Substance Use in Adolescents Presenting to the Emergency Department

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Abstract: Background: Adolescent substance use is a dynamic public health problem. Adolescence is a unique developmental period involving overlapping biological, psychological, and social factors which increase the rates of initiation of substance use. The developing adolescent brain is particularly susceptible to the effects of substances and most adults with substance use disorders began to have symptoms and problems in their adolescent years. Yet, for various reasons, most adolescents who use, misuse, abuse, or are addicted to substances do not perceive the need for treatment.

Objective: Drug and alcohol use among adolescents is a common presentation in hospital Emergency Departments (EDs) and presents in different forms including in association with intoxication, withdrawal states, or trauma associated with drug-related events. For many adolescents with substance use, the Emergency Department (ED) is the first point of contact with medical personnel and thus also serves as a potential entry point into treatment.

Methods: This article reviews the common ways drug and alcohol problems present in the ED, clinical assessment of the patient and family, screening, laboratory testing, brief interventions in the ED, and referral to treatment beyond the ED.

Conclusion: Guidelines on how to manage the shifting terrain of adolescent substance use presenting in EDs across the nation continue to evolve. We highlight that considerable further research is needed to inform effective ED protocols to address this important individual and public health safety concern. Systems of care models which include collaborative teams of diverse stakeholders are needed to effectively manage adolescents with substance use disorders.

Keywords: Adolescent, alcohol, drug, substance use, emergency department, screening.

1. INTRODUCTION

Adolescent substance use is a pressing public health problem. Twenty-one percent of 12th graders have used an illicit drug other than marijuana at least once, and about 36 percent reported using marijuana in the last year (Johnston, Miech, O’Malley, Bachman, Schulenberg, & Patrick, 2018). Misuse of prescription drugs is a concern with 5.5 percent of high school seniors reporting nonmedical use of the prescription stimulant Adderall® in the past year (Johnston et al., 2018). Additionally, opioids are the leading cause of death from unintentional drug overdose in adolescents aged 15 to 19 (Curtin, Tejada-Vera, & Warner, 2017). The age-adjusted rate of drug overdose deaths involving synthetic opioids other than methadone (drugs such as fentanyl, fentanyl analogs, and tramadol) doubled between 2015 and
When encountering adolescents in emergency settings with a concern for substance abuse, physicians sometimes tailor the history and physical examination to discover clinical findings that may describe specific toxidromes e.g. pinpoint pupils in opioid intoxication, intractable nausea and vomiting in cannabis use, etc. However, the manifestations of substance use extend beyond specific toxidromes. Drug testing is also utilized to determine the cause of the patient’s symptoms. Notably, some of these newer substances in use are not detectable in routinely used drug screens, creating more obstacles to determining what substance(s) the patient has ingested.

2. CLINICAL PRESENTATION

Compared to adults, adolescents generally present with shorter substance use histories, have limited insight to the dangers of substance use and often experience acute symptoms precipitating emergency care visits. Although their presentation is sometimes dramatic, their behaviors are typically less ingrained, making them more amenable to brief interventions. This makes the emergency room a prime point of contact for initiating early intervention in adolescents with substance use.

3. SUBSTANCE USE AND CO-OCCURRING MENTAL HEALTH CONDITIONS

Several studies show as high as 61 to 88% of co-occurring mental disorders in adolescents with substance use disorders (Couwenbergh et al., 2002). Among adults presenting for substance use treatment, those with onset substance use prior to age 11 reported the highest proportion of co-occurring mental health disorders suggesting that early initiation of substance use may be an early indicator of mental health disorders (Substance Abuse and Mental Health Services Administration, 2014). Mental health disorders in adolescents often predate substance use. Unaddressed psychiatric symptoms may make it difficult for teens to stop using. Once substance use develops, the underlying psychiatric disorder is often worsened. This results in a bidirectional relationship between the substance use and co-occurring psychiatric conditions in youth. Conditions associated with substance use in adolescents include ADHD, Conduct Disorder (Bukstein & Horner, 2010; Wilens et al., 2011), major depressive disorder (Pang, Farrahi, Glazier, Sussman & Leventhal, 2014) and exposure to interpersonal violence (Funk, McDermeit, Godley & Adams, 2003; Giaconia et al., 2000). Among adolescents with PTSD, up to 59% subsequently develop substance abuse problems (Giaconia et al., 2000; Funk et al., 2003). Identifying co-occurring mental health conditions in adolescents who present to the ED for substance use conditions may decrease repeated use of prehospital resources.

