

Self-reported and Documented Substance Use Among Adolescents in the Pediatric Hospital

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abstract

BACKGROUND AND OBJECTIVES: Adolescent substance use is associated with numerous adverse health outcomes. A hospitalization represents an opportunity to identify and address substance use. We sought to describe self-reported and documented substance use among hospitalized adolescents.

METHODS: We conducted a cross-sectional survey of adolescents aged 14 to 18 years old admitted to two pediatric hospitals between August 2019 and March 2020. Using previously validated questions, we assessed the proportion of adolescents reporting ever, monthly, and weekly use of alcohol, marijuana, tobacco, electronic cigarettes, and other illicit drugs and nonmedical use of prescription medications. We reviewed medical records for substance use documentation.

RESULTS: Among 306 respondents, 57% were older (16–18 years old), 53% were female, and 55% were of non-Hispanic white race and ethnicity. The most frequently reported substances ever used were alcohol (39%), marijuana (33%), and electronic cigarettes (31%); 104 (34%) respondents reported ever use of >1 substance. Compared with younger adolescents, those aged 16 to 18 years were more likely to report ever use of alcohol (29% vs 46%; $P = .002$), marijuana (22% vs 41%; $P < .001$), and ≥ 2 drugs (26% vs 40%; $P = .009$). A positive substance use history was rarely documented (11% of records reviewed), and concordance between documented and self-reported substance use was also rare.

CONCLUSIONS: In this study of hospitalized adolescents, the most commonly reported substances used were alcohol, marijuana, and electronic cigarettes. Positive substance use documentation was rare and often discordant with self-reported substance use. Efforts to improve systematic screening for substance use and interventions for prevention and cessation in hospitalized adolescents are critically needed.



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Dr Masonbrink conceptualized and designed the study, participated in data collection, critically reviewed the study data and conducted data analyses, and drafted the initial manuscript; Drs Hunt, Randell, Mermelstein, and Miller participated in study design and critically reviewed the study data; Ms Bhandal and Ms Wells participated in study design and data collection and critically reviewed the study data; and all authors reviewed and revised the manuscript, approved the final manuscript as submitted, and agree to be accountable for all aspects of the work.

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WHAT'S KNOWN ON THIS SUBJECT: Adolescent substance use is associated with numerous adverse health outcomes; however, clinicians frequently miss opportunities for routine substance use screening. Adolescent hospitalizations represent prime opportunities to systematically screen for health risk behaviors, including substance use, and offer intervention.

WHAT THIS STUDY ADDS: Nearly 40% of hospitalized adolescents report alcohol ever use; approximately one-third report ever use of marijuana, electronic cigarettes, or ≥ 2 substances. Positive substance use documentation is rare and often discordant with self-report, indicating missed opportunities for systematic screening in the hospital.

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Early initiation of substance use among adolescents is associated with numerous adverse health effects and increased risk for future substance use disorders and addiction.¹⁻⁴ Exposure to drugs during adolescence can worsen anxiety and mood disorders as well as affect key areas of the developing brain, impacting attention, learning, and memory.^{2,4,5} In 2019, 59% of 12th-grade students reported ever use of alcohol and 29% reported current (past 30-day) use, 36% reported ever use of marijuana, and 22% reported current use, and 14% reported currently vaping marijuana.⁶ In addition, adolescent electronic cigarette use has risen dramatically; electronic cigarettes are now the most common nicotine product used by adolescents and young adults. From 2011 to 2019, current electronic cigarette use increased from 1.5% to 28% among high school students and from 0.6% to 11% among middle school students.^{7,8}

