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Medical conditions of adolescents in alcohol and drug treatment: Comparison with matched controls

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Abstract

Purpose—Alcohol and drug problems are associated with medical problems among adults. Research on the relationship of adolescent alcohol and drug use disorders to specific medical problems is less developed and focused on acute consequences. This study addresses gaps in the literature regarding medical comorbidities in adolescents with alcohol and drug use disorders.

Methods—This study compares the prevalence of medical conditions among 417 adolescent alcohol and drug treatment patients with 2,082 demographically-matched controls from the same managed care health plan and examines whether comparisons vary among substance-type subgroups.

Results—Approximately one-fourth of the comorbid conditions examined were more common among adolescent alcohol and drug patients than among matched controls, and several were among the most costly conditions (e.g. asthma, injury). We also found that pain-related diagnoses, including headache, and abdominal pain, were more prevalent among alcohol and drug patients.

Conclusions—Our findings point to the importance of examining comorbid medical and chemical dependency in both adolescent primary care and specialty care. Moreover, optimal treatment of many common medical disorders may require identification, intervention, and treatment of a substance use problem.

Introduction

A large body of research suggests that alcohol and drug problems are associated with medical problems among adults [1-3]. Although numerous studies have documented that adolescents with substance use conditions have a high prevalence of psychiatric comorbidities (see Sterling et al [4]), research on the relationship of adolescent alcohol and drug use disorders to specific medical problems is less developed.

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Studies point to lower overall health status among young people with substance use conditions [5-7]. Some prior literature focuses on issues such as STDs, HIV and other public health issues, and consistently finds strong associations [8-10]. A few studies measure particular acute and rare effects—such as poisonings, overdoses, intense intoxication [11]. One study using self-report data found higher levels of chronic effects, such as insomnia and chronic fatigue, in heavier, than in experimental users of crack cocaine [12]. A study of adolescents with alcohol dependence and abuse versus a community comparison group found higher rates of self-reported conditions, and higher rates of mouth and cardiopulmonary and abdominal abnormalities [7]. Research on an adolescent inpatient sample [5] found appetite changes, weight loss, dermatologic problems, gastrointestinal problems, headaches, and higher levels of One study of an adolescent community sample in Greece identified higher levels of bronchial asthma and peptic ulcer [13]. A few studies have found higher levels of ALT, AST, or GGT (indicating liver enzymes related to protein metabolism, indicators of viral hepatitis or infectious mononucleosis, etc.) in those with alcohol problems [5,7].

Previous research finds associations between particular acute medical problems and specific drugs. For example, use of methamphetamine, which has had high prevalence in California and the Western U.S. and is increasing throughout the U.S. and worldwide [2,14-16], may be associated with cardiovascular effects in case studies [17]; however, research is relatively undeveloped regarding methamphetamine consequences [18]. Inhalant use is associated with headaches and vomiting [19]. Cocaine use is associated with arrhythmias, myocardial infarction, headaches, and seizures in adults [20], as well as sinusitis and rhinitis [21]. MDMA or ecstasy has medical consequences, ranging from the more benign “ecstasy pimples”/acne [22] to convulsive seizures, intracranial hemorrhages, hepatic necrosis, [23] and cardiac arrhythmias [24]. However, more research is needed on long-term effects.

Prior studies on the prevalence of medical conditions in adolescents with alcohol and drug misuse or problems has largely been conducted on public populations [9], inpatient populations [5] or general populations [13,25]. Other studies use small samples, case studies of one or few patients, have no or very small non-substance-using comparison groups [12,17,19,22,26,27] rely solely on self-report of medical problems [12,13] or overall health status [6,28], or do not examine specific medical conditions [7]. Prior medical literature focuses mainly on acute effects, many involving ER or urgent care visits immediately after substance use [17]. Research is sparse on specific, physician-diagnosed medical conditions (and particularly non-acute and more common conditions) in studies of larger samples or on privately insured populations. It is important to examine diagnosed medical problems as self-report medical problems can be confounded with negative emotionality [7].