In the ED, substance use and co-occurring mental disorders are common among adolescent and are strongly associated with increased use of prehospital resources. Data from the National Hospital Ambulatory Medical Care Survey (1997-2010) showed substance use and mental health conditions accounted for 2.1% and 4.3% of all adolescent ED visits with 20.9% of substance abuse visits complicated by mental health (Fahimi, Aurrecochea, Anderson, Herring, and Alter, 2015). Co-occurring mental health conditions increased length of stay from 71.33 mins for substance abuse, 89.77 minutes for mental health, to 139.99 minutes for dual diagnoses visits. Both mental health and substance use were associated with higher admission or transfer rates. Factors significantly associated with substance use included ambulance arrival, night and weekend shift, anxiety disorders, mood disorders, and psychotic disorders.

4. SUBSTANCE USE AND SUICIDAL BEHAVIORS

Substance use can increase the risk for suicidal behavior due to the decrease in judgment and increased impulsivity which correlates in some cases with the attraction for illicit drug use. Suicide is an important factor that can either lead to substance use within the actual act of attempting or committing suicide. It is not uncommon in teens presenting to the ED due to suicide attempts made within the context of an overdose involving prescription drugs and street drugs. Youth with substance use are more likely to be depressed and are at increased risk of attempting suicide (Abraham & Sher, 2017; Substance Abuse and Mental Health Services Administration, 2016). In some adolescent studies, being female and using alcohol and cannabis have been found to be positively associated with suicidal ideation, while tobacco was
positively associated with suicide attempts (Sampasa-Kanyinga, Dupuis, & Ray, 2017).

Cannabis and cocaine use have been found to be a significant risk factor for the history of suicide attempts while polysubstance use was associated with both non-suicidal self-injury and history of suicide attempts (Guvendeger Doksat et al., 2017). Prescription opioid misuse was found to be significantly associated with various suicide-related outcomes including suicidal ideation, suicide planning, and suicide attempts (Ashrafioun, Bishop, Conner & Pigeon, 2017). Furthermore, in adjusted models, the frequency of prescription opioid misuse was significantly associated with suicidal ideation for each category. Notably, adolescents reporting weekly or more use on average, opioid prescription misuse was associated with suicide planning and attempts (Ashrafioun et al., 2017). In adolescents, suicidal behavior is associated with substance use which is, in turn, also mediated by mental health (Janssen, Spilka & Beck, 2017).

5. SUBSTANCE USE AND HIGH-RISK BEHAVIOR

Substance abuse in adolescents leads to risky decision-making, especially when using drugs to the point of losing awareness of their surroundings and control of their actions. This results in the adolescent being unable to protect themselves in the face of pressure from peers or in the face of danger often resulting in additional sequelae. Drug use causes poor judgment and adolescents will get behind the wheel or commit acts that they may not necessarily do under normal circumstances. Adolescents are more likely to participate in risky behavior such as engaging in sexual activities or driving while under the influence of substances. In youth, a history of multiple head injuries has been associated with increased odds of binge-drinking, marijuana, and prescription drug use (Kort-Butler, 2017) with the suggestion that multiple head injuries may be a marker of a constellation of risk-taking behaviors that contributes to substance use.

6. COMMONLY ABUSED SUBSTANCES

6.1. Cannabinoids

Adolescent ED visit numbers and rates for both cannabis-only and cannabis-polydrug use have ris-

ing sharply in the past few decades (Zhu & Wu, 2016), making cannabis the second leading cause of the need for treatment in adolescents. Cannabis-related visits increase the odds of hospitalization compared to ED only visits and this has been shown to increase with age (Zhu & Wu, 2016). Cannabis use in adolescents is associated with decreased neural connectivity and reduced IQ (Volkow, Baler, Compton & Weiss, 2014). Population studies reveal that about 1 in every 11 marijuana users aged 15 or older becomes dependent on marijuana, with consequently increased ED visits. An increasingly common finding in EDs recently is the problem associated with marijuana withdrawal. Patients may present with intractable nausea, vomiting and abdominal pain and after obtaining an extensive history, the clinician is able to add cannabinoid hyperemesis syndrome to their differential based on their social history of their daily habits of smoking marijuana up to three to five times per day. Cannabinoid hyperemesis syndrome is described as chronic cannabinoid use, cyclic episodes of nausea and vomiting and relief with hot baths, not to be mistaken for cyclical vomiting syndrome or gastroparesis. (Desjardins & Stheuneur, 2016; Galli, Sawaya, & Friedenberg, 2011; Pelissier, Claudet, Gandia-Mailly, Benvymina & Franchitto, 2016; Wilson, Lutton & Doherty, 2015). Some major differences between cannabinoid hyperemesis syndrome and cyclical vomiting syndrome (CVS) are that CVS is associated with depression, anxiety, migraine headaches and is characterized by an accelerate gastric emptying rate. Acute symptomatic management is supportive. However, this condition responds less effectively to conventional pharmacologic antiemetics. In adults, benzodiazepines (Richards, Gordon, Danielson & Moulin, 2017; Richards, 2018), the antipsychotic haloperidol, (Hickey, Witsil & Mycyk, 2013; Inayat, Virk, Ullah & Hussain, 2017; Witsil & Mycyk, 2017) have been shown to be effective in treating this condition. In adolescents, as in adults, topical capsaicin has been shown to successfully reduce symptoms (Dezieck et al., 2017; Graham, Barberio & Wang, 2017; Moon, Buckley & Mark, 2018) while the long-term treatment of this condition remains abstinence.

