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Three-Year Chemical Dependency and Mental Health Treatment Outcomes Among Adolescents: The Role of Continuing Care

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Abstract

Background—Few studies have examined the effects of treatment factors, including the types of services [chemical dependency (CD), psychiatric, or both], on long-term outcomes among adolescents following CD treatment, and whether receiving continuing care may contribute to better outcomes. This study examines the effect of the index CD and ongoing CD and psychiatric treatment episodes, 12-step participation, and individual characteristics such as CD and mental health (MH) severity and gender, age, and ethnicity, on 3-year CD and MH outcomes.

Methods—Participants were 296 adolescents aged 13 to 18 seeking treatment at 4 CD programs of a nonprofit, managed care, integrated health system. We surveyed participants at intake, 1 year, and 3 years, and examined survey and administrative data, and CD and psychiatric utilization.

Results—At 3 years, 29.7% of the sample reported total abstinence from both alcohol and drugs (excluding tobacco). Compared with girls, boys had only half the odds of being abstinent (OR = 0.46, $p = 0.0204$). Gender also predicted Externalizing severity at 3 years (coefficients 18.42 vs. 14.77, $p < 0.01$). CD treatment readmission in the second and third follow-up years was related to abstinence at 3 years (OR = 0.24, $p = 0.0066$ and OR = 3.33, $p = 0.0207$, respectively). Abstinence at 1 year predicted abstinence at 3 years (OR = 4.11, $p < 0.0001$). Those who were abstinent at 1 year also had better MH outcomes (both lower Internalizing and Externalizing scores) than those who were not (11.75 vs. 15.55, $p = 0.0012$ and 15.13 vs. 18.06, $p = 0.0179$, respectively).

Conclusions—A CD treatment episode resulting in good 1-year CD outcomes may contribute significantly to both CD and MH outcomes 3 years later. The findings also point to the value of providing a continuing care model of treatment for adolescents.

Keywords

Adolescent; Chemical Dependency Treatment; Mental Health; Continuing Care; Managed Care

Recent studies have examined the development and long-term course of substance use problems among community samples of adolescents (Brown et al., 2008; Clark, 2004; Fothergill and Ensminger, 2006; Georgiades and Boyle, 2007; Kirisci et al., 2007;Masten et al., 2008; Needham, 2007; Wittchen et al., 2007; Zucker, 2008). There is also a rich literature on shorter-term outcomes of adolescents entering chemical dependency (CD) treatment. Few studies, however, have examined long-term outcomes among adolescents following treatment (Brown et al., 2001; Chung et al., 2003; Myers et al., 2007), and we know relatively little about what combination of treatment services (CD, psychiatric, or both) may provide enduring benefits. Also lacking in the literature are studies of

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comprehensive continuing care service models. In addition, with a few important exceptions (Brown, 2004; Crowley et al., 1998b; Tomlinson et al., 2004), the CD treatment literature has not consistently considered mental health (MH) outcomes as primary, along with CD outcomes, although the majority of adolescent CD treatment patients have co-occurring CD and MH problems that may impact their course of problems (Chan et al., 2008; Chung and Martin, 2005; Hser et al., 2001). Earlier study findings indicated a high prevalence of MH comorbidity among this sample, and a positive relationship between concomitant CD and psychiatric service use and short-term outcomes (Sterling and Weisner, 2005). The current study extends this work by examining the effect of the index CD treatment and ongoing CD and psychiatric services on 3-year CD and MH outcomes.

Chemical dependency problem severity at intake may play an important role in the course of treatment and outcomes. CD severity at intake has been found to be moderately related to alcohol use patterns (Chung and Martin, 2005), and predicted worse CD outcomes at 2 years, in a sample of delinquent adolescents with co-occurring problems (Crowley et al., 1998b). A study of treated adolescents also found that baseline dependence symptoms and higher intensity of past 30-day use at intake predicted continued dependence at 1 year (Anderson et al., 2007), independent of MH status.

Comorbidity is also related to treatment outcomes in adolescents; patients with co-occurring MH and CD problems have often been found to have less successful outcomes (Alterman and Cacciola, 1991; Haller et al., 1993; Helzer and Pryzbeck, 1988; Hesselbrock, 1991; Kaminer, 1999; McLellan et al., 1983; Montoya and Atkinson, 1991; Powell et al., 1992; Rounsaville et al., 1987; Schuckit, 1985) (though this has not always been the case—see Friedman and Glickman, 1987). For example, adolescents with comorbid MH conditions have been found to be more likely than others to drop out of CD treatment (Dobkin et al., 1998; Kaminer et al., 1992), or relapse (Kaminer, 1999). Another study found that adolescents with comorbid MH problems were both more likely to relapse in the 6 months following treatment, and relapsed earlier, than those without MH problems, even though they were more likely to receive both CD and psychiatric treatment during that time (Tomlinson et al., 2004). Similarly, a 2004 study found that adolescents with alcohol use disorders and comorbid major depression disorders (MDD) relapsed to drinking significantly earlier than those without a diagnosis of MDD (Cornelius et al., 2004). A recent study found that the presence of MH disorders at intake predicted relapse, and that their absence predicted abstinence at 1 year (Anderson et al., 2007).

Certain MH problems have been found to be related to CD severity (Miller-Johnson et al., 1998; Riggs et al., 1995; Whitmore et al., 1997), as well as poorer treatment outcomes (Grella et al., 2001; Rowe et al., 2004). In a national adolescent treatment sample, conduct disorder, depression, and attention deficit hyperactivity disorder (ADHD) were all found to independently predict both higher CD severity at intake as well as worse CD outcomes at 1 year post-intake (Grella et al., 2001). A study of 3-year alcohol and drug outcomes in a treatment sample found conduct disorder to be associated with trajectories of continuing CD problems, while depression was associated with both “low/improving” and “continuing” CD trajectories (Chung et al., 2003). Winters (see Chung et al., 2003) examined MH status and CD outcomes of an adolescent clinical sample and found that those with an absence of Externalizing characteristics were less likely to report problematic use at 5 years (Chung et al., 2003). A more recent 5-year outcome study also found Externalizing disorders to be related to poorer CD outcomes (Winters et al., 2008). A clinical trial comparing cognitive behavioral therapies found that patients who had both Internalizing and Externalizing disorders in addition to a CD disorder had worse CD outcomes at 1 year than those with a CD disorder only, or those with a CD disorder and an Externalizing disorder (Rowe et al., 2004). Other studies, however, have found that Internalizing disorders such as depression

may have a less synergistic negative relationship with outcomes than do Externalizing disorders (Tomlinson et al., 2004).

