate treatment and referral of these problems. Early intervention and treatment efforts for clients with co-occurring problems are thought to be of great value in preventing the progression of substance use and other co-occurring problems and reducing the long-term risk of relapse.

Recently, investigators in addiction treatment research have concluded that substance dependence is often a chronic condition that leads to poorer clinical outcomes and warrants continuing care and monitoring (Dennis & Scott, in press; McLellan, Lewis, O'Brien, & Kleber, 2000). In addition, people with substance and co-occurring mental health problems are a unique high-risk population excessively vulnerable to antisocial behavior, crime, and suicide. The varied patterns of internalizing and externalizing problems by age in the current study suggest treatment programs should target appropriate age groups and their primary co-occurring problems, because substance users with different co-occurring problems may have differential responses to substance abuse treatment. In summary, comorbidity among substance users is the rule, not the exception. Future research is recommended to focus on improving assessment for mental health problems, referral and linkage to mental health treatment, and evaluating whether the impact of better meeting mental health needs leads to better treatment outcome.

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