REVIEW ARTICLE

Mapping the Landscape of Adolescent Substance Use: A Review

Sudip Bhattacharya, Nishat Ahmed Sheikh, G. Jahnavi, Asha Bhagat, Bikash Barma

[1,3,4,5]Department of Community and Family Medicine, All India Institute of Medical Science, Deoghar

[2]Department of Forensic Medicine and Toxicology, All India Institute of Medical Science, Deoghar

CORRESPONDING AUTHOR

Dr. Sudip Bhattacharya, Department of Community and Family Medicine, Academic Building,1st Floor, Devipur Campus, All India Institute of Medical Sciences Deoghar, Jharkhand - 814142

E-mail: drsudip81@gmail.com

CITATION

Bhattacharya S, Sheikh NA, Jahnavi G, Bhagat A, Barma B. Mapping the Landscape of Adolescent Substance Use: A Review. Indian J Comm Health. 2026;38(1):26-31. https://doi.org/10.47203/IJCH.2026.v38i01.006

ARTICLE CYCLE

Received: 15/10/2025; Accepted: 19/02/2026; Published: 28/02/2026

ABSTRACT

Introduction: Adolescence (10–19 years) is a critical developmental period marked by biological, psychological, and social transitions that increase vulnerability to substance use. Globally, alcohol, tobacco, cannabis, and emerging products such as e-cigarettes contribute substantially to adolescent morbidity and long-term health risks. The evolving landscape of novel psychoactive substances, shifting cannabis policies, and post-pandemic behavioral changes necessitates updated synthesis of evidence. **Methods:** A systematic search of PubMed, MEDLINE, PsycINFO, Scopus, Web of Science, and the Cochrane Library identified peer-reviewed studies published between January 2010 and December 2024. Eligible studies included adolescents (mean age 10–19 years) and examined prevalence, determinants, consequences, or interventions. Two reviewers independently screened records (κ = 0.84). Of 1,261 identified records, 24 studies met inclusion criteria. Due to heterogeneity, findings were synthesized narratively using a socio-ecological framework. Study quality was appraised using the Mixed Methods Appraisal Tool (MMAT). **Results:** Alcohol and tobacco remain the most prevalent substances globally, with increasing uptake of e-cigarettes and region-specific rises in cannabis and opioid use. Indian studies report prevalence ranging from 7% to 56%, with tobacco as the most common substance and early initiation often before age 15. Risk factors span genetic vulnerability, mental health disorders, peer influence, family substance use, and socioeconomic disadvantage. Consequences include impaired neurocognitive development, psychiatric comorbidity, academic decline, and social dysfunction. School-based life-skills programs, family-focused interventions, taxation policies, and brief motivational interventions demonstrate modest but meaningful preventive effects. **Conclusion:** Adolescent substance use is a multifactorial public-health challenge requiring integrated, multi-level prevention and culturally responsive interventions, particularly in low- and middle-income settings.

KEYWORDS

Adolescent; Substance-Related Disorders; Alcohol Drinking; Tobacco Use; Prevention & Control.