In a previous study [4], we examined the psychiatric conditions of individuals aged 13-18 years entering adolescent chemical-dependency treatment, and compared them to demographically matched controls. The current study examines medical conditions in the same patients and matched controls. The study was conducted in Northern California Kaiser Permanente (KP), a large, group-model managed care health plan. KP is an ideal setting for this study because of its diverse population. Its Northern California membership is approximately 3 million individuals covering 40% of the commercially insured population. The adult membership is diverse occupationally and socio-economically; it includes municipal, university, business professionals, and service workers. Thus, it has generalizability to other private, commercially insured populations.

Understanding the prevalence and patterns of medical conditions among drug-type subgroups of adolescents with alcohol and drug disorders is particularly important given the high severity of alcohol and drug problems found in this adolescent population [29]. These individuals have access to health care and stable health plan enrollment, yet their alcohol and drug problems are

severe with early onsets and relatively high prevalences for “harder” drugs such as stimulants [29]. Information on their associated medical comorbidities could be used to suggest the medical screening and other services that could optimize health care in both public and private populations. Further, adolescents in alcohol and drug treatment could benefit if their medical and psychiatric conditions were treated concurrently. Recent studies have focused on the benefits of linking medical and substance abuse services among adults and the same may be true among adolescents [2,30-32].

The current study addresses gaps in the adolescent substance use epidemiology literature by comparing the prevalence of clinically derived medical conditions of adolescent alcohol and drug treatment patients with demographically-matched controls from the same health plan. It also examines whether the prevalence of medical conditions varies by frequent use of specific substances. The study’s strengths include clinical diagnoses, a matched controls design, and examination of largely chronic conditions rather than rare, acute effects.

Methods

Study setting, samples, and design

The cases are from a sample of 419 adolescent patients, aged 13-18, who entered specialty Chemical Dependency (CD) treatment at one of four Kaiser Permanente Northern California Chemical Dependency Recovery Programs (CDRP) between March 2000 and May 2002. We recruited 64% of all patients 18 and under entering treatment at the adolescent clinics in the four sites and 83% of those who started treatment [29]. Patients arrived for their intake appointment with a parent. After the patient’s intake assessment, a research assistant explained the study and obtained assent to participate from adolescents and informed consent from parents. Patients were eligible for the study immediately at intake. The Institutional Review Boards of Kaiser Foundation Research Institute and the University of California at San Francisco approved the study. For more details about the study recruitment and setting see Sterling et al [29].

Kaiser Permanente is a large, group-model, integrated health care system in Northern California, with approximately 3.1 million members. Eighty-eight percent of the membership is commercially insured, 10 percent is insured through Medicare and 2 percent through Medicaid. In general, the membership is working, middle-class, and well educated, with 78% having at least some college education [33].

The controls consisted of 2,082 matched controls who were also enrolled in the Kaiser Health Plan. They were matched according to age, gender and length of health plan enrollment. We selected a maximum of five controls for each CD patient [34] from the health plan membership database of those residing in the service area of the CDRP facility from which the case was recruited. The matched controls excluded those with a diagnosis of substance abuse or dependence or who had CD treatment in the health plan. They did not exclude those with only a Nicotine Dependence diagnosis because smoking cessation is not a focus of the treatment program. The controls were matched to their respective case on gender, beginning health plan membership date (within six months), end of health plan membership date (if ended), and age category (13-14, 15-16, 17-18). A small number of cases (n=7) had less than five controls because appropriate matches could not be found. Two cases had no matched controls, and were deleted from the analyses, leaving a total sample of 417 cases. The matched controls design enables a comparison of the diagnoses of a CD treatment sample to that of a general membership population that is demographically equivalent; reducing confounding due to age, gender, or length of enrollment differences.

A baseline questionnaire was completed by all cases during the study recruitment in the CD program. The questionnaire was largely a computerized self-report instrument (with a research assistant available to administer the questionnaire if needed), and was designed to obtain baseline (pre-treatment) measures of alcohol and drug problem use, dependence and abuse, as well as ethnicity, and other demographic characteristics. As part of the same study, one parent of each patient was interviewed, in order to obtain additional information about the child as well as the patient's family and household, such as household income.