The American Academy of Pediatrics recommends the use of screening, brief intervention, and referral to treatment (SBIRT), an evidence-based framework to identify at-risk youth and prevent or reduce substance use among adolescents during all clinical encounters.^{9,10} However, many adolescents do not receive this critical intervention.¹¹⁻¹³ Many youth at risk for substance use may not attend routine primary care visits and thus may rely on the hospital-based setting to meet their health care needs.^{14,15} In addition, primary care providers may have inadequate time, knowledge, or training to implement the SBIRT framework during preventive care visits.^{11,16} Although efforts to expand use of the SBIRT framework to target alcohol and marijuana use among adolescents and young adults in the emergency department have revealed success, expansion of these services to adolescents in the inpatient setting remains limited.¹⁷⁻²⁰ One single-site

retrospective review investigated substance use screening among hospitalized adolescents and found that documentation of screening was rare. Clinicians documented screening for alcohol use in 16% of records, for tobacco use in 11%, illicit drug (eg, cocaine) use in 29%, and for one or two substances (eg, alcohol, marijuana, tobacco) in less than one-half of the records.²¹

Because mental health and substance use disorders are among the most common reasons for hospitalizations among adolescents, this setting offers unique opportunities to identify and provide substance use treatment of high-risk youth.^{22,23} However, to date, the inpatient setting remains underused to provide this evidence-based care. Additionally, prevalence of substance use among hospitalized adolescents remains poorly described. Our study objectives were to do the following: (1) describe the prevalence of substance use and (2) assess substance use history documentation and concordance with self-reported use among hospitalized adolescents.

METHODS

Study Design

We performed a cross-sectional survey of adolescents aged 14 to 18 years old who were hospitalized at 2 Midwestern tertiary care children's hospitals from August 2019 to March 2020. Inclusion criteria were admission to the general medical or surgical units, English fluency, and no severe illness, developmental delay, or current cancer diagnosis as determined by electronic health record (EHR) review or discussion with the medical or surgical team. The study was approved by the institutional review board at each institution.

Data Collection

The research team reviewed the EHR to identify eligible adolescents,

notified (ie, via pager, phone, or in person) the adolescent's medical or surgical team (ie, nurses and physicians), and then approached the adolescent for study enrollment. Eligible adolescents provided verbal consent or assent. Parental consent for minors was waived. If a parent or guardian was present at enrollment, they were given brief information about the study and asked to leave the room for consent or assent and study procedures. Study data were collected and managed by using Research Electronic Data Capture.²⁴ The research team extracted data from the EHR, including age, insurance type, and underlying medical conditions. We assessed for underlying mental health diagnoses by either self-reported (ie, "Has a medical provider ever told you that you have any of following conditions") or EHR documentation of depression, anxiety, or posttraumatic stress disorder (PTSD); bipolar disorder or schizophrenia; and eating disorder. The research team also reviewed the EHR, including the admission history and physical and progress notes, to collect documentation of a substance use history among a subset of participants (ie, those enrolled from September 2019 to March 2020). Because there are known differences in substance use patterns among racial and ethnic groups that may inform future development of tailored interventions, we collected self-reported race and ethnicity by asking, "What is your race?" and "What is your ethnicity?"²⁵⁻²⁷ Responses were categorized as non-Hispanic white, non-Hispanic Black, Hispanic, or other (native Hawaiian or Pacific Islander, Asian, or multiracial). For those who declined to participate, we collected age, sex, race and ethnicity, and insurance type from the EHR, although, because of a procedural error, this was fully completed at site 1 and partially completed at site 2. After survey completion, participants were given printed community health

resources (eg, reproductive and sexual health clinics and substance use treatment clinics) and a \$10 gift card.

Survey Instrument

Our multidisciplinary team of pediatric hospitalist, adolescent medicine, and emergency medicine physicians adapted previously validated survey instruments to create a 92-item instrument to assess substance use (using questions from the Youth Risk Behavior Surveillance Survey [YRBSS]), health care use, and demographics.^{6,28,29} Because of increasing trends in electronic cigarette use among adolescents, we added items from the National Youth Tobacco Survey to assess electronic cigarette use and vaping in November 2019 after initial data collection had begun. The survey was pretested for readability, clarity, and length with 5 adolescents representative of the sample and revised on the basis of feedback.

Outcome Measures

Our outcome measures were the proportion of enrolled adolescents reporting use of alcohol, marijuana, tobacco, electronic cigarettes, other illicit drugs (defined as cocaine or ecstasy by the YRBSS), nonmedical use of prescription medications, and ≥ 2 substances. We used validated questions from the YRBSS and the National Youth Tobacco Survey to assess and categorize use of each substance as ever, monthly, or weekly use on the basis of responses to dichotomous (“yes” or “no”) and Likert scale items (“never,” “once or twice,” “monthly,” “weekly,” “almost daily,” or “daily”). Because of variability in the most commonly used validated questions, we combined questions asking about monthly substance use in the past 12 months and past 30-day use into one outcome measure (ie, monthly use). See Supplemental Table 5 for details on substance use survey items.

Statistical Analysis

We used descriptive statistics to report means and standard deviations for normally distributed continuous data. Categorical data were presented as proportions. Participants with missing data were included in frequency calculations. Because our data were normally distributed, χ^2 and Fisher’s exact tests were used to compare between categorical variables. All statistical tests were conducted by using IBM SPSS Statistics Version 24 for Windows (IBM SPSS Statistics, IBM Corporation, Armonk, NY).

RESULTS

Among 306 respondents across the two study sites, a majority were older (57%: 16–18 years old), female (53%), and non-Hispanic white race and ethnicity (55%) (Table 1). Seventy-three (24%) respondents had a mental health diagnosis; of these, 65 (89%) had depression, anxiety, and/or PTSD (collected as a combined category), 21 had bipolar disorder or schizophrenia (13 of those also had depression, anxiety,

and/or PTSD), and three had an eating disorder. The most frequent underlying medical diagnoses were diabetes (7%), inflammatory bowel disease (7%), sickle cell anemia (5%), seizures or epilepsy (4%), and cystic fibrosis (3%). We collected participation rates for a majority of the study; Of 298 respondents approached, 254 (77%) agreed to participate. There were no differences between those who participated and those who declined in age group, sex, and race and ethnicity, although a higher proportion of those who declined had public insurance (61% vs 40%; $P = .006$). We did not collect these data for a small subset of participants ($n = 52$).

Overall Substance Use Patterns

Among all respondents, alcohol (39%) was the most frequently reported substance ever used, followed by marijuana (33%), and electronic cigarettes (31%) (Table 2). Additionally, more than one-third reported ever use of ≥ 2 substances. Compared with younger adolescents, older adolescents were more likely to report ever use of ≥ 2 substances (26% vs 40%; $P = .009$). Among those

TABLE 1 Characteristics Among Hospitalized Adolescents

Characteristic	Overall, $N = 306^a$
Mean age, y (SD)	15.8 (1.2)
Age category, y, n (%)	
14–15	133 (43.5)
16–18	173 (56.5)
Sex, n (%) ^b	
Female	162 (53)
Male	138 (45)
Nonbinary or third gender	5 (2)
Race, n (%)	
Non-Hispanic Black	69 (23)
Non-Hispanic white	169 (55)
Hispanic	37 (12)
Other (native Hawaiian or Pacific Islander, Asian, multiracial)	31 (10)
Insurance type, n (%)	
Public	121 (39.5)
Private	141 (46)
Self-pay	34 (11)
Other (eg, military)	10 (3)
Underlying mental health diagnosis, n (%)	73 (24)

^a Indicates total No. respondents enrolled across both study sites.

^b Missing, $n = 1$.

TABLE 2 Substance Use Patterns Among Hospitalized Adolescents

	Overall, n (%)	Aged 14–15 y, n (%)	Aged 16–18 y, n (%)	P
Total No. adolescents	306	133	173	—
Alcohol				
Ever use	118 (39)	38 (29)	80 (46)	.002*
Monthly or past 30-d use	21 (7)	11 (8)	10 (6)	.393
Weekly use	7 (2)	3 (2)	4 (2)	.974
Marijuana				
Ever use	100 (33)	29 (22)	71 (41)	<.001*
Monthly or past 30-d use	33 (11)	12 (9)	21 (12)	.384
Weekly	37 (12)	11 (8)	26 (15)	.072
Electronic cigarette ^a				
Ever use	40 (31)	17 (26)	23 (36)	.23
Monthly or past 30-d use	17 (13)	7 (11)	10 (16)	.415
Electronic cigarette or vaping with tetrahydrocannabinol ^a				
Ever use	30 (23)	13 (20)	17 (27)	.378
Monthly or past 30-d use	15 (12)	7 (11)	8 (13)	.759
Prescription pain medication (eg, opioids)				
Ever use	26 (8)	12 (9)	14 (8)	.772
Monthly or past 30-d use	6 (2)	2 (2)	4 (2)	.613
Weekly use	8 (3)	3 (2)	5 (3)	.730
Other prescription medication (eg, Ritalin)				
Ever use	25 (8)	10 (8)	15 (9)	.715
Monthly or past 30-d use	7 (2)	5 (4)	2 (1)	.131
Weekly use	5 (2)	2 (2)	3 (2)	.875
Tobacco cigarettes				
Ever use	22 (7)	12 (9)	20 (12)	.472
Monthly or past 30-d use	9 (3)	3 (2)	6 (4)	.534
Weekly use	6 (2)	2 (2)	4 (2)	.613
Other illicit drugs				
Ever use	14 (5)	8 (6)	6 (4)	.291
Monthly or past 30-d use	1 (0)	1 (1)	0 (0)	.253
Weekly use	4 (1)	2 (2)	2 (1)	.791
≥2 substances				
Ever use	103 (34)	34 (26)	69 (40)	.009*
Monthly or past 30-d use	17 (6)	9 (7)	8 (5)	.417
Tobacco craving ^a	12 (9)	7 (11)	5 (8)	.563
Positive substance use history documented ^b	19 (11)	8 (10)	11 (12)	.658

—, not applicable.

^a Of *n* = 129.^b Of *n* = 1177.* *P* < .05.

reporting ever use of ≥2 substances, the most frequent substance combinations were marijuana and alcohol (69%), marijuana and electronic cigarettes (26%), and alcohol and electronic cigarettes (26%).

Alcohol and Marijuana

Compared with younger adolescents, older adolescents were more likely to report ever use of alcohol (29% vs 46%; *P* = .002) and marijuana (22% vs 41%; *P* < .001). Twenty-one (7%) respondents reported monthly use of alcohol, with no difference seen

between age, sex, and race and ethnicity categories. Thirty-three (11%) reported monthly marijuana use, and 37 (12%) reported weekly marijuana use. Of the respondents to the vaping questions, 30 (23%) reported ever vaping tetrahydrocannabinol (THC) and 15 (12%) reported monthly vaping THC.

Tobacco and Electronic Cigarettes

Twenty-two participants (7%) reported ever use of conventional cigarettes. Seventeen (13%) reported monthly use of electronic cigarettes, and 12 (9%) reported symptoms of

tobacco craving. There were no differences in tobacco or electronic cigarette use between age, sex, and race and ethnicity categories.

Prescription Medications and Other Illicit Drugs

Twenty-six (8%) of respondents reported ever use of nonmedical prescription pain medications (eg, opioids) and 8 (3%) reported weekly use. Twenty-five (8%) reported ever use of other prescription medications (eg, stimulants). Other illicit drugs (eg, cocaine) were the least frequently reported substances used, with 14 (5%) respondents reporting ever use and no differences seen between age, sex, and race and ethnicity categories.

Substance Use Documentation

Of 177 records reviewed, 114 (64%) had any substance use history documented; 19 (11%) records were positive and 95 (54%) were negative for substance use. The most frequently documented substances in the EHR were marijuana (10 participants), alcohol (8), tobacco (7), 2 or more drugs (9), and other illicit drugs (1). Of 162 adolescents reporting ever substance use and whose EHR was reviewed, concordance between EHR documentation and self-reported substance use was rare, with 8 (15%) records concordant for tobacco or electronic cigarette use, 10 (18%) concordant for marijuana use, 6 of 68 (9%) concordant for alcohol use, and 1 of 11 (9%) concordant for illicit drug use (Table 3). None of the adolescents with nonmedical prescription pain medication ever use (*n* = 12) or other prescription medication ever use (*n* = 19) had concordant histories documented. Of the participants with EHR review, the most common diagnoses in participants with a documented positive substance use history were bipolar or schizophrenia (60% of those within the diagnosis category), seizures or epilepsy (25%), and

TABLE 3 Self-reported and Documented Substance Use in Hospitalized Adolescents

Self-reported Substance Use ^a (n = 162)	EHR Documentation		
	Any ^b	Concordant ^c	Negative Substance Use History ^d
Alcohol ever use (n = 68), n (%) ^e	16 (24)	6 (9)	33 (49)
Marijuana ever use (n = 55), n (%)	16 (29)	10 (18)	23 (42)
Tobacco or electronic cigarettes (n = 52), n (%)	13 (25)	8 (15)	16 (31)
Other illicit drugs (n = 11), n (%)	8 (73)	1 (9)	3 (27)
Prescription pain medications (n = 12), n (%)	4 (33)	0	8 (67)
Other prescription medications (n = 19), n (%)	8 (42)	0	10 (53)

^a There were 162 adolescents with self-reported ever use of any substance who also had their EHR reviewed.

^b The EHR documented previous use of any substance.

^c The EHR documented substance use history was concordant with self-reported substance use.

^d The EHR documented no substance use.

^e Row percentages are calculated on the basis of the No. participants with EHR documentation of substance use by their self-reported ever use of each substance.

depression, anxiety and/or PTSD (20%; Table 4).

DISCUSSION

This is among the first multisite studies to describe substance use prevalence among hospitalized adolescents. Nearly 40% of hospitalized adolescents in our study reported alcohol ever use and ~1 in 3 reported ever use of marijuana, electronic cigarettes, or ≥2 drugs. Although alcohol use was most frequently reported, the reported rates of alcohol ever use among hospitalized adolescents in our study are lower than rates of alcohol ever use among youth nationally.³⁰ The rates of marijuana and electronic cigarette ever use among hospitalized

adolescents in our study are similar to national rates among high school students, which have been recently increasing.^{6–8} Nearly 1 in 4 hospitalized adolescents had an underlying mental health disorder, and, although these participants more frequently had a positive substance use history documented compared with those with other diagnoses, 39% had no substance use history documented. Because mental health and substance use disorders commonly co-occur and hospitalized adolescents represent an at-risk population for substance use disorders, universal substance use screening is especially important in this population.^{4,30} Our findings reveal important opportunities to improve identification of substance

use and offer evidence-based interventions among hospitalized adolescents.

Whereas a majority (64%) of the reviewed participant EHRs had any (positive or negative) substance use history documented, this finding was lower than a previous chart review, in which any substance use documentation was found in 80% of charts.²¹ The prevalence of any positive substance use documentation (11%) was much lower than the participant-reported substance, particularly for certain substance types (eg, prescription medications), which also differed compared with a previous study of hospitalized adolescents, in which 29% of records documented drug use, 16% documented alcohol use, and 11% documented tobacco use.²¹ Potential underlying reasons reflect patient-, provider-, and system-level barriers. Adolescents are most likely to honestly disclose health risk behaviors when assured of confidentiality (as allowed) and asked in a nonjudgmental manner. Many prefer paper or electronic screening over verbal screening by a nurse or doctor.^{31,32} Pediatricians rarely use validated substance use screening tools and frequently rely on clinical impressions to identify substance use problems in their adolescent patients.^{32,33} Pediatricians also cite a number of barriers to identifying and intervening for health risk behaviors, including substance use, such as time constraints, lack of knowledge and comfort, and unfamiliarity with standardized tools.^{16,32–37} Additionally, system-level barriers may not enable adolescent-friendly care provision, such as limited space for a confidential conversation and lack of systematic electronic screening for adolescent health behaviors. Protection of confidentiality for adolescents is even further complicated by the recent implementation of the 21st Century

TABLE 4 Most Frequent Diagnoses and Documented Substance Use in Hospitalized Adolescents

Participants With EHR Reviewed (n = 177)	EHR Documentation		
	No Substance Use History Documented ^a	Positive Substance Use History ^b	Negative Substance Use History ^c
Depression, anxiety, or PTSD (n = 46), n (%) ^d	18 (39)	9 (20)	19 (41)
Diabetes (n = 16), n (%)	8 (50)	0	8 (50)
Inflammatory bowel disease (n = 12), n (%)	5 (42)	0	7 (58)
Sickle cell anemia (n = 11), n (%)	4 (36)	0	7 (64)
Bipolar or schizophrenia (n = 10), n (%)	2 (20)	6 (60)	2 (20)
Seizures or epilepsy (n = 8), n (%)	1 (12.5)	2 (25)	5 (62.5)

^a No substance use history was documented in the EHR.

^b The EHR documented positive substance use.

^c The EHR documented no substance use.

^d Row percentages are calculated on the basis of the No. participants with EHR documentation of substance use by diagnosis category.

Cures Act. Although this policy is intended to benefit patients by increasing access to EHR information, the Act may allow parents or guardians to access private health information without permission from the adolescent.³⁸

Nearly 1 in 8 adolescents reported monthly or past 30-day use of electronic cigarettes or vaping tetrahydrocannabinol. Because electronic cigarette use is strongly linked with nicotine dependence, this prevalence signals a high potential for unrecognized and untreated nicotine withdrawal among hospitalized adolescents.³⁹⁻⁴⁴ Thus, screening for symptoms of dependence among hospitalized adolescents is critical to identify those who warrant further intervention, including treatment of those at risk for withdrawal. Additionally, adolescents with underlying asthma would specifically benefit from tobacco screening (ie, electronic cigarettes and conventional cigarettes) because they are at increased risk for asthma exacerbation and related hospitalizations. Also, there has been a recent increase in hospitalizations for electronic cigarette and vaping-associated lung injury, with many of these cases (16%) occurring among children and adolescents (≤ 18 years). The majority of cases of electronic cigarette and vaping-associated lung injury have been linked to tetrahydrocannabinol-containing electronic cigarette products, highlighting the need for targeted screening that includes specifically the type of substance used as well as the modality of consumption.

Efforts are needed to improve systematic substance use screening for hospitalized adolescents.

Incorporation of substance use screening prompts into the EHR and use of self-reported electronic screening based on validated measures could facilitate accurate identification of substance use among hospitalized adolescents.⁴⁵

Educational interventions for hospital providers are needed to improve comfort and knowledge with validated substance use screening and intervention. Development of hospital-system processes are vital to promote adolescent privacy protections and improve screening for and identification of adolescent health needs, such as substance use. These include development of a clinical workflow process for all hospital staff as well as educational materials for hospitalized adolescents and their families to standardize confidential care provision, use of confidential notes, and creation of a separate adolescent health information portal. These efforts have the potential to increase systematic confidential screening and intervention for hospitalized adolescents and thus positively impact their related health outcomes.^{34,35}

Our findings should be viewed with recognition of limitations. Because we enrolled a convenience sample, our findings are subject to sampling bias. Because of a procedural error, we were only able to report partial data on participation rates. Although we enrolled at 2 tertiary care children's hospitals, both were located in the Midwest; our findings may not be generalizable to other settings or regions. Because of collection of sensitive information, our data are subject to reporting bias, however every attempt was made to ensure confidentiality, including use of

electronic data collection completed in a private setting and with a waiver of parental consent.

CONCLUSIONS

Hospitalized adolescents frequently report substance use, including alcohol, marijuana, electronic cigarettes, and use of ≥ 2 substances. Future work is warranted to improve systematic, confidential substance use screening among hospitalized adolescents and to develop interventions for prevention, risk reduction, and cessation strategies with a focus on the most commonly used substances, including alcohol, marijuana, and electronic cigarettes.

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ABBREVIATIONS

EHR: electronic health record
PTSD: posttraumatic stress disorder
SBIRT: screening, brief intervention, and referral to treatment
YRBSS: Youth Risk Behavior Surveillance Survey

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