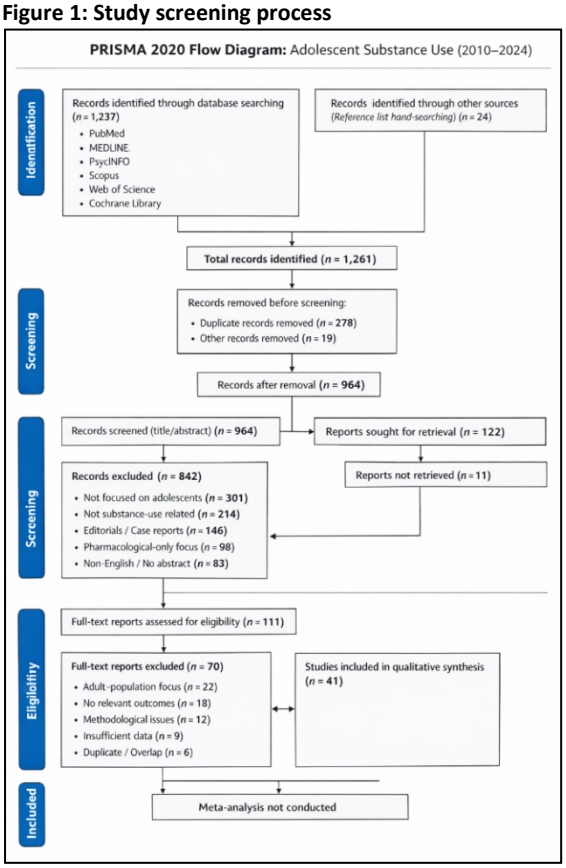
INTRODUCTION

Adolescence, defined by the World Health Organization as the period between 10 and 19 years of age, is characterized by profound biological, psychological, and social changes. These changes create a heightened vulnerability to risk-taking behaviors, including the initiation of alcohol, tobacco, and other drug use. (1) While substance use can be a transient experimental phase for some, a substantial minority progress to regular use, dependence, and associated adverse outcomes that reverberate across the lifespan. The public-health significance of adolescent substance use is underscored by global estimates indicating that approximately 15 % of adolescents aged 15 -19 years report past-month alcohol use, 7 % report tobacco use, and 4 % report illicit drug use (UNODC, 2022).(2) In many high-income countries, these figures have plateaued or declined over the past decade, yet they remain unacceptably high in low- and middle-income regions where surveillance is sparse and prevention infrastructure is limited. Moreover, the landscape of substance use is dynamic. The emergence of novel psychoactive substances (NPS), the proliferation of e-cigarettes, and shifting legal frameworks surrounding cannabis have introduced new challenges for researchers and policymakers. (3) Simultaneously, the COVID-19 pandemic precipitated abrupt disruptions to social networks and health services, potentially influencing substance use patterns in ways that are only beginning to be quantified. (4) Given these complexities, a comprehensive narrative synthesis is warranted to - consolidate recent epidemiological trends, elucidate the multi-level determinants that shape use, evaluate the effectiveness of existing preventive and therapeutic interventions, and identify critical knowledge gaps that should guide future inquiry. (5) This review therefore aims to map the landscape of adolescent substance use through a socio-ecological lens, offering a broad yet nuanced perspective that can inform both scholarly discourse and public-health action.

MATERIAL & METHODS

A systematic search of the peer-reviewed literature was conducted to identify studies relevant to adolescent substance use published between January 2010 and December 2024. The following electronic databases were interrogated: PubMed, MEDLINE, PsycINFO, Scopus, Web of Science, and the Cochrane Library. Search terms were constructed using a combination of MeSH headings and free-text keywords, including adolescent, teen, youth, substance use, drug use, alcohol, tobacco, cannabis, e-cigarette, risk factors, protective factors, consequences, prevention, intervention, and policy. Boolean operators (AND, OR) were employed to refine the query. (Figure 1)

Figure 1: Study screening process



Inclusion criteria were: Empirical studies (quantitative, qualitative, or mixed-methods) focusing on participants with a mean age between 10 and 19 years, publication in English or with an English abstract, examination of at least one of the following: prevalence, correlates, outcomes, or interventions related to substance use, and peer-reviewed status. (6)

Exclusion criteria comprised: Case reports, editorials, or commentaries without original data, studies exclusively addressing adult populations and research focusing solely on pharmacological treatment of substance use disorder without broader contextual analysis. Two reviewers independently screened titles and abstracts, achieving an inter-rater reliability of $\kappa = 0.84$. Discrepancies were resolved through discussion with a third reviewer. Full-text articles meeting inclusion criteria were retrieved, and reference lists were hand-searched to capture additional relevant literature.(7) A comprehensive search of PubMed, MEDLINE, PsycINFO, Scopus, Web of Science, and the Cochrane Library identified 1,237 records, with an additional 24 records retrieved through manual reference list screening, yielding a total of 1,261 records. After removal of 278 duplicates and 19 records excluded prior to screening for technical or indexing reasons, 964 titles and abstracts were screened independently by two reviewers ($\kappa = 0.84$).

During title and abstract screening, 842 records were excluded for failing to meet inclusion criteria, primarily due to non-adolescent populations, non–substance use focus, editorial or commentary format, pharmacological-only treatment emphasis, or language limitations. Consequently, 122 full-text articles were sought for retrieval; 11 reports could not be accessed, leaving 111 full-text articles assessed for eligibility. Of these, 87 full-text articles were excluded for the following reasons: adult-predominant samples, absence of relevant outcomes (prevalence, correlates, consequences, or interventions), insufficient methodological rigor, inadequate extractable data, duplicate datasets, or exclusive focus on pharmacotherapy without broader contextual analysis. Ultimately, 24 studies met all predefined inclusion criteria and were included in the final qualitative synthesis. Due to substantial heterogeneity in study designs, outcome measures, and analytical frameworks, quantitative pooling was not appropriate; therefore, findings were synthesized narratively and organized according to socio-ecological levels (individual, family, peer, school, community, and macro-policy). Quality appraisal using the Mixed Methods Appraisal Tool (MMAT) indicated that most included studies were of moderate to high methodological quality.