Longer treatment retention has often, though not always (Crowley et al., 1998a), been associated with decreased substance use, criminal activity and arrests, and better school performance (Grella et al., 2001; Hoffman and Harrison, 1986; Hser et al., 2001; Latimer et al., 2000b). It is unclear, however, how the index CD treatment length of stay affects outcomes over time. A recent adult study found that CD readmissions contribute to better long-term outcomes (Mertens et al., 2005). However, the few adolescent studies examining continuing care have tended to examine CD aftercare during the period immediately following treatment and have focused on case management services (Garner et al., 2007; Godley et al., 2007; Latimer et al., 2000a,b) or self-help group participation (Chi et al., 2009; Hsieh et al., 1998; Kelly and Myers, 2007; Kelly et al., 2000, 2005; Kennedy and Minami, 1993; Winters et al., 2000) rather than CD readmissions or longer outcomes. This study will be the first to examine the relationship of CD readmissions, as one component of *continuing care*, among a sample of adolescents in a private, managed care health plan, a major model of CD treatment.

Evidence suggests that psychiatric treatment can also contribute to improved adolescent CD outcomes (Riggs et al., 1995). In public studies, treatment which includes psychotherapies has been found to be associated with better CD, MH and family functioning outcomes (Kaminer and Burleson, 1999; Kaminer et al., 2002). Adult studies have also found psychiatric services to be related to 5-year CD outcomes (Ray et al., 2005). We consider ongoing psychiatric services, along with CD readmissions, as another component of continuing care as it relates to 3-year outcomes.

While fewer adolescent CD treatment studies have examined MH as a primary outcome, those that have often found improvements in patients' MH distress or psychological adjustment following treatment (Hser et al., 2001). Severity of conduct disorder, depression, and ADHD all decreased during the 2-year period following treatment among a sample of delinquent boys with co-occurring disorders, even though there was little decrease in drug use (Crowley et al., 1998b). Another study of adolescent CD patients found those whose substance use worsened over time during the 2 years following treatment experienced increased emotional problems, compared with those whose use did not worsen (Brown et al., 1994). These findings all underscore the interrelated nature of CD and MH problems among adolescent CD patients, and their complex relationships to outcomes.

Demographic characteristics are also important predictors of long-term treatment outcomes. Most of the research on *gender* has found that boys have worse outcomes than girls (Duncan et al., 1997; Moon et al., 2000; Rivers et al., 2001; Rounds-Bryant and Staab, 2001). Several studies have found that boys and girls have different risk factors for poor CD outcomes (Blood and Cornwall, 1994; Chi et al., 2006). One study found that girls were more likely to be abstinent than boys at 12 months (Grella and Joshi, 2003). Another found that boys had a higher likelihood of being symptomatic for CD problems at 1 year (Chung and Martin, 2005). The effect of *age* at treatment on long-term outcomes has rarely been examined among adolescents. Younger age during CD treatment was found to be associated with "minor" versus "major" relapses (Anderson et al., 2007), while another study found that older age tended to predict short-term improvements (Dobkin et al., 1998).

This study examines demographic and problem characteristics, as well as CD readmissions and psychiatric treatment throughout the period from intake to 3 years. Our model builds on the treatment outcome and utilization literature (Aday and Andersen, 1974; Aday et al., 1999; Donovan and Rosengren, 1999; Weisner and Schmidt, 2001) and examines the

relationship of *individual* characteristics of gender, age, ethnicity, CD severity and MH comorbidity, and 1-year CD and MH outcomes to 3-year outcomes. We also consider the effects of *treatment* characteristics—including the index CD treatment length of stay, CD readmissions, and psychiatric services and 12-step participation—on both CD (abstinence from both alcohol and drugs) and MH (Internalizing and Externalizing symptom severity) outcomes at 3 years post-intake. Based on the epidemiologic and treatment literature, we hypothesize that MH comorbidity and CD severity at intake will be related to poorer CD and MH outcomes at 3 years, and that continuing psychiatric and CD services and gender will be related to better CD and MH outcomes. Knowing what factors contribute to long-term treatment success of adolescents can influence health policy and inform clinical practice and continuing care.

MATERIALS AND METHODS

Study Site

The study site was Northern California Kaiser Permanente (KP), a large, nonprofit, group model managed care integrated health delivery system. It is the largest private health insurer in the region, covering 3.4 million members and 30% of the population of the 13 county area of Northern California. Eighty-eight percent of the membership are commercially insured, 10% are insured through Medicare and 2% through Medicaid (2 sites in our study are Medicaid providers for their county). In general, the membership is employed and middle class, with 62% having household incomes over $50,000, and 81% having at least some college education (Gordon, 2004).

The programs were 4 KP Chemical Dependency Recovery Programs, chosen based on their geographic and population diversity. Each site offers a CD treatment program for adolescent health plan members and their families. The programs offer the same modalities and standard of care as all CD programs in the Northern California region, and are coordinated by a region-wide Oversight Committee. They include 12-step based and family centered modalities, and are representative of U.S. adolescent CD treatment approaches (Jainchill, 2000). They are abstinence-based, with regular breathalyzer and urine screening tests, and require the participation of a parent or guardian. The programs provide intensive, structured outpatient treatment, with referral to the Psychiatry Department for further assessment, diagnosis and treatment of MH conditions, or to contracted residential programs as needed. The services provided include group, individual and family therapy, education, and relapse prevention training. Regular 12-step meeting attendance is required. Although program length varies based on individual needs and problem severity, it is targeted to be of about 1-year duration, with 3 treatment phases: Early Recovery, Continuing Recovery/Relapse Prevention, and Aftercare.

Sample and Procedures

Patients were eligible for the study immediately at CD program intake. Study participation was independent of receiving program services and regardless of whether they had further contact with the program after intake, and program personnel were not informed about participation. The study has been approved annually by the Institutional Review Boards (IRB) of Kaiser Foundation Research Institute and the University of California, San Francisco.