Synthetic cannabinoids, including “Spice,” “K2,” “Nice Guy,” “NBT,” “Black Mamba,” and “Crazy Monkey,” all imitate the psychotropic element of cannabinoids but sometimes go unde-
tected by routine drug tests, making it harder to diagnose in the ED without the proper history. Relative to delta-9 tetrahydrocannabinol (delta-9-THC) agonism of cannabinoid receptor type 1 (CB1), the synthetic compounds are more potent and efficacious agonists (Pertwee, 2008) which present to the ED with symptoms of tachycardia, hypertension, nausea, vomiting, somnolence, xerostomia, and injected conjunctivae. Psychiatric symptoms include anxiety, agitation, paranoia, hallucinations, and other psychotic states (Rowley et al., 2017; Tournebize, Gibaja & Kahn, 2017). Atypical and serious medical outcomes including myocardial infarction (Mehta, Mahendran, Bajaj & Doshi, 2017), acute poisoning, renal injuries, cerebral ischemia, myocardial infarction have also been observed with significant medical sequelae (Palamar et al., 2017; Tournebize et al., 2017).

6.2. MDMA (Ecstasy)

MDMA (3,4-methylenedioxymethamphetamine) is a synthetic compound that was developed in 1914 as an appetite suppressant with structural and pharmacologic similarities to both amphetamines and mescaline. In more recent years, ecstasy was a party drug that was commonly used at dance clubs and music festivals, giving its users feelings of euphoria, wakefulness, intimacy, sexual arousal and disinhibition (Arria, Yacoubian, Fost & Wish, 2002). In the ED, clinical manifestations include CNS agitation, hypertension, tachycardia, and hypothermia (Mas et al., 1999). As a serotonergic amphetamine, MDMA intoxication can cause serotonin syndrome, severe hyponatremia, seizures, and obtundation. Although ecstasy use is decreasing overall, it is still used by adolescents due to the myth that ecstasy provides a “safe” high. 5.7% of 12th-grade students reported using MDMA and 4.4% of 12th-grade students report its use. (Palamar et al., 2014). An additional reason ecstasy is particularly dangerous is because it is often adulterated with other substances including new psychoactive substances (Palamar, Salomone, Vincenti, & Cleland, 2016; Salomone, Palamar, Gerace, Di Corcia & Vincenti, 2017). Studies have recently shown that ecstasy users are often exposed to MDPV (methylenedioxypyrovalerone, also known as “bath salts”) and other new psychoactive substances (Palamar et al., 2017). Many of the compounds sold as ecstasy by Internet vendors include phenylethylamines 2CB, 2CT2, 2CT7, DOM, Bromo-dragonfly, and the tryptamines DMT, 5 Meo-DMT, and “Foxy.” These compounds have more potency, which increases the toxicity of the clinical symptoms mentioned earlier. Since major toxicity and death can occur in a single tablet, which normally contains 50 to 200 mg, ingestion of larger amounts can only lead to worsened outcomes. This mythological “safeness” about ecstasy and the ability of the pills to provide feelings of “Superman” powers, increased alertness, reduction of fatigue and euphoria, unfortunately, has potentially severe and life-threatening outcomes. In addition, any patient’s report of drug use poses immediate concerns about serious medical conditions secondary to this substance abuse, such as cardiovascular emergencies of MI, aortic dissection, intracranial hemorrhage and dysrhythmia (Duflou & Mark, 2000, Lai, Hwang, Fang & Chen, 2003; Madhok, Boxer & Chowdhury, 2003).

6.3. Opioids

Opiates are extracted from the poppy plant Papaver somniferum and they belong to a larger class of drugs, called the opioids. The attraction of opioids is due to the analgesic effects due to the inhibition of nociceptive information, euphoria from increased dopamine released in the mesolimbic system (Bonci, Bernardi, Grillner & Mercuri, 2003), and anxiolysis from effects on noradrenergic neurons in the locus coeruleus (Aghajanian & Wang, 1987; Wang & Aghajanian, 1987). Opioids have been used therapeutically, recreationally, for attempted suicide, etc. Some opioids, particularly heroin, are illegal and currently classified by the DEA as schedule one, a level indicating that this substance is dangerously addictive and with no medicinal value. Other opioids are legal and can be prescribed to treat pain.