Epidemiology of Adolescent Substance Use

Global Prevalence Recent global surveillance indicates that alcohol remains the most commonly used substance among adolescents, with past-month prevalence ranging from 5 % in South-East Asia to 30 % in Europe.(8) Tobacco use has declined in many high-income nations due to stringent tobacco control policies, yet remains high in parts of Eastern Europe and the Western Pacific, where past-month cigarette smoking among 15-year-olds reaches 12 %.(9) The prevalence of cannabis use among adolescents has risen in regions where legalization or decriminalization has occurred, with past-year use reported at 13 % in North America and 7 % in Oceania.(10) E-cigarette (vaping) prevalence has surged dramatically, particularly after 2018, with past-month use among high-school students in the United States reaching 27 % (CDC, 2023). This trend is mirrored in other high-income countries, while data from low- and middle-income nations remain limited but suggest emerging uptake among urban youth.(11) Illicit drug use (excluding cannabis) remains relatively low but is increasing for certain substances such as synthetic cannabinoids and stimulants like methamphetamine, especially in Southeast Asia and the Middle East (UNODC, 2022). The COVID-19 pandemic appears to have altered consumption patterns, with some studies reporting

reduced alcohol and tobacco use during lockdowns but increased use of cannabis and NPS due to disrupted supply chains and heightened stress.(12)

Regional Focus: South Asia Within South Asia, India presents a particularly complex epidemiological picture. The National Survey on Drug Use and Health (NSDUH) 2021 estimated that 6.2 % of adolescents aged 15–19 years reported past-month alcohol use, 3.1 % reported tobacco use, and 1.4 % reported cannabis use (Ministry of Health & Family Welfare, 2022). However, these figures are likely underestimates given the social stigma attached to substance use and limited surveillance in rural areas.(13) Urban-centric studies reveal higher prevalence rates. For instance, a school-based survey in Delhi reported past-month alcohol use at 14 % and e-cigarette use at 9 % among 16-year-olds. In contrast, a community-based study in rural Bihar found past-month alcohol use at 2 % but a higher prevalence of smokeless tobacco (12 %). These disparities underscore the importance of contextual factors such as socioeconomic status, cultural norms, and access to substances. (14)Trends Over Time Longitudinal data from the Global Burden of Disease (GBD) study demonstrate a modest decline in adolescent alcohol and tobacco use between 2010 and 2019, followed by a plateau or slight increase in certain regions after 2020 (GBD, 2021).(15) The most pronounced upward trend is observed for e-cigarette use, which rose from 1 % in 2015 to over 20 % in 2023 among high-school students in the United States (CDC, 2023).(16) Similarly, past-year cannabis uses among adolescents increased from 7 % in 2010 to 13 % in 2022 in Canada, coinciding with legislative changes (Health Canada, 2023). These trends suggest that while traditional substances remain prevalent, the adolescent substance use landscape is being reshaped by emerging products and policy environments. The heterogeneity in data quality across regions, however, complicates definitive conclusions and highlights the need for standardized surveillance mechanisms.(17)

RESULTS AND DISCUSSION

Risk and Protective Factors

Twin and adoption studies consistently demonstrate a heritable component to substance use initiation, with estimates of genetic influence ranging from 30 % to 60 % Neurodevelopmental research indicates that the adolescent brain, particularly the prefrontal cortex and reward circuitry, is highly plastic and sensitive to the effects of alcohol and nicotine, which can disrupt executive function and increase risk of later dependence.(18) Depression, anxiety, and conduct disorder are robust predictors of substance use onset. A meta-analysis of longitudinal studies found that adolescents with depressive symptoms have 2.3-fold increased odds of initiating alcohol use within two years. (19) Similarly, attention-deficit hyperactivity disorder (ADHD) is associated with earlier cannabis initiation, mediated partly by impulsivity and peer affiliation. High sensation-seeking, low self-control, and positive outcome expectancies are consistently linked to higher rates of substance experimentation. Conversely, high academic self-efficacy and future orientation act as protective buffers. Parental monitoring, clear rules about substance use, and supportive communication are protective, whereas permissive or neglectful parenting increases risk.(20) A longitudinal study in Brazil showed that adolescents whose parents set strict limits on alcohol had a 40 % lower likelihood of binge drinking at age 17. Exposure to family violence, parental substance use, and household stress are strong risk factors. Children of parents with alcohol use disorder have a three-fold increased risk of developing substance use disorders themselves, mediated by both genetic and environmental pathways. Higher SES is generally protective against illicit drug use but may be associated with higher alcohol consumption due to greater disposable income.(20) Conversely, adolescents from low-SES backgrounds face heightened risk of tobacco and smokeless tobacco use, reflecting targeted marketing and stress-related coping mechanisms. Peer norms exert a powerful effect, with adolescents being 2–3 times more likely to use substances if their close friends do. Social network analyses reveal that both direct (friend use) and indirect (friend-of-friend use) exposures contribute to initiation, particularly for cannabis and e-cigarettes.(21) Schools with strong anti-substance policies, engaging extracurricular activities, and supportive teacher relationships report lower prevalence of substance use. Conversely, schools located in neighborhoods with high substance availability see increased rates of use.