Measures from health plan databases

We used the health plan's Outpatient Summary Clinical Record and admissions/discharges/transfers automated diagnostic databases [35] to identify patients diagnosed as having medical disorders in KP outpatient clinics or hospitals in the two years prior to and six months post intake date for the cases. (Physicians record a primary and multiple secondary diagnoses at each health plan visit and inpatient stay.) To identify sexually transmitted diseases, we also used the health plan's Laboratory Utilization Reporting System (LURS) database. The 30-month window for the matched controls began two years prior to the intake date of the matching case. Thus, for each case and their matched controls, we examined diagnoses in the same 30-month time period which was 2 years before through six months after the intake date for the case. We examined 20 medical conditions which may be associated with substance use, as guided by our research on adults [1] and further informed by the adolescent literature. (International Classification of Diseases, Ninth Revision codes available on request). These included acid-related peptic disorders, asthma, benign conditions of the uterus (including endometriosis, amenorrhea and dysmenorrhea), hypertension, pneumonia, injury and overdoses, sexually transmitted diseases (STDs) (including Chlamydia, Gonorrhea, syphilis, genital herpes, trichomoniasis, and Human papilloma virus), Hepatitis B and C, urinary tract infections (due to their association with sexual activity) (UTI), sleep disorders, acne, rhinitis, sinusitis, fibromyalgia, headaches, lower back pain, and abdominal pain, ventricular arrhythmias, and acute MI. We also examined seven other chronic conditions which have not been examined in the adolescent substance abuse literature, but have implications for usefulness to health services research and cost [36], including arthritis, diabetes, renal failure, congestive heart failure, ischemic heart disease, chronic obstructive pulmonary disorder, and benign prostatic hyperplasia. We then excluded those conditions with a prevalence of less than 0.5% in both cases and controls from further analyses. These were: arthritis, hypertension, renal failure, and congestive heart failure, fibromyalgia, ischemic heart disease, chronic obstructive pulmonary disorder, Hepatitis C or B, benign prostatic hyperplasia, cardiac arrhythmias, acute MI, stroke, and aspiration pneumonia; there were no cases or controls diagnosed with the latter ten conditions.

We did not include human immunodeficiency virus (HIV), because no individuals from our patient sample had this diagnosis and because of extraordinary health plan confidentiality of HIV data.

Gender, age, and length of health plan enrollment for the cases and matched controls were obtained from KP's automated membership databases.

Measures from the questionnaire

For the cases we also used measures from the study's baseline questionnaire that was administered at recruitment. Questions on drug and alcohol use were drawn from the Comprehensive Adolescent Severity Inventory (CASI), a semi-structured self-report questionnaire measuring adolescent health and functioning [37]. The baseline questionnaire also included questions on ethnicity and other demographic characteristics.

Analyses

We examined the prevalence of medical conditions for cases and controls. Because this was a matched controls design, we used conditional logistic regression to obtain odds ratios and 95% confidence intervals of the odds of each diagnoses among cases compared to their controls. For comparisons in which the prevalence was zero for either cases or controls, we used Fisher's Exact tests. No adjustments were made for multiple comparisons [38].

Although the primary purpose of this study is to provide a clinical description of medical risk among those in chemical dependency treatment populations, we also conducted post-hoc analyses to examine whether chemical dependency case status was independently related to the health risks examined controlling for psychiatric conditions. In these analyses, we controlled for Depression, Anxiety, ADHD, Conduct Disorders, Eating Disorders and other psychiatric conditions that differed between cases and controls (personality disorders, major psychoses, disorders due to brain damage).

We also examined subgroups of those cases who had used any substance at least 2-3 times per month in the six months prior to baseline interview, for those substances for which more than 80 subjects did so. These were: tobacco, marijuana, and alcohol. For each of these subgroups, we compared cases to their matched controls for those particular cases.

Health plan databases do not contain demographic information other than age and gender so we were unable to examine or control for variables such as ethnicity and income.

Results

Characteristics of cases

The sample of chemical dependency treatment cases consisted of 66% boys (N=275) and 34% girls (N=142) admitted to treatment. Forty-nine percent were white, 20% Latino/Hispanic, 16% African-American, 9% Native American and 6% Asian. The mean age of the patient sample was 16, with 12% aged 13-14, 46% aged 15-16, 29% aged 17, and 14% aged 18. Fourteen percent of the sample had annual household incomes of less than \$30,000, 26% had incomes between \$30,000 and \$49,000, and 61% had incomes of \$50,000 or more.

With regard to substance use and problems, 90% used alcohol in the six months prior to baseline, 84% used alcohol, 75% used tobacco, 25% used hallucinogens, 22% used stimulants such as methamphetamines, 22% used narcotic analgesics, 16% used cocaine, and 13% used inhalants. Ritalin/Dexedrine, barbiturates, tranquilizers, and heroin were each used by less than 10% of the cases. A total of 52% met criteria for substance dependence, 32% met criteria for substance abuse; the mean number of abuse/dependence symptoms was 5 (standard deviation=3.3).

Medical conditions

Table 1 presents 30-month period prevalence (and 95% confidence intervals) for the medical conditions examined, for the total sample of cases (N=417) and controls (N=2082), as well as odds ratios (and 95% confidence intervals) for the odds that cases were diagnosed, relative to controls. Almost half (49.6%) of the cases were diagnosed with injuries or overdoses compared to 36.4% of matched controls (O.R.=1.7; 95% CI 1.4-2.2). Sinusitis was diagnosed in 18% of cases and 11% of controls (OR=1.87; 95% CI 1.40-2.51). CD patients also had a significantly higher prevalence of asthma (15.6% vs. 12%; OR=1.37; 95% CI 1.01-1.84), abdominal pain (10.6% vs. 5.7%; OR=1.95; 95% CI 1.35-2.81), benign conditions of the uterus (7.7% vs 3.2% OR=2.80; 95% CI 1.75-4.47), STDs (4.8% vs. 1.5%; OR=3.67; 95% CI 2.0-6.75), and sleep

disorders (1.0% vs 0.1%; OR=6.67; 95% CIs 1.49-29.79). UTIs were of marginally higher prevalence in cases than controls ($p=0.074$).

Medical conditions that were not significantly different between cases and controls for the overall sample included acid-related disorders, headache, diabetes, lower back pain, pneumonia, acne, and rhinitis.

Comparison of prevalence of medical conditions for specific substance use subgroups

We also examined medical conditions of the cases who used a substance at least 2-3 times per month in the six months prior to baseline, limited to those substances for which at least 80 cases did so (alcohol, marijuana, and tobacco), and compared these cases to their controls (not shown).

Among those using alcohol at least 2 times per month in the six months prior to baseline ($N=201$) versus their controls ($N=1004$), results were similar to the full sample, however in this subgroup, the prevalence of headache was significantly higher in cases (9.5%) than controls (5.2%) (OR=2.02; 95% CIs 1.14-3.58) and UTIs were significantly higher in cases (5.5%) than controls (2.3%) (OR=2.69; 95% CIs 1.23-5.88). Asthma and sleep disorders were not of higher prevalence in these cases versus their controls.

Among those using marijuana at least twice a month in the six months prior to baseline ($N=323$) versus their controls ($N=1614$) results were similar to the full sample; however, cases were not at increased risk of UTIs. Results among those who used tobacco at least twice a month in the six months prior ($N=257$) versus their controls ($N=1284$) were similar to those in the full sample; however cases had a higher prevalence of headache (9.7%) than controls (5.0%) (OR=2.15; 95% CI 1.30-3.54) and the increased risk for UTIs was statistically significant (4.3% among cases versus 2.1% among controls (OR=2.30; 95% CI 1.05-4.76) Sleep disorders were not significantly higher in these cases than controls.