During the study recruitment period (May 1, 2000 to June 30, 2002), 630 adolescents ages 13 to 18 presented for an intake appointment at 1 of the 4 CD programs. Following intake assessment, a research assistant explained the study and obtained verbal assent to participate from adolescents and signed informed consent from parents. Sampling consecutive intakes

in the 4 sites, we recruited 66% (n = 419) of the 630 adolescents with an intake appointment (and a parent or guardian for each adolescent). This baseline study sample of 419 consisted of 83% of those who actually began treatment. We conducted CD intake chart reviews of those we were unable to recruit; there were no gender or age differences between those who were successfully recruited and those not recruited. The same proportion of those in the baseline sample and those not recruited had a parent with an alcohol or drug problem (44%), and the same proportion of each was enrolled in school (83%). There was a higher proportion of Native Americans (9% vs. 3%) in the baseline sample than among those not recruited and a higher proportion of Whites in the nonrecruited group than among the baseline sample (65% vs. 49%) (both $p < 0.01$). There were higher proportions of patients with Depression (24% vs. 13%), Anxiety (7% vs. 2%), Conduct Disorder w/ODD (16% vs. 3%), and ADHD (10% vs. 3%) diagnoses in the baseline study sample than among those not recruited (all $p < 0.05$). Both groups had equal representation of adolescents who had used alcohol, marijuana, cocaine, heroin, hallucinogens, stimulants, and sedatives in the 6 months preceding intake. A higher proportion of those in the baseline sample had used inhalants (13% vs .7%), party drugs (21% vs. 6%), tobacco (75% vs. 57%), Ritalin (12% vs. 0.09%), and painkillers (25% vs. 8%), than what was listed in the charts of those who were not recruited (all $p < 0.05$).

We asked eligible patients not recruited at intake to explain why they declined to participate. Of the 211 not recruited at intake, 44% (n = 93) were unable to be contacted, 49% (n = 103) said they were not interested in participating (either the teen or the parent or both), 6% (n = 13) gave specific reasons why they were too busy to participate, and 1 person died before he could be recruited.

Response rates for follow-up interviews were 92% (n = 384) at 1 year and 85% (n = 358) at 3 years. Of the baseline sample of 419, 354 (84.5%) had at least 22 months of membership during the 3-year follow-up period. For this study, we selected those participants from the baseline sample who had completed both 1- and 3-year interviews, *and* had at least 22 months of membership during the total follow-up period (n = 296). The criterion of 22 months or more of health plan membership for analysis is consistent with other work which has found 60% of a given time period to strike a good balance between the dual goals of preserving sample participants and accurately predicting utilization for the period (Ray et al., 2005).

The final sample differed little from the baseline sample; it was 38% female; 2% age 13, 12% age 14, 20% age 15, 27% age 16, 27% age 17, and 12% age 18. The final sample (n=296) and the rest of the baseline sample (n = 123) reported similar substance use in the prior 6 months at baseline except for marijuana; a higher proportion of those in the baseline sample had used marijuana than their counterparts in the final study sample (93% vs. 84%; $p < 0.05$). The final sample (n = 296) was ethnically heterogeneous (50% Caucasian, 21% Hispanic, 14% African American, 8% Native American, and 6% Asian/Pacific Islander). There were no statistically significant ethnic differences between the baseline and final samples.

Data Sources and Measures

At baseline, each adolescent completed self-administered computerized and paper and pencil questionnaires. Follow-up interviews were conducted by telephone from the KP Division of Research. The study included self-report measures from adolescents on substance use, MH symptoms, 12-step participation, and out-of-health-plan CD and psychiatric utilization, as well as computerized clinical diagnoses and administrative health plan data on CD and psychiatric services utilization.

CD Outcomes and Problem Severity—We measured quantity and frequency of alcohol and drug use at intake, and at the 1- and 3-year follow-ups. This included reporting days of use of alcohol (both any use at all and 5 or more drinks in 1 day) and of tobacco and 11 other substances in the past 30 days. These measures were drawn from the Comprehensive Adolescent Severity Inventory, a semi-structured self-report questionnaire measuring adolescent health and functioning in several domains, including education, legal issues, and family relations (Meyers et al., 1995). It has been widely used in recent adolescent research (Donovan and Rosengren, 1999; Whitmore et al., 1997). Consistent with program goals, we used 30-day abstinence from all substances (excluding tobacco) at the 3-year follow-up as the CD outcome measure. Our multivariate models controlled for CD severity at intake, measured as a sum of dependence and abuse symptoms (ranging 0 to 14). We also examined 30-day abstinence at 1 year as a measure of short-term CD outcomes in predicting 3-year outcomes.

Mental Health Outcomes and Problem Severity—Mental health problems were assessed at intake and 1 year using the Youth Self-Report (YSR) (Achenbach, 1991), and at 3 years using the Adult Self-Report (ASR). The ASR is derived from and comparable to the YSR, but is designed for adults. Both are structured self-report questionnaires measuring competencies and problems in several areas, and can be administered verbally. The YSR domains are: Aggressive Behavior, Anxious/Depressed, Attention Problems, Delinquent Behavior, Social Problems, Somatic Complaints, Thought Problems, and Withdrawn; the ASR measures competencies and problems in all but the Social Problems domain, including: Anxious/Depressed; Withdrawn; Somatic Complaints; Thought Problems; Attention Problems; Aggressive Behavior; Rule-Breaking Behavior; and Intrusive. Both include normed scales for adaptive functioning and empirically based syndromes, and both allow for global measurement of problems using a Total Problem scale and Internalizing and Externalizing scales. The YSR and ASR have demonstrated solid psychometric properties across a variety of adolescent and young adult populations (Achenbach, 1991; Ferdinand and Verhulst, 1994; McConaughy et al., 1992). The child–adolescent and adult versions have high agreement (Achenbach and Edelbrock, 1983). A study of the applicability of the adult version of the scales to a sample which had initially been assessed using the youth version, demonstrated high stability coefficients between the YSR and ASR (Ferdinand et al., 1995).

We also used the YSR Anxious/Depressed scale and the Externalizing scale scores at 1 year as measures of short-term MH outcomes in predicting 3-year outcomes. At the request of the KP IRB, at all follow-ups the Anxious/Depressed scale excluded 2 questions (out of the 14) that specifically address suicidality, thus, our mean scores on the Anxious/Depressed and Internalizing scales are conservative.

Treatment Measures

Health Plan Chemical Dependency and Psychiatric Services Utilization—We extracted psychiatric and CD service utilization data from KP administrative data to classify visits within KP MH and CD departments (Chi et al., 2006; Sterling and Weisner, 2005). This includes every encounter, procedure, and transaction which occurs in (or is paid for by) the health plan. We identified the percentage of patients who received CD and psychiatric services in each of the 2 years following the index treatment year. During those 2 years, 90 people received additional CD treatment; among those, 44 (49%) received all their treatment through the health plan.

Out-of-Health-Plan CD and Psychiatric Services Utilization—Out-of-health-plan utilization in the second and third years not paid for by KP following intake was measured

using self-report data from the 3-year interview. Analyses conducted in another KP sample of young adults aged 18 to 25 years old found substantial agreement between self-report and administrative data (Mertens et al., 2008).

Twelve-Step Attendance at 1 and 3 Years Post-Treatment Intake—We asked participants whether they attended 10 or more meetings in the prior 6 months at 1 and 3 years.

Program Site—There may be organizational differences across programs which may have affected treatment outcomes. We examined outcomes by site in bivariate analyses and found no associations between program site and either CD or MH outcome.

Demographic Characteristics—The instruments included items on age, gender, and race/ethnicity.

Statistical Analyses

We first conducted chi-square tests for categorical outcome measures, and *t*-tests, ANOVA, and correlation tests for the continuous measures to examine associations between each individual and treatment characteristic in our model and each of the outcomes at 3 years. We then built multivariate logistic and linear regression models to examine the independent effects of individual characteristics (age, gender, CD, and MH severity at intake), 1-year CD and MH outcomes, and treatment characteristics (index CD treatment length of stay, CD readmissions in the second and third years, psychiatric services in each follow-up year, and 12-step participation at 1 and 3 years) on the 3-year CD and MH outcomes. All statistical analyses were performed using SAS version 9.1 (SAS Institute Inc., Cary, NC).

RESULTS

Abstinence at 3 Years by Individual and Treatment Characteristics

At 3 years, 138 (38.6%) reported abstinence from alcohol and 203 (56.7%) from drugs in the prior 30 days, with 88 (29.7%) reporting abstinence from both alcohol and drugs (excluding tobacco). Of the 12 substances examined, alcohol use was the most prevalent (61.5%), followed by marijuana (41.6%), stimulants (4.2%), and opiates or painkillers (4.2%). A significantly higher proportion of boys than girls reported use of alcohol and marijuana (65.7% vs. 53.9%, $p < 0.05$ and 47.4% vs. 31.3%, $p < 0.01$, respectively), and boys also tended to report more use of opiates or painkillers (boys vs. girls = 5.7% vs. 1.6%, $p < 0.10$) (not shown). In the 3 years following intake, 27% received more than 5 psychiatric visits, 24% received between 1 and 5 visits, and 48% received no psychiatric visits (not shown).

Table 1 presents individual and treatment characteristics by abstinence status at 3 years. We found higher proportions of girls (51.1% vs. 32.2%, $p < 0.01$) and a lower mean age (15.7 vs. 16.2, $p < 0.01$) in the abstinent than the nonabstinent group. Higher CD and MH severity at intake, and abstinence at 1 year, were significantly associated with abstinence at 3 years. No associations were found between abstinence and site, index CD treatment length of stay or any CD readmission in the second follow-up year, but more in the abstinent group had at least 1 CD readmission in the third follow-up year (17.1% vs. 7.7%, $p < 0.05$). Higher proportions of those abstinent received any psychiatric services within the health plan in each follow-up year (all $p < 0.05$). Twelve-step participation at 1 and 3 years was significantly associated with abstinence at 3 years.

ASR Internalizing and Externalizing Scores at 3 Years by Individual and Treatment Characteristics

Girls had significantly higher average Internalizing Score (14.8 vs. 11.9, $p < 0.05$), but lower average Externalizing score (13.4 vs. 16.5, $p < 0.05$), than boys (Table 2). Age was not associated with ASR scores. Those with higher MH severity at intake continued to have worse ASR Internalizing and Externalizing scores at 3 years, while baseline CD severity was significantly associated with Internalizing scores at 3 years, but not with Externalizing scores. Better 1-year CD and MH outcomes were significantly associated with better 3-year ASR scores. Psychiatric services received in the first, second and third follow-up years within the health plan were significantly associated with worse Internalizing scores at 3 years, and out-of-plan psychiatric services in the second and third follow-up years were significantly associated with both ASR score. Receiving continuing CD treatment in the second follow-up year was significantly associated with worse Externalizing scores at 3 years; no other CD treatment characteristics were significantly associated with 3-year MH outcomes. We also conducted post hoc analyses and found that site was not a significant predictor of either CD or MH outcomes in multivariate models.

Independent Predictors of Total Abstinence at 3 Years

Table 3 presents the results of the multivariate logistic regression analysis of total 3-year abstinence. Compared with girls, boys had half the odds of being abstinent (OR = 0.46, 95% CI = 0.24–0.90, $p<0.05$). Age, baseline MH and CD severity, and length of the index CD treatment episode were not associated with abstinence. CD readmissions in the second and third follow-up years were inversely related to abstinence at 3 years (OR = 0.24, 95% CI = 0.08–0.67, $p < 0.01$ and OR = 3.33, 95% CI = 1.20–9.64, $p < 0.05$, respectively). Receiving psychiatric services in years 2 and 3, within or outside of the health plan, was not associated with abstinence. Being abstinent at 1 year predicted abstinence at 3 years (OR = 4.11, 95% CI = 2.09–8.10, $p < 0.0001$). Attending 10 or more 12-step meetings in the prior 6 months at 3 years was associated with abstinence at 3 years (OR = 3.40, 95%CI = 1.27–9.70, $p < 0.05$).

Independent Predictors of MH Outcomes at 3 Years

Independent Predictors of ASR Internalizing Scores—Table 4 presents the results of the multivariate general linear regression of ASR Internalizing score at 3 years. We found no age or gender effects. Baseline severity was significantly associated with severity at 3 years: higher Internalizing scores at intake were associated with higher 3-year Internalizing scores (coefficient = 0.3099, $p < 0.001$). Higher YSR anxiety/depression scores at 1 year were also related to higher Internalizing severity at 3 years (coefficient = 0.8645, $p < 0.0001$). We found no significant effects of index CD treatment length of stay, CD readmissions within or outside of the health plan, or 12-step participation at either 1 or 3 years. However, those who received any out-of-plan psychiatric treatment during the second and the third follow-up years had higher scores (15.77 vs. 11.54, $p < 0.05$). Those who were abstinent at 1 year had lower scores than those who were not (11.75 vs. 15.55, $p < 0.001$).

Independent Predictors of ASR Externalizing Score—Regression results of the independent effects of individual and treatment characteristics on ASR Externalizing scores are reported in Table 4. Boys had significantly higher scores than girls at 3 years (18.42 vs. 14.77, $p < 0.01$). Age was not significant. Neither MH nor CD severity at intake was associated with Externalizing scores at 3 years. Higher Externalizing severity at 1 year was related to higher scores at 3 years (coefficient = 0.3876, $p < 0.0001$). Index CD treatment length of stay, CD readmissions received in the third year within the health plan, and 12-step participation at 1 or 3 years were not significant. However, receiving CD services in the health plan in the second year, and receiving psychiatric services outside of the health plan

during the second and the third years, were associated with higher scores at 3 years (18.44 vs. 14.75, $p = 0.05$ and 18.58 vs. 14.61, $p < 0.05$, respectively). Those who were abstinent at 1 year had lower ASR Externalizing scores than those who were not (15.13 vs. 18.06, $p < 0.05$).

Relationships Between Abstinence and MH Severity at 1 Year and Services in Years 2 and 3

We conducted post hoc analyses to examine 1-year CD and MH outcomes in relation to receipt of services in years 2 and 3 to determine the direction of the relationships. Higher CD and MH severity at 1 year seemed to be associated with receiving services in subsequent years: a higher YSR anxiety score at 1 year was significantly associated with receiving CD services in year 2 ($p < 0.01$), and receiving psychiatric services in years 2 and 3, both within and outside the health plan (all $p < 0.05$). A higher Externalizing score at 1 year was significantly associated with receiving CD services in years 2 and 3, both within and outside the health plan (all $p < 0.05$), as well as with receiving psychiatric services within the health plan in year 2 ($p < 0.05$). Nonabstinence at 1 year was significantly associated with receiving psychiatric services within the health plan in year 2 ($p < 0.05$) (not shown).

Relationships Between Psychiatric and CD Services and Outcomes Within Subgroups Stratified by Baseline MH Severity

We also conducted post hoc analyses to examine the association between psychiatric and CD services, both inside and outside the health plan, on all three 3-year outcomes, among those whose baseline YSR Internalizing or Externalizing score was above the median, and among those whose scores were both below the median, to determine whether services proved more beneficial for a particular severity group. Results suggested that the associations between services and 3-year outcomes were significant or in the same directions for both groups. Among those with higher baseline MH severity ($n = 192$), abstinence at 3 years was significantly associated with receiving CD visits in year 3 ($p < 0.05$) and psychiatric visits in year 3 ($p < 0.01$), while higher 3-year Internalizing severity was associated with receiving psychiatric visits in year 2 ($p < 0.05$) and with receiving out-of-health-plan psychiatric services in year 3 ($p < 0.05$), and higher 3-year Externalizing severity was associated with receiving out-of-health-plan psychiatric services in year 3 ($p < 0.05$). Among those with lower baseline MH severity ($n = 104$), abstinence at 3 years was associated with receiving psychiatric visits in years 2 and 3 (both $p<0.05$), higher 3-year Internalizing severity was associated with receiving psychiatric visits in year 2 ($p < 0.01$), and higher 3-year Externalizing severity was associated with receiving out-of-health-plan psychiatric services in year 3 ($p < 0.01$) (not shown).

DISCUSSION

This adolescent CD treatment sample is similar to those in many other studies; its members entered treatment with severe CD problems and a high prevalence of MH problems. This study contributes to the literature by using a private managed care sample, by following patients for 3 years, and by examining both their MH and CD outcomes.

Studies have demonstrated that both CD and psychiatric services may significantly impact adolescents' short-term CD outcomes. Previous examination of this sample found that receiving concomitant psychiatric services was associated with abstinence at 6 months (Sterling et al., 2004), and both Hser and Latimer found CD treatment retention to be related to better outcomes (Hser et al., 2001; Latimer et al., 2000a). A key finding here is that abstinence at 1 year is significantly associated with both CD and MH outcomes 3 years later.

This suggests that successful engagement in treatment should become a major focus of CD programs.

Treatment readmission after the index episode may also play a beneficial role in long-term outcomes. The CD treatment system traditionally has not been organized to treat alcohol and drug use problems as chronic conditions, and while relapse is acknowledged as a common occurrence, treatment readmission has often been thought of as failure. As the field moves toward a continuing care approach however, several have argued that a single treatment episode should not be seen as a "magic bullet." They argue that treatment readmissions should be conceptualized as part of a cumulative process of treatment and recovery, similar to the chronic care models commonly used to treat diabetes or asthma (Hser et al., 1997; Mertens et al., 2005), and their findings suggest that readmissions may lead to better long-term CD outcomes. This area has been less studied in adolescents. This observational study is the first to demonstrate the potential benefits of continuing CD and psychiatric care in an adolescent sample. Our finding that, when controlling for other factors, receiving any CD services in year 3 was significantly related to abstinence at 3 years, but that receiving CD services in year 2 was related to nonabstinence, suggests a proximal effect of treatment, and that adolescents may need more frequent and regular "booster" doses of treatment during the early years of recovery. The impact of continuing care models of treatment for CD problems should be studied in other designs and settings, including primary care. CD programs could consider including continuing services beyond traditional aftercare, such as CD or psychiatric "check-up" calls or visits, on-line "recovery communities," enhanced "alumni" or "wellness" groups, or tighter linkage with patients' primary care services, as part of their treatment "menu." By incorporating concepts such as "patient activation" and "self-management," which are gaining traction in the addiction treatment field and which build on its tradition of self-help, programs could serve to strengthen and maintain the relationship between patients and programs, reinforcing the benefits of treatment, while minimizing potential patient perceptions of stigma and time commitment associated with traditional CD treatment (Institute of Medicine, 2001, 2005; Lorig and Holman, 2003).