Ease of obtaining alcohol, tobacco, and cannabis is a key determinant. In jurisdictions where the legal drinking age is lower, adolescent binge drinking rates are higher. Similarly, the proliferation of online vape shops has facilitated under-age purchases, contributing to the rapid rise in e-cigarette use. Cultural attitudes that normalize alcohol consumption or glamorize drug use increase risk, while protective cultural practices (e.g., religious prohibitions) reduce initiation. (22) Media representation, particularly on social platforms, shapes perceptions of risk and prevalence, with exposure to pro-vaping content linked to higher odds of vaping initiation. Comprehensive tobacco control policies, including taxation, advertising bans, and plain packaging, have been effective in reducing adolescent smoking. Conversely, lax cannabis regulation has been associated with increased adolescent use in some jurisdictions. Intersectionality Risk and protective factors do not operate in isolation; they intersect across levels. For example, a low-SES adolescent with high sensation-seeking traits, living in a community with high substance availability, and experiencing parental substance use faces compounded risk.(23) An intersectional approach is therefore essential for tailoring interventions.

Consequences of Adolescent Substance Use

Regular alcohol consumption during adolescence is linked to impaired liver function, heightened risk of hypertension, and compromised growth. Tobacco use leads to reduced lung function, increased respiratory infections, and early onset of atherosclerosis. (24)Cannabis use, particularly high-THC products, is associated with altered brain morphology and decreased cognitive performance. Substance use exacerbates underlying psychiatric conditions and can precipitate the

onset of mood and anxiety disorders. A longitudinal cohort study found that adolescents who engaged in binge drinking had a 1.8-fold increased risk of developing major depressive disorder within three years.(25) Cannabis use during adolescence is strongly correlated with the later emergence of psychotic symptoms, especially in individuals with a genetic predisposition Alcohol-related road traffic injuries remain a leading cause of death among adolescents worldwide, accounting for approximately 13 % of all adolescent fatalities. Overdose deaths involving opioids and synthetic cannabinoids have risen sharply in the past five years, particularly in North America and Europe.(26) Substance use is associated with lower academic achievement, higher absenteeism, and increased school dropout rates. A meta-analysis of 45 studies reported that adolescents who used cannabis regularly had a 0.5-grade point average reduction and a 30 % higher likelihood of dropping out of high school. These educational setbacks translate into reduced employment prospects and lower lifetime earnings(27). Substance-using adolescents are more likely to engage in risky sexual behaviors, experience intimate partner violence, and participate in delinquent activities. The clustering of risk behaviors suggests common underlying determinants, such as impulsivity and adverse childhood experiences. Substance use can strain family relationships, lead to peer group homogenization, and diminish social capital. Longitudinal research indicates that adolescents who heavily use alcohol experience decreased social support and higher rates of loneliness in early adulthood.(28) The cumulative economic cost of adolescent substance use - encompassing healthcare, law enforcement, and lost productivity is estimated at $200 billion annually in the United States alone (NIDA, 2023). In low- and middle-income countries, where resources are limited, these costs can have disproportionate impacts on national development.(29)