We next, as a post-hoc analyses, re-ran the full sample analyses controlling for psychiatric conditions that differed between cases and controls in the full sample. In the full sample after controlling for covariates, the increased risk for injury (OR=1.49; 95% CI 1.16-1.93), STDs (OR=3.06, 95% CI 1.43-6.57) and sinusitis (OR=1.55, 95% CI 1.07-2.24) remained, and differences for benign conditions of the uterus (OR=1.77, 95% CI 0.96-3.25), diabetes (decreased risk for cases) (OR=0.12, 95% CI 0.01-1.44), and abdominal pain (OR=1.51, 95% CI 0.95-2.39) approached significance (i.e., p -values<0.10, but $p>0.05$) after controlling for psychiatric conditions. Of those medical conditions that were significantly higher in cases in the analyses presented in Table 1, only asthma (OR=1.24, 95% CI 0.85-1.81) and sleep disorders (OR=0.42, 95% CI 0.04-4.31) were no longer associated with cases when controlling for psychiatric diagnoses.

To examine whether findings differed among services utilizing patients (i.e., those who had at least one outpatient visit or inpatient hospitalization during the study period) ($N=419$ cases; $N=1748$ controls), the analyses (including the overall sample as well as the substance type subgroups) were re-run on these patients. There was no difference in the pattern of results when examining the full sample of utilizing patients, with only one exception—asthma was no longer significantly higher in cases for the full sample or substance type subgroups. In the alcohol using subgroup ($N=201$ cases, $N=849$ controls), the p -values for headache ($p=.063$) and UTI ($p=.065$) rose slightly but still approached significance. In the marijuana-using subgroup ($N=323$ cases, $N=1344$ controls), the difference for headache and UTI which had approached significance in the full subgroup were no longer significant. In the tobacco-using subgroup

(N=257 cases, N=1063 controls), only UTI was no longer significant. So, the majority of results remained the same.

Discussion

The results of this study among an ethnically diverse sample of over 400 teen chemical dependency patients and 2082 matched controls broadens the findings of a higher prevalence for medical conditions among adolescents with heavy substance use to a large sample and from a prior focus on acute effects to include chronic medical problems, including asthma, benign conditions of the uterus (e.g., endometriosis), sleep disorders, and sinusitis.

We found higher prevalence in adolescent CD patients for more than one-fourth (seven) of the 26 medical conditions we initially examined. These included injury (which remained significant after controlling for psychiatric conditions and when examining only those who had health care utilization during the study period). Consistent with prior research [8,21] we found a higher prevalence for STDs, and sinusitis in cases and these remained after controlling for psychiatric conditions and when examining those with utilization.

Adolescents with alcohol and drug problems may have more medical problems because of their heavy use of alcohol and drugs. Alternatively, their medical problems may be at least partially caused by less healthy lifestyle behaviors. Although we do not have information about other health behaviors for the current study, a prior study found that those with alcohol use disorders were more likely to smoke, less likely to exercise, eat a balanced diet and take vitamins than a community sample without alcohol use disorders [39]. Psychiatric problems may also play a role in medical conditions. Some disorders we examined, such as sleep disorders and asthma were no longer significant when controlling for psychiatric disorders. This is consistent with prior research suggesting that negative emotionality may play a role in reporting of medical symptoms by adolescents with alcohol use disorders [7]. However, all other disorders for which we found significant differences remained so after controlling for psychiatric disorders.

It's unclear why case status was associated with lower prevalence of diabetes. Perhaps adolescents with diabetes are less likely to heavily use alcohol and other drugs because of pre-existing medical concerns. Or it may be that their behaviors and lifestyles are more carefully controlled by their parents or they may socialize with peers less often due to health concerns.

Consistent with findings among adults[1], pain disorders were more common in the chemical dependency population than controls. Abdominal pain was significantly higher for cases than controls in the full sample (and subgroups examined). Cases also had a higher prevalence of headache among alcohol and tobacco users. Abdominal pain may be due to many causes, but some prior research suggests that it is related to stressors and anxiety disorders[40], although we found that the relationship remained robust in the full sample even when controlling for psychiatric co-morbidities (including anxiety disorders) and when examining only those with health care utilization. More research is needed to examine whether stressors or some other factor is predicting both substance use and abdominal pain or whether substances are used to self-medicate abdominal pain in this population.

A limitation of this study is that we cannot determine causality. Future studies should examine these issues prospectively over the long-term. However, this study which suggests heightened prevalence of many medical issues among adolescent alcohol and drug populations has important strengths that are not found in prior literature. The study has a large sample and comparison group, a relatively long observation period, examines conditions other than acute events, and examines conditions diagnosed clinically, and examines an insured population. The study was also limited because we were unable to control for income and ethnicity as these

data are not available in the health plan databases (and thus were not available for the matched controls. However, the study sample controls for the important variable of access to health care as all subjects had health plan membership. A further limitation is that, due to the relatively small numbers of patients who frequently used less prevalent drugs, we could not examine how those drugs were related to increased risk of medical conditions. Future research should examine the relationship of use of specific substances with medical conditions, particularly in an insured population. Understanding why certain conditions are more prevalent in adolescent alcohol and drug patients could have important clinical implications and should be examined in future research.

This study has several important clinical implications. The findings argue for screening for alcohol and drug use in adolescents in the course of general health care in order to identify those with problems earlier, as there is a high likelihood of related medical problems that may worsen. In addition, adolescents in CD treatment should be assessed and treated for medical issues. These patients should also be followed over the long-term as they began heavy drinking and using drugs earlier than patients in adult CD samples from this health plan [29] and medical comorbidities are heightened in that population as well [1]. Thus, there may be ongoing medical issues in this population over the long-term, and particularly for those who continue to misuse alcohol and other substances. Optimal treatment of such disorders may require identification and treatment of a substance use problem.

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Prevalence and Conditional Logistic Regression Results for Each Medical Diagnosis in the 2 years prior and 6-months post-intake Full sample of cases (N=417) and Controls (N=2082)

Table 1

	Percentage Diagnosed (and 95% Confidence Intervals)		Odds Ratio	95% Confidence Intervals		p-value
	Cases	Controls		Lower	Upper	
Acid-related Disorders	1.7 (0.6,2.9)	1.6 (1.1, 2.2)	1.03	0.46	2.33	0.944
Asthma	15.6 (12.1,19.1)	12.0 (10.6,13.4)	1.37	1.01	1.84	0.042
Benign Conditions of the Uterus	7.7 (5.1,10.2)	3.2 (2.4,3.9)	2.80	1.75	4.47	<.0001
Diabetes	0.2 (0.0,0.7)	0.8 (0.4,1.2)	0.30	0.04	2.21	0.235
Headache	7.9 (5.3,10.5)	6.0 (5.0,7.0)	1.36	0.91	2.04	0.136
Lower Back Pain	2.6 (1.1,4.2)	1.7 (1.1,2.2)	1.57	0.80	3.09	0.191
Pneumonia	1.0 (0.0,1.9)	2.1 (1.5,2.7)	0.44	0.16	1.25	0.123
Injury & Poisoning	49.6 (44.8,54.4)	36.4 (34.3,38.4)	1.77	1.42	2.20	<.0001
STDs	4.8 (2.8,6.9)	1.5 (1.0,2.0)	3.67	2.00	6.75	<.0001
Urinary Tract Infection	3.4 (1.6,5.1)	2.0 (1.4,2.6)	1.79	0.95	3.39	0.074
Abdominal Pain	10.6 (7.6,13.5)	5.7 (4.7,6.7)	1.95	1.35	2.81	0.000
Sleep Disorder	1.0 (0.0,1.9)	0.1 (0.0,0.3)	6.65	1.49	29.72	0.013
Acne	17.0 (13.4,20.6)	15.2 (13.7,16.8)	1.14	0.86	1.52	0.369
Rhinitis	1.4 (0.3,2.6)	1.1 (0.6,1.5)	1.36	0.55	3.36	0.500
Sinusitis	18.0 (14.3,21.7)	10.7 (9.3, 12.0)	1.87	1.40	2.51	<.0001