While we did not find length of stay for the index CD treatment to be related to improved MH outcomes, abstinence at 1 year was—to both Internalizing and Externalizing outcomes at 3 years. These findings on MH outcomes, like those of CD outcomes, point to important long-term improvements which might be gained from successful index CD treatment; for adolescents with CD problems, obtaining sobriety may improve their MH status.

Although we were unable to examine bidirectional relationships between severity and services in our models, post hoc analyses found that those with highest MH severity received the most services. It was not the case that those who experienced improvement early on continued to access more services than those who did not. We did not find support for significant effects of receiving continuing care—either CD readmissions or psychiatric services—on better MH outcomes at 3 years when controlling for other factors, and post hoc analyses of the association of services with 3-year MH outcomes suggest that those with more severe MH symptomatology at intake did not receive greater benefit from the psychiatric services they did receive. Patients may need a higher intensity or dose of either or both types of services, to achieve optimal MH outcomes; only a quarter of the sample received more than 5 psychiatric visits in the health plan during the 3 years, and close to half received none. CD programs might consider "prescribing" a requisite number of psychiatric assessment visits during treatment, or including regular psychiatric "check-ups" as part of a continuing care model, especially for patients who exhibit emotional distress at treatment entry.

Several studies have attempted to explain the complex interplay between MH symptomatology and CD outcomes among treated adolescents. One possible explanatory mechanism for the poorer outcomes often realized by teens with co-occurring disorders is self-medication to relieve feelings of stress or emotional distress (Henwood and Padgett, 2007; Khantzian, 1997). Although self-medication has not been well-studied in adolescents, a recent study examined its role in relapse among a sample of treated adolescents with co-occurring problems, and found that the presence of higher numbers of overall MH symptoms, and of depression symptoms, prior to relapsing, was related to the use of drugs (other than alcohol and marijuana) (McCarthy et al., 2005). They also found evidence to suggest that substance use following treatment may exacerbate preexisting MH problems. A similar study of adults also found evidence of a worsening of MH symptoms after a relapse to substance use post-treatment (Tomlinson et al., 2006).

Compared with other teens, adolescents with co-occurring CD and MH problems may also possess fewer personal resources such as social support, self-efficacy, or coping skills, which may make it more difficult to achieve and maintain abstinence. They may respond to stress differently than teens without co-occurring conditions. For example, Ramo and colleagues (2005) found that among a sample of treated, comorbid adolescents, lower self-efficacy in the context of several stressful emotional states increased the likelihood of relapse.

In contrast to much of the literature, in bivariate analyses, we found that although patients with the most severe MH problems at intake continued to have more MH problems at 3 years, they also had the highest abstinence rates. In multivariate models however, controlling for other factors, higher baseline and 1-year MH severity did not predict 3-year abstinence. Baseline Internalizing severity was predictive of Internalizing but not Externalizing severity at 3 years, and baseline Externalizing severity was predictive of neither. Interim MH severity was more closely related to 3-year outcomes; 1-year Internalizing problems predicted both Internalizing and Externalizing severity at 3 years, and 1-year Externalizing scores predicted 3-year Externalizing severity. This suggests that treatment providers may need to place greater emphasis on achieving good MH outcomes (as well as good CD outcomes, as discussed above) during initial treatment, possibly through integrating CD and psychiatric services, to promote longer-term benefits. These findings may also reflect the episodic nature of certain MH disorders, or may be indicative of typical developmental changes, and merit further examination. Post hoc analysis of the relationship of concomitant MH and CD status at 3 years found no significant association between Internalizing severity and abstinence, and only a marginally significant negative association between Externalizing severity and abstinence ($p = 0.063$). We did find a significant negative association between 3-year drug-only abstinence and both Internalizing and Externalizing severity at 3 years. Thus, in this instance, we did not find evidence for a strong link between later MH symptomatology and CD outcomes. This, combined with the findings that neither type of continuing care services predicted better MH outcomes, and that those with more severe MH problems did not derive greater benefit from psychiatric services than those with lower MH severity, suggests that in many adolescent CD treatment patients, emotional distress may persist, even with psychiatric treatment and in the presence of CD improvement, and that programs may need to look at integrating more, and more intensive, psychiatric services, into their curricula.

Our finding that 12-step participation in the 6 months prior to the 3-year follow-up was highly predictive of abstinence at 3 years adds to the growing literature on the benefits of 12-step programs for adolescents (Chi et al., 2009; Kelly et al., 2008; Winters et al., 2007). We also found no association between 12-step participation at either time point to MH

outcomes, suggesting that for adolescents with co-occurring MH problems, 12-step participation alone, as aftercare, may not help toward easing problems other than CD.

Gender has often been found to be an important predictor of treatment outcomes, with most studies finding that girls tend to have better outcomes than boys (Duncan et al., 1997; Grella and Joshi, 2003; Moon et al., 2000; Rivers et al., 2001; Rounds-Bryant and Staab, 2001; Winters et al., 2000). At 6 months, there were no differences in outcomes in this sample by gender (Sterling et al., 2004). At 3 years, however, we found that girls were more likely to be abstinent and had lower Externalizing severity. Although our analysis controlled for problem severity and services, this finding may yet be an artifact of the differences in severity and utilization by gender; while girls were more severe than boys on several CD and MH problem measures at baseline (Sterling and Weisner, 2005), they also typically received more services, which may have contributed to their better outcomes.

This study is limited by the fact that it was conducted in a nonprofit, private sector, managed care health plan, and may not be generalizable to other health systems. However, managed care is a major organizational model for private and public health care, including many state Medicaid arrangements. In addition, we had the opportunity to examine administrative databases to monitor CD and MH utilization, rather than relying solely on self-report.

Among all the adolescents who came to 1 of the 4 CD programs for an intake appointment to discuss their substance problem during the recruitment period, a third declined participation in the study. The nonrecruited group, many of whom also did not return to start treatment, may have decided that the program offered was too intense or may have felt that their problems did not warrant specialty treatment, or may not have been ready to address substance use issues. Compared with those not recruited, the study sample was significantly more severe on several measures of CD and MH status, so findings may not be generalizable to the adolescent privately insured CD population as a whole. A less severe sample, more representative of the adolescent population as a whole, might have experienced better outcomes over time, or perhaps more of them would have matured out of earlier substance problems, possibly tempering our findings for continuing care. However, the high problem severity of this sample is similar to that found in other adolescent treatment studies, thus we feel any threat of bias of this type to be minimal (Grella et al., 2001; Wise et al., 2001). The final sample contained a larger proportion of non-White participants than the nonrecruited group.

Due to our sample size, we were unable to use a mixed model approach, which would have been the optimal approach for examining the possible cluster effects of treatment site. While we found no significant differences in either CD or MH outcomes by site in bivariate analyses, and did not find it to be a significant covariate in post hoc multivariate models, future studies with larger sample sizes could better address the clustering data structure by applying mixed modeling approaches.

As with all observational studies, our results cannot be interpreted as causal. When continuing care is available, it would likely be considered the standard of care, and a randomized study therefore would not be ethical. There are also potential self-selection effects, which might involve the motivation of those who return for further services, which could be influenced by a variety of factors. Comorbid adolescents, for instance, may be less motivated to engage in treatment; they have been found to be less likely to recognize the need for CD treatment than those without a co-occurring disorder (Breda and Heflinger, 2004). Further, among a sample of treated, comorbid adolescents, those who relapsed immediately following treatment were less likely than those who relapsed later to view substance use as problematic (Ramo et al., 2005). Correlation among severity and service

use may also confound outcomes, and similarly, doing well in the short-term may relate to doing well in the long-term. The fact that those who received more psychiatric services had worse MH outcomes suggests that the more severe patients may need yet more services than they typically receive.

Some of the differences we found in outcomes, and the prevalence of substance use at 3 years may also simply reflect common developmental changes as the sample ages. Although the study did not examine such changes, we found that age, a proxy measure of development, was not predictive of differences in either CD or MH outcomes. Future studies may examine developmental maturation as it relates to long-term treatment outcomes.

While acknowledging these limitations, the findings suggest that continuing care (formal and informal) may improve outcomes for adolescents with CD problems, and that treatment programs may need to consider innovative treatment approaches which adopt models of care used for other chronic health conditions. They also suggest that certain individual factors and characteristics—CD and MH problem severity and gender—are associated with long-term treatment outcomes, and that programs may want to consider these factors when planning interventions. Most importantly, they also point to the importance of building on interim outcomes in shaping longer-term outcomes, and the value of providing a continuing care model of treatment for adolescents.

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Table 1

Abstinence at 3 Years by Individual and Treatment Characteristics (n = 296)

	Abstinence from both alcohol and drugs		
	Yes (n = 88)	**No (n = 208)**	***p* value**
Demographics			
Girls (%)	51.1	32.2	0.0022
Age, mean (SD)	15.7 (1.3)	16.2 (1.2)	0.0042
Race/ethnicity (%)			
African American	14.9	13.9	NS
Native American	4.6	9.6	
Hispanic	18.4	22.6	
Asian	8.1	5.3	
White	54.0	48.6	
Baseline MH severity			
YSR internalizing score, mean (SD)	17.2 (10.9)	13.6 (9.6)	0.0048
YSR externalizing score, mean (SD)	22.2 (9.4)	19.3 (8.9)	0.0110
Substance use problems at baseline			
Number of abuse/dependence symptoms, mean (SD)	5.2 (3.7)	4.2 (3.1)	0.0244
Short-term outcomes at 1 year			
Abstinence (%)	65.9	39.9	<0.0001
Anxious/depressed scale, mean (SD)	6.0 (5.8)	5.4 (5.0)	NS
Externalizing scale, mean (SD)	14.0 (8.5)	14.0 (8.7)	NS
CD treatment			
Index treatment facility (%)			
Site 1	6.8	14.9	NS
Site 2	30.7	31.7	
Site 3	28.4	24.0	
Site 4	34.1	29.3	
Index treatment length of stay, mean (SD)	95.4 (98.1)	76.6 (88.7)	NS
CD visits within the health plan			
≥1 in the second year (%)	13.6	15.4	NS
≥1 in the third year (%)	17.1	7.7	0.0163
Any CD treatment outside the health plan in the second and third years (%)	15.9	15.4	NS
Psychiatric services			
Psychiatric visits within the health plan			
≥1 in the first year (%)	60.2	36.5	0.0002
≥1 in the second year (%)	35.2	22.1	0.0188
≥1 in the third year (%)	30.7	12.0	0.0001
Any psychiatric treatment outside the health plan in the second and third years (%)	15.9	8.7	0.0662
12-step participation			
Attending 10 or more meetings in prior 6 months at 1 year (%)	34.1	23.1	0.0493
Attending 10 or more meetings in prior 6 months at 3 years (%)	20.5	7.3	0.0010

Notes: *p* values are from chi-square tests for comparisons of categorical individual or treatment characteristics, and *t*-tests for comparisons of continuous individual or treatment characteristics, by abstinence status. CD, chemical dependency; NS, not significant; MH, mental health; YSR, Youth Self-Report.

Table 2

ASR Internalizing and Externalizing Scores at 3 Years by Individual and Treatment Characteristics (n = 296)

	ASR Internalizing score				ASR Externalizing score			
	Mean	**SD**	**Correlation coefficient**	***p* value**	**Mean**	**SD**	**Correlation coefficient**	***p* value**
Demographics								
Gender								
Boys	11.9	10.3		0.0393	16.5	11.5		0.0164
Girls	14.8	12.2			13.4	9.9		
Age			−0.0015	NS			−0.0849	NS
Race/ethnicity								
African American	13.6	10.0		NS	16.9	10.2		NS
Native American	12.6	13.0			13.3	10.0		
Hispanic	14.7	11.6			15.1	10.1		
Asian	14.3	12.0			18.8	12.9		
White	12.1	10.8			15.0	11.6		
Baseline MH severity								
YSR Internalizing score			0.4312	<0.0001			0.1577	0.0069
YSR Externalizing score			0.1694	0.0036			0.2782	<0.0001
Substance use problems at baseline								
Number of abuse/dependence symptoms			0.1681	0.0038			0.0727	NS
Short-term outcomes at 1 year								
Abstinence								
Yes	10.4	8.1		<0.0001	12.8	9.5		<0.0001
No	15.4	12.8			17.7	11.8		
Anxious/depressed scale			0.5447	<0.0001			0.3583	<0.0001
Externalizing scale			0.2621	<0.0001			0.4735	<0.0001
CD treatment								
Index treatment facility								
Site 1	11.3	9.6		NS	16.0	11.0		NS
Site 2	14.1	12.6			16.0	11.9		
Site 3	12.5	9.1			14.9	9.4		
Site 4	13.0	11.6			14.8	11.5		

	ASR Internalizing score				ASR Externalizing score			
	Mean	**SD**	**Correlation coefficient**	***p* value**	**Mean**	**SD**	**Correlation coefficient**	***p* value**
Index treatment length of stay			−0.0512	NS			0.0523	NS
Any CD visit within the health plan in								
Second year								
Yes	14.9	11.9		NS	19.4	13.3		0.0277
No	12.7	10.9			14.6	10.5		
Third year								
Yes	12.7	8.7		NS	17.4	11.7		NS
No	13.0	11.3			15.1	10.9		
Any CD visit outside the health plan in								
Second and third year								
Yes	11.5	10.4		NS	17.5	11.7		0.0277
No	13.3	11.2			15.0	10.9		
Psychiatric services								
Any psychiatric treatment within the health plan in the								
First year								
Yes	14.9	12.1		0.0107	15.6	11.5		NS
No	11.6	10.1			15.2	10.7		
Second year								
Yes	17.6	13.1		0.0003	18.0	12.1		0.0150
No	11.4	9.8			14.4	10.5		
Third year								
Yes	16.1	11.1		0.0278	17.8	11.1		0.0841
No	12.4	11.0			14.8	11.0		
Any psychiatric treatment outside the health plan in the								
Second and third year								
Yes	20.4	14.6		0.0037	21.4	12.4		0.0010
No	12.1	10.3			14.6	10.6		
Twelve-step participation								
Attending 10 or more meetings in prior 6 months at 1 year								
Yes	13.3	11.0		NS	17.2	12.3		0.0880

	ASR Internalizing score				ASR Externalizing score			
	Mean	**SD**	**Correlation coefficient**	***p* value**	**Mean**	**SD**	**Correlation coefficient**	***p* value**
No	12.9	11.2			14.7	10.5		
Attending 10 or more meetings in prior 6 months at 3 years								
Yes	16.1	14.1		NS	19.0	12.9		0.0427
No	12.6	10.6			14.8	10.7		

Notes: *p* values are from *t*-tests or ANOVA tests for comparisons of ASR scores by individual or treatment characteristics, and correlation tests of ASR scores and continuous individual or treatment characteristics. ASR, Adult Self-Report; NS, not significant; CD, chemical dependency; MH, mental health; YSR, Youth Self-Report.

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Table 3

Multivariate Logistic Regression Predicting 30-Day Abstinence From Both Alcohol and Drugs at 3 Years (n = 296)

		OR (95% CI)	*p* value
Demographics			
Gender	Boy vs. Girl	0.46 (0.24, 0.90)	0.0224
Age	(as continuous)	NS	NS
Baseline MH severity			
Internalizing scale	(as continuous)	NS	NS
Externalizing scale	(as continuous)	NS	NS
Baseline SU severity			
Counts of substance	(as continuous)	NS	NS
Treatment in the first year			
CD Length of stay in days	(as continuous)	NS	NS
Psychiatric visits	1+ vs. 0	1.84 (0.94, 3.60)	0.0775
12-step meetings in past 6 months	10+ vs. 0–9	NS	NS
Short-term outcomes at 1 year			
Abstinence	Yes vs. no	4.11 (2.09, 8.10)	<0.0001
Anxious/depressed scale	(as continuous)	NS	NS
Externalizing scale	(as continuous)	NS	NS
Treatment services received in the second and third years			
CD visit in the second year	1+ vs. 0	0.24 (0.08, 0.67)	0.0066
CD visit in the third year	1+ vs. 0	3.33 (1.20, 9.24)	0.0207
CD treatment out-of-health-plan	Any in the 2 years vs. none	NS	NS
Psychiatric visits in the second year	1+ vs. 0	NS	NS
Psychiatric visits in the third year	1+ vs. 0	NS	NS
Psychiatric treatment out-of-health-plan	Any in the 2 years vs. none	NS	NS
12-step meetings in past 6 months	10+ vs. 0–9	3.40 (1.27, 9.70)	0.0149

Notes: NS, not significant; CD, chemical dependency; MH, mental health.

Table 4

Multivariate General Linear Regression Models Predicting Internalizing and Externalizing Scores at 3 Years (n = 296)

		Internalizing score		Externalizing score	
		LSMean or coefficients	***p* value**	**LSMean or coefficients**	***p* value**
Demographics					
Gender	Boy vs. girl	NS	NS	18.42 vs. 14.77	0.0063
Age	(as continuous)	NS	NS	NS	NS
Baseline MH severity					
Internalizing scale	(as continuous)	0.3099	0.0002	NS	NS
Externalizing scale	(as continuous)	−0.1608	0.0565	NS	NS
Baseline SU severity					
Counts of substance	(as continuous)	NS	NS	NS	NS
Treatment in the first year					
CD Length of stay in days	(as continuous)	NS	NS	NS	NS
Psychiatric visits	1+ vs. 0	NS	NS	NS	NS
12-step meetings in past 6 months	10+ vs. 0–9	NS	NS	NS	NS
Short-term outcomes at 1 year					
Abstinence	Yes vs. no	11.75 vs. 15.55	0.0012	15.13 vs. 18.06	0.0179
Anxious/depressed scale	(as continuous)	0.8645	<0.0001	0.3272	0.0387
Externalizing scale	(as continuous)	NS	NS	0.3876	<0.0001
Treatment services received in the second and third years					
CD visit in the second year	1+ vs. 0	NS	NS	18.44 vs. 14.75	0.0523
CD visit in the third year	1+ vs. 0	NS	NS	NS	NS
CD treatment out-of-health-plan	Any in the 2 years vs. none	NS	NS	NS	NS
Psychiatric visits in the second year	1+ vs. 0	NS	NS	NS	NS
Psychiatric visits in the third year	1+ vs. 0				
Psychiatric treatment out-of-health-plan	Any in the 2 years vs. none	15.77 vs. 11.54	0.0225	18.58 vs. 14.61	0.0432
12-step meetings in past 6 months	10+ vs. 0–9	NS	NS	NS	NS

Notes: LSMean were presented for categorical predictor variables and coefficients were presented for continuous predictor variables. NS, not significant; CD, chemical dependency; MH, mental health.