Prevention and Intervention Strategies

Evidence-based programs such as Life Skills Training (LST) and the European Drug Addiction Prevention (EU-DAP) trial have demonstrated modest reductions in alcohol and tobacco initiation. A systematic review of 30 randomized controlled trials reported a 15 % relative risk reduction in past-month substance use among participants receiving curriculum-based interventions. National campaigns that combine graphic health warnings with social-norm messaging have been effective in reducing adolescent smoking and alcohol consumption.(30) The “Truth” campaign in the United States contributed to a 30 % decline in youth smoking between 2014 and 2020. Increasing the minimum legal drinking age, enforcing taxation on sugary alcoholic beverages, and restricting the sale of e-cigarettes to minors have shown population-level impacts.(31) A quasi-experimental study in India demonstrated that a 20 % increase in tobacco tax led to a 7 % reduction in adolescent tobacco use within two years. The Strengthening Families Program (SFP) and the Parent-Child Interaction Therapy (PCIT) have shown efficacy in reducing substance use among at-risk youth by improving parental monitoring and family cohesion.(32) A meta-analysis of 18 trials reported a pooled effect size of d = 0.42 for reducing alcohol initiation among high-risk adolescents. Implementing routine substance-use screening using validated tools (e.g., CRAFFT) followed by brief motivational interviewing has been effective in reducing hazardous drinking among adolescents in primary care and school settings. Web-based and mobile applications offering personalized feedback, coping strategies, and peer support have shown promise, particularly for reaching hard-to-reach populations.(33) A randomized trial of the “MyLife” app demonstrated a 12 % reduction in past-month cannabis use among participants aged 15 - 18. However, concerns remain regarding data privacy and the durability of effects.(34) Cognitive-behavioral therapy (CBT) and contingency management (CM) are the most empirically supported treatments for adolescent substance use disorders. A multisite trial found that adolescents receiving CBT + CM had higher self-discipline rates at 12 months compared with CBT alone. (35) While limited, certain medications (e.g., bupropion for nicotine dependence, naltrexone for alcohol dependence) have been trialed in adolescents with modest efficacy and acceptable safety profiles. Further research is needed to establish guidelines for pharmacotherapy in this age group. Co-locating substance-use services within mental-health and primary-care settings improves treatment engagement and outcomes, particularly for adolescents with comorbid psychiatric conditions.(36) Successful scale-up of evidence-based programs requires attention to fidelity, contextual adaptation, and sustainable financing. The RE-AIM framework (Reach, Effectiveness, Adoption, Implementation, Maintenance) provides a useful structure for planning and evaluating large-scale interventions. In low-resource settings, task-shifting, training non-specialist providers to deliver brief interventions has emerged as a viable strategy.(37)

Gaps in the Literature and Future Directions

Despite the range of research on adolescent substance use, several critical gaps persist. First, longitudinal studies that capture the dynamic interplay between neurobiological development, mental health, and substance exposure across diverse cultural contexts are scarce.(38) Most existing cohorts are based in high-income countries, limiting generalizability to regions experiencing rapid epidemiological transitions, such as sub-Saharan Africa and South Asia. Second, the rapid proliferation of novel psychoactive substances and e-cigarettes has outpaced regulatory science and research.(39) There is a lack of high-quality epidemiological data on the prevalence, patterns, and health effects of NPS among adolescents, particularly in low- and middle-income nations where these substances may be more accessible. Third, intervention research has predominantly focused on single-substance or single-level approaches. There is a need for integrated, multi-component interventions that simultaneously address multiple substances, mental health, and social determinants. Moreover, implementation science is under-developed; few studies have rigorously examined the processes required to scale evidence-based programs within real-world health systems.(40) Fourth, the role of

digital media and social networks in shaping substance-use norms is not fully understood. While some studies have explored the impact of online exposure to pro-substance content, the bidirectional influence of adolescent digital behavior on substance use trajectories remains an emerging area. Finally, equity considerations are often overlooked.(41) Research must prioritize vulnerable populations including LGBTQ+ youth, refugees, and those with disabilities who experience disproportionate substance-use burden but are frequently under-represented in research.

Conclusion

Adolescent substance use constitutes a multifaceted public-health challenge that unfolds across individual, relational, and societal levels. This narrative review has synthesized current evidence on the epidemiology, determinants, consequences, and interventions related to substance use among youth, with particular attention to the evolving landscape of novel products and the contextual nuances of South Asia. While substantial progress has been made in understanding risk factors and implementing preventive programs, significant gaps remain especially regarding the neurobiological underpinnings of early substance exposure, the health impacts of emerging substances, and the scalability of interventions in low-resource settings.