Prescription drug abuse is a fast-developing problem among youth. About 3.6% of adolescents reported misusing opioids in the preceding year with the higher percentage among older adolescents and young adults 18 to 25. In 2016, a national survey showed that an estimated 239,000 adolescents aged 12 to 17 were current misusers of pain relievers, and an estimated 631,000 young adults aged 18 to 25 misused pain relievers in the past month (Substance Abuse and Mental Health Services Administration, 2017). Moreover, there were about 3,000 adolescents, aged 12-17, and 88,000 young adults, aged 18 to 25, who were cur-
rent users of heroin (Substance Abuse and Mental Health Services Administration, 2017). The use of illegal opioids and misuse of prescription opioids are associated with severe addiction, overdose incidents, and death.

Death from overdose is the most serious consequence of prescription drug misuse in youth. While the absolute number of deaths from drug overdose remains comparatively low in adolescents, the rate of overdose deaths among this vulnerable population is very concerning. In 2016, 5376 youth aged 15 to 24 years died from a drug-related overdose with half of this attributable to opioids (Substance Abuse and Mental Health Services Administration, 2017). In the same period, of all drug overdose deaths among adolescents aged 15-19, up to eight in ten (80.4%) were unintentional, 13.5% were from suicide, 5.2% were of undetermined intent, and 0.9% were homicide (Substance Abuse and Mental Health Services Administration, 2017). Opioid drug overdose deaths for adolescents aged 15-19 more than tripled from 1999 (0.8 per 100,000) to 2007 (2.7 per 100,000), were generally stable between 2007 and 2011, declined in 2012-2014 (2.0 per 100,000) and then increased again between 2014 and 2015 (2.4 per 100,000) (Curtin et al., 2017). Despite some relief provided by decreases and fluctuations in numbers, the prevailing rates over recent years have remained about triple the rates occurring two decades ago. Moreover, the health consequences of opioid misuse extend beyond the immediate victims. For each young adult overdose death, the CDC estimates that there are 119 ED visits and 22 treatment admissions (Curtin et al., 2017).

Data show that adolescents and young adults with opioid use disorders (OUD) underutilize opioid-specific treatment (Hadland et al., 2017; Wu, Zhu & Swartz, 2016). This is due in part to the very low rate of perceived need for treatment with only 4.2% of adolescents with opioid dependence, 0.5% with opioid abuse, and 0.6% of subthreshold users saying they need treatment (Wu, Blazer, Li & Woody, 2011). This places adolescents with OUDs at increased risk of negative outcomes of opioid use including overdose incidents and deaths. From 2006 through 2012, nationwide, there were about 22,000 pediatric ED visits for prescription opioid poisonings with more than half being unintentional and mostly affecting young children age 0 – 5 (Tadros, Layman, Davis, Bozeman & Davidov, 2016). For the adolescent age group, the majority of adolescents presenting to the ED with opioid-related overdoses were intentional (Tadros et al., 2016). The most commonly used opioids were oxycodone (44%), hydrocodone (39%), methadone (9%), and codeine products (7%) codeine products (Substance Abuse and Mental Health Services Administration, 2012). Opioid reversal agents, Naloxone (Narcan®), the immediately-acting antidote for opioid poisoning is available for use in emergency settings. In recent years, a prefilled auto-injection device of naloxone (Evzio®) is used to reverse life-threatening effects of known or suspected opioid overdose which is available for use also in non-emergency settings pending the arrival of emergency personnel.

6.3.1. Medication-assisted Treatment

Medication Assisted Treatment (MAT) refers to the use of various pharmacological treatment options for OUDs, including buprenorphine, naltrexone and methadone along with psychosocial treatment. MAT has been robustly shown to reduce morbidity and mortality associated with OUDs. Specifically, several studies show that MAT decreases opioid-related overdose deaths, opioid use, criminal activity, and infectious disease transmission (Mattick, Breen, Kimber & Davoli, 2014). With the institution of MAT programs, some US cities, such as Baltimore, Maryland, have seen opioid-related overdoses from heroin decrease by as much as 37 percent. MAT is not appropriate for adolescents or youth who are experimenting with, or occasional users of opioids (Hopfer, Khuri, Crowley & Hooks, 2002). Medications including a buprenorphine-naloxone combination (Suboxone®) has been shown to be effective and safe for use in older adolescents, i.e. 16 years or older (Marsch et al., 2016; Subramaniam, Fishman & Woody, 2009; Warden et al., 2012; Woody et al., 2008). Extended-release naltrexone (Vivitrol®), an opioid antagonist, is sometimes used in older adolescents within treatment programs (Fishman, 2008; Fishman, Winstanley, Curran, Garrett & Subramaniam, 2010). Methadone, a full opioid agonist, is used only within specialized treatment programs for adolescents aged 16 and older with documented prior treatment failure attempts and legal guardianship consent.
While the evidence base for use of medications in adolescents is limited, MAT should also be considered for youth with an OUD (Borodovsky, Levy, Fishman & Marsch, 2018; Committee On Substance Use and Prevention, 2002; Yule, Wilens & Rauch, 2017). The ED provides a prime opportunity to screen adolescent patients for OUD and precipitate entry into treatment. Adult patients who initiated MAT in the ED were more than twice as likely to remain engaged in treatment compared to patients referred for treatment (Busch et al., 2017; D’Onofrio et al., 2015). Such evidence has led to calls to improve access to MAT in youth with OUD (Levy & Williams, 2016; Yule et al., 2017).

Importantly, MAT is more comprehensive than medications only. Medications should be combined with behavioral counseling for a “whole person” or “whole patient” approach which is developmentally imperative for the adolescent. The initiation of MAT can be problematic for in adolescents seen in the ED within the context of crisis, as determining whether dependence is present can be difficult. Notably, addiction can occur with some MAT medications, when misused in dependent individuals or when used in non-dependent individuals. Given that, for adolescents, the decision to initiate medications for MAT should be made only after comprehensive assessment considering the youth’s longitudinal history to determine the best course of treatment for the individual within their ecosystem. However, referral for evaluation for MAT treatment is certainly appropriate for some adolescents. Specialized treatment programs that admit adolescent patients with OUD’s directly from ED’s may provide a much-needed bridge from the ED to successful treatment and rehabilitation.

6.4. Alcohol

About 40% of youth drug-related visits to the emergency room involve alcohol (Grigsby, Forster, Unger & Sussman, 2016). Alcohol is the most commonly abused substance in youth. Young people drink less often than adults, but when drinking, they drink more in quantity than adults. About 90% of the alcohol consumed by youth under the age of 21 occurs by binge-drinking (U.S. Department of Justice, Office of Juvenile Justice and Delinquency Prevention,2005). About 62% of high school students have consumed alcohol (more than a few sips) by the end of high school (Johnston, 2018). Each year in the United States about 5,000 young people under age 21 die as a consequence of underage drinking. This includes 1,900 deaths from motor vehicle accidents, 1,600 from homicides, 1,200 from alcohol poisoning, falls, burns, and drowning, and 300 from suicides. In the US, youth aged 21 and below drink 11% of alcohol consumed in the US. In girls under the age of 17 and boys aged 9 to 13, binge-drinking is defined as having three or more drinks on one occasion. For boys aged 14 to 15, drinking four or more drinks in a row is considered binge-drinking, while for boys aged 16 and older, five or more drinks on one occasion constitute binge-drinking (National Institute on Alcohol Abuse and Alcoholism, 2004).

Most young binge-drinkers do not consider themselves as having a problem with alcohol. High-intensity drinking, (i.e consuming 10+ drinks in a row) is an increasing pattern of drinking in youth which occurs in a subset of binge-drinkers, sometimes within context of special celebratory occasions such as parties, birthdays, sleep-overs and is often associated with the transition out of high school, college students, and youth who do not live with their parents (Patrick & Terry-McElrath, 2017; Patrick, Terry-McElrath, Kloska, & Schulenberg, 2016).

Alcohol use is related to both suicidality and depression among young teens. There is a 3-fold increase in attempted suicide among 8th-grade females who drink alcohol. Sixteen to nineteen-year-old females were more than six times as likely to experience depression if they were alcohol abusers than if they were not (Galaif, Sussman, Newcomb & Locke, 2007). In addition to depression and suicide, studies have found that adolescents who drink experience cognitive effects including increased alcohol-related blackouts (later inability to recall events) as their drinking age increases, a rate which some studies have shown to be as high as 30% in 15-year-olds increasing to up to 74% in 19-year olds (Schuckit et al., 2015).

6.5. Newer Psychoactive Substances

Newer psychoactive substances (NPS) have made their entry into the illicit drug industry with the emergence of large numbers of new substances belonging to diverse chemical categories. In the past decade, there has been the emergence of about 750 different NPS reported worldwide (United Nations Office on Drugs and Crime, 2017). These new substances often emerge quickly and disappear.
again, while some are regularly used among different subpopulations. On average, over 80 NPS appear every year and become established on the global market. This includes tryptamines, synthetic cathinones, synthetic cannabinoids, synthetic stimulants, phenylethylamine-type drugs, plant-based substances, phencyclidine-type drugs, and other substances. These new synthetic substances are often undetectable by current laboratory tests. The challenges of keeping up with reporting and testing for each of these substances are daunting.

6.6. Clinical Assessment in the ED

Adolescents who use substances can experience medical complications that precipitate visits to the emergency room. They are often brought by concerned family members. The best assessment a physician can make is a thorough clinical evaluation, which includes collateral information as obtained from the caregivers and other sources. Approaching adolescents and the accompanying family members with a non-judgmental stance facilitates the process of information gathering upon which accurate assessments can be made. Adolescent patient reports have been shown to have good correlations with actual substance use. Maintaining an open-minded approach and asking questions to better understand the adolescent’s circumstances helps facilitate an understanding of the psychosocial conditions the adolescent may be facing. It is advisable to avoid judgment-laden words or language e.g. indicating a “good” or “bad” choice/behavior/action and substitute this with a “helpful” or “not helpful” choice/behavior/action. This sounds less judgment-laden, reducing the need for the adolescent and/or their family to be defensive. This in turn facilitates a more objective assessment of the symptoms (or behavior) by the adolescent and their family members.

6.7. History Taking

The adolescent and parents should be interviewed separately. Useful warning signs to inquire about from the adolescent, family or other accompanying persons include the occurrence of cognitive changes even when brief, or previously dismissed due to what seemed to be reasonable explanations at the time. These changes could be manifested by difficulties with attention and focus, memory problems, or trouble with recall of actual events or periods of time. Other telltale signs include various states of drowsiness including appearing “spaced out” or unusually sleepy, slower or slurred speech, altered vision, lack of coordination, unusual problems walking, falls, seizures, loss of consciousness, or head injury (Ali et al., 2011). Sudden changes in behavior, specifically in mood, appetite, sleep or energy patterns should be noted (Ali et al., 2011). This could include sudden euphoria, irritability, anger or other forms of agitation; unexplained bouts of lethargy or energy; unusual alertness or sluggishness, or sudden increases or decreases in appetite which are unusual for the adolescent. Other behavioral changes include sudden changes in personality, personal hygiene and self-care, loss of motivation or loss of interest in previous hobbies. Psychosocial factors related to drug use could include changes in peer groups and social interests, increased interpersonal conflict, changes in school or work tardiness, decreased attendance or performance, disciplinary problems, etc. Financial-related behavior concerns include borrowing or stealing money in the form of cash or via unauthorized credit card use, performing unhealthy or illegal acts for money such as promiscuity in both male and female adolescents, etc. Legal problems including being on probation, driving while under the influence, physical or sexual assault charges should be noted. Inquiring about evidence of substance use, including unusual smells and drug paraphernalia is helpful.

6.8. Physical Findings

Adolescents can exhibit a high tolerance for substances. Withdrawal symptoms occur less often than in adults but do exist for adolescents. Adolescents may arrive at the ED in severe intoxication may be manifested by delirium, somnolence, or unconscious states. In awake patients, physical examination may show overt disorientation or subtler cognitive symptoms such as impaired ability to direct, sustain, and shift focus and attention. Opioid intoxication should always be suspected when there is the clinical triad of central nervous system depression, respiratory depression, and pupillary miosis. The increased osmolar gap can occur in alcohol intoxication while ketoacidosis can occur in adolescents with diabetes who drink alcohol (Koren, 2007; Meehan, Bryant & Aks, 2010). Depending on the substance or substances ingested, physical findings may vary. These are summarized in Table 1.
6.9. Screening for Alcohol and Substance Use

Substance use and alcohol use are often found in injured adolescents in the ED irrespective of the cause or severity of their injury. This makes the ED an opportune time to screen and intervene in adolescents with alcohol and drug use. As such, all adolescents presenting to the ED should be screened for alcohol and other substance use using standardized questionnaires and other screening tools. Indeed, for certification as a level 1 trauma center, the American College of Surgeons requires the implementation of universal screening for alcohol misuse and delivery of an intervention for adolescents screening positive (American College of Surgeons Committee on Trauma, 2006). Universal screening of adolescents in the ED can be instrumental in detecting substance use early which could precipitate early intervention. The process of screening itself may have some therapeutic effect including potentially deterring future substance use. Brief screening tools are feasible within the ED setting. Physician-conducted CRAFFT screen interview requires an average of 74 seconds to complete, while a computer self-administered version has been found to be feasible and required an average of 49 seconds (Harris, Louis-Jacques & Knight, 2014; Harris, Knight, Van Hook, Sherritt, Brooks, Kulig & Saitz, 2016). The currently validated screening tools for substance use in adolescence are the CRAFFT and the AUDIT, which can be administered through an interview, by the patient on paper, or electronically via tablet or computer. For the CRAFFT, two or
more positive items indicate the need for further assessment. In addition, “riding with a driver who is using drugs or alcohol” has been found to be the single most important question for assessing substance use (Knight et al., 1999; Knight, Sherritt, Shrier, Harris & Chang, 2002). For the AUDIT (administered in 2 to 3 minutes), a score of 4 or more is considered positive in adolescents and indicative of further assessment (Babor, Higgins-Biddle, Saunders & Monteiro, 2001). Other evidence-based brief screening tools include the AUDIT-C which helps capture binge-drinking, DAST-10, and the NIDA-modified ASSIST (Alcohol, Smoking and Substance Involvement Screening Test).

6.10. Drug Testing in the Emergency Room Setting

In the adolescent, drug testing is a useful tool to deter, delay, or detect substance use. As such, adolescents presenting to the ED should have drug-screens done as a routine given that the potential benefits far outweigh the risks. Urine, blood, saliva, and hair samples can be used for detecting the presence of drugs. Blood alcohol concentration (BAC) detects intoxication with the legal limit often set at 80 mg/dL, a level above which driving ability is impaired for most individuals. Of important note, evidence shows BAC rises much faster in adolescents. After consumption of three standard drinks within a 2-hour period, BAC levels were found to be between 80 and 139 mg/dL for boys aged 9-13 and for girls aged 9-17, respectively, indicating considerable potential alcohol impairment (Donovan, 2009). At five drinks consumed within two hours, BAC among college students and children aged 9-13 has been estimated to be two to three times the adult legal limit for intoxication of 80 mg/dL (Donovan, 2009). Such evidence has led to some countries lowering the legal intoxication rate for adolescents to as low as 50 mg/dL.

For other substances, a urine drug test is the most commonly used to detect the presence of drugs. The ED presentation of adolescents is highly variable and often differs from adults in the sense that adolescents are more likely to use multiple drugs to achieve their “high” (desired or altered emotional state). Adolescents are also more willing to experiment with drugs that are newer on the market, making their use undetectable in the typical urine drug screen. The basic drug screen in the United States tests for amphetamines, cocaine, cannabis, opioids and phencyclidine. However, currently, there is no consensus among physicians regarding the indications for drug testing in ED settings (Levy & Siqueira, 2014).

There is also little guidance on how to use this process effectively to inform treatment in the ED and the immediate cost-benefit ratio has been cited as a drawback (Levy, Harris, Sherritt, Angulo & Knight, 2006; Hadland & Levy, 2016; Donofrio, Santillanes, McCammack, Lam, Menchine, Kaji & Claudius, 2014). In such instances, to provide some clarity, medically indicated drug-testing has been suggested for use in target populations taking into account the history and clinical findings (Onigu-Otite, Oyebadejo, Moukaddam, Santillanes & Tucci, 2016; Tucci, Siever, Matorin & Moukaddam, 2015; Santillanes, Donofrio, Lam & Claudius, 2014). Youth presenting with agitation, cardio-respiratory or psychiatric symptoms of unclear origin who test negative on drug screening tests may be experiencing intoxication with new psychoactive substances. In such cases, more targeted toxicological analysis may be required to determine the substance(s) influencing their presentation (Hohmann, Mikus & Czock, 2014). Nevertheless, if resources permit, there may be no true harm in drug testing all adolescents presenting to the ED.

It is important to be aware of the limitations of drug testing. Drug testing has limited utility in the diagnosis of substance use, often does not measure the severity of the disease, and only detects substances above a set detection level. Notably, drug screens indicate the presence of drugs, not the absence of drugs. Thus, a negative drug screen does not exclude the presence of substance use, especially with the newer drugs. As such, information provided by drug testing is limited and should be interpreted within the clinical context.

6.11. Confidentiality

Adolescents often show relief when they know their parents will be made aware of serious problems affecting them including drug use. However, there are legal and ethical considerations when making decisions related to confidentiality (Berlan & Bravender, 2009; Levy et al., 2016). In general, substance abuse is an exception to the requirement
in most states for parental consent for medical treatment provided to minors. When screening and treating adolescents for sensitive health conditions such as substance abuse, physicians should balance the need to deter or detect drug use with protecting the dignity of the adolescent. Ideally, the confidentiality of the patient (the adolescent) should be honored whenever this is deemed safe and legal to do by the physician. Notably, drug-testing laws for minors vary by state and change over time (Weddle & Kokotailo, 2005). The “limit” to upholding confidentiality depends on the physician’s clinical judgment. This should weigh the need to engage the adolescent and provide treatment against the need to prevent imminent harm to the patient or others. Still, providers must be aware of the health and safety implications, federal policies, common law, and the specific state laws guarding this important individual, yet public health safety concern.

### 6.12. Medical Stabilization in The Emergency Department

The medical management of adolescents in the ED with substance use concerns should be focused on the clinical symptoms and complications if present. This may include treatment of acute intoxication states which depend on the substance(s) ingested. For acute opioid intoxication, intramuscular or intravenous naloxone is the immediate antidote that reverses this potentially fatal condition. Benzodiazepines are sometimes used in cases of acute alcohol intoxication. In general, symptomatic treatment includes addressing restlessness, agitation, acute anxiety, paranoia or other psychotic states and aggressive behavior. Oral or intramuscular, or intravenous benzodiazepines often decrease anxiety states and agitation. In cases of agitation within the context of suspected or actual head injury, short-acting benzodiazepines such as lorazepam may afford intermittent assessment of the patient’s level of consciousness to detect any worsening or improvement. Intramuscular or intravenous antipsychotics such as olanzapine, ziprasidone, or haloperidol can result in immediate reduction of aggressive behavior. Intravenous access should be secured to ensure fluid administration and provide a ready access for emergency drug administration. The correction of fluid and electrolyte changes, *e.g.* dehydration, hypoglycemia, hypokalemia, hypomagnesemia is helpful as well as attending to other physical injuries which could have been sustained within the context of trauma (Pianca, Sordi, Hartmann & von Diemen, 2017).

### 6.13. Brief Interventions in The Emergency Department

Brief intervention should focus on promoting safe health practices and reducing unsafe and risky behaviors including the use of substances. The “Alcohol Screening and Brief Intervention for Youth, A Practitioners Guide” is a resource that has been developed by the National Institute on Alcohol Abuse and Alcoholism (2015) for use by practitioners who provide care for adolescents. It includes screening questions that have been empirically validated and can be downloaded from the NIAAA website. Screening, Brief Intervention, and Referral to Treatment (SBIRT), is an evidence-based approach for identification and intervention in adults with substance use disorders; research on its use in adolescents is ongoing. The American Academy of Pediatrics has recommended this be used to screen all adolescents at who present for pediatric check-ups (Beaton, Shubkin, & Chapman, 2016; Levy, Williams, & Committee On Substance Use and Prevention, 2016). This intervention delineates specific tasks and goals, as listed in Fig. (1) and Table 2.

Although the components of these interventions are grounded in evidence-based practice, they have not been studied all together or in all settings. Thus far, studies on the benefits of ED-based brief interventions to decrease alcohol or other substance use have shown mixed results (Banta-Green et al., 2018; Newton et al., 2013). These findings underscore the importance of developing increasingly effective ways to provide targeted interventions deliverable in the ED settings and beyond (Cunningham et al., 2009; Mello et al., 2018).

### 6.14. Referral to Treatment and Follow up beyond the Emergency Department

Identifying appropriate levels of care for adolescents whose substance abuse is identified at an ED visit is important for treatment success. Some will need specialized substance use facilities, and others will be admitted to medical units because of trauma or other associated medical symptoms. Adolescents with significant underlying mental health symptoms, including those who are acutely...
suicidal, homicidal, or have significant aggression or bizarre behaviors reflecting they are out of contact with reality are in need of acute inpatient psychiatric hospitalization for mental health stabilization. Beyond emergency care, adolescents with substance use involvement are best cared for collaboratively by their primary care physician and mental health providers. However, data shows that referral to treatment beyond the ED is low. According to yearly reports, almost 200,000 adolescents with ED visits for conditions involving underage drinking receive no follow-up referral for further treatment (Bernstein et al., 2017).

Importantly, studies have shown that with the implementation of intervention programs including a brief motivational interview with a social worker before discharge, followed by a telephone consultation, referrals to follow-up increase, especially in younger adolescents (Vallersnes et al., 2016) (Bernstein et al., 2010). For alcohol, the implementation of brief motivational intervention has been associated with significant efforts to change behavior (quit drinking and be careful about situations while drinking) although it did not alter between-group consumption or consequences (Bernstein et al., 2010). In the US, there has been increasing investigation into the potential of expanding interactive computer technologies to aid SBIRT delivery to adolescents and young adults (Rose et al., 2015). An important point to remember is that adolescents with substance use concerns often have underlying psychiatric conditions. Thus, attention to underlying mental illness could boost their treatment success. As such, based on the severity of the substance use disorder referral...
to treatment should be to an appropriate level of care which includes a range of services from adolescent mental health counseling or treatment to specialized treatment programs such as inpatient drug rehabilitation facilities.

CONCLUSION

Adolescent drug use is a dynamic public health concern which often presents to the ED in a variety of ways. A pediatric ED visit presents an opportunity to identify adolescents with or at risk of substance use. An ED encounter is a prime point of contact providing the opportunity for prevention, detection, engagement and referral to specialized services when indicated. Psychoeducation of the adolescent patient and their family on the immediate dangers and long-term effects of substance use including the medical impact and psychosocial complications is the key. Beyond the ED, there are many reasons why youth with substance use, like adults, do not request or follow through with treatment recommendations. Denial, minimalization, and lack of perceived need for treatment are factors that often interfere with the follow-through of referrals provided in the ED. Therefore, coordination of care between the ED and community is advisable (Simmons et al., 2008). Systems of care models that include collaborative teams of diverse stakeholders are needed to effectively manage patients from their point of identification, from the ED to receive appropriate levels of care based on the severity of their symptoms or disorder.

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