Recommendation

A socio-ecological perspective underscores that effective mitigation requires coordinated action: strengthening family and school environments, enforcing evidence-based policies, expanding access to youth-friendly treatment, and fostering community engagement. The integration of digital health tools offers promising avenues for outreach, yet must be accompanied by robust safeguards for privacy and equity. Moving forward, research must prioritize longitudinal, interdisciplinary studies that capture the dynamic interplay of biological, psychological, and social influences across diverse populations. Implementation science should guide the translation of proven interventions into routine practice, ensuring fidelity while allowing cultural adaptation. Finally, policy decisions should be informed by up-to-date surveillance and guided by a commitment to reducing health disparities among the most vulnerable adolescents. By addressing these priorities, stakeholders, researchers, clinicians, educators, policymakers, and families can collaboratively shape a healthier future for the next generation, reducing the burden of substance-related harm and unlocking the full potential of adolescence as a foundation for lifelong wellbeing.

Limitation of the Study

This review has several limitations. The study relies on published literature, which may introduce publication bias and underrepresentation of low- and middle-income countries. The heterogeneity in study designs and outcome measures limited comparability and prevented meta-analysis, resulting in a narrative synthesis. Additionally, many included studies were cross-sectional, limiting causal inference and generalizability across diverse settings.

Relevance of the Study

This study is relevant as it provides a comprehensive socio-ecological understanding of adolescent substance use, informing evidence-based prevention, policy, and intervention strategies across multiple levels of influence.

Authors Contribution

All authors have contributed equally.

Financial Support and Sponsorship

Nil

Conflict of Interest

There are no conflicts of interest.

Acknowledgement

The authors sincerely acknowledge and thank all the researchers and authors whose work has been cited in this review, as their valuable contributions formed the foundation of this synthesis.

Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors acknowledge that artificial intelligence was used only for language editing and grammar refinement, and the authors take full responsibility for the content and interpretation of the manuscript.

References

1. World Health Organization. Adolescent health [Internet]. Geneva: WHO; [cited 2026 Feb 19]. Available from: https://www.who.int/health-topics/adolescent-health
2. Schulte MT, Hser YI. Substance use and associated health conditions throughout the lifespan. Public Health Rev. 2014;35(2). doi:10.1007/BF03391702.
3. Gittins R, Guirguis A, Schifano F, Maidment I. Exploration of the use of new psychoactive substances by individuals in treatment for substance misuse in the UK. Brain Sci. 2018;8(4):58. doi:10.3390/brainsci8040058.
4. Medicine (Baltimore). Impact of the COVID-19 pandemic on mental health [Internet]. 2025 [cited 2026 Feb 19]. Available from: https://journals.lww.com/md-journal/fulltext/2025/01100/impact_of_the_covid_19_pandemic_on_the_mental.6.aspx
5. Skivington K, Matthews L, Simpson SA, Craig P, Baird J, Blazeby JM, et al. Framework for the development and evaluation of complex interventions. Health Technol Assess. 2021;25(57):1–132. doi:10.3310/hta25570.
6. Opara I, Leonard NR, Thorpe D, Kershaw T. Understanding neighborhoods' impact on youth substance use and mental health outcomes. JMIR Res Protoc. 2021;10(5):e29427. doi:10.2196/29427.
7. Hai AH, Lee CS, Abbas BT, Bo A, Morgan H, Delva J. Culturally adapted evidence-based treatments for adults with substance use problems: systematic review and meta-analysis. Drug Alcohol Depend. 2021;226:108856.
8. World Health Organization. Alcohol, e-cigarettes, cannabis: concerning trends in adolescent substance use [Internet]. 2024 [cited 2026 Feb 19]. Available from: https://www.who.int/europe/news/item/25-04-2024-alcohol--e-cigarettes--cannabis--concerning-trends-in-adolescent-substance-use--shows-new-who-Europe-report
9. United Nations. Tobacco use declining despite industry interference [Internet]. 2024 [cited 2026 Feb 19]. Available from: https://news.un.org/en/story/2024/01/1145552
10. Hammond CJ, Chaney A, Hendrickson B, Sharma P. Cannabis use among U.S. adolescents in the era of marijuana legalization. Int Rev Psychiatry. 2020;32(3):221–234. doi:10.1080/09540261.2020.1713056.

11. Hammond CJ, Chaney A, Hendrickson B, Sharma P. Cannabis use among U.S. adolescents in the era of marijuana legalization. Int Rev Psychiatry. 2020;32(3):221–234. doi:10.1080/09540261.2020.1713056.
12. Hawdon J, Parti K, Dearden T. Changes in online illegal drug buying during COVID-19. Am J Crim Justice. 2022;47(4):712–734. doi:10.1007/s12103-022-09698-1.
13. Dhawan A, Chatterjee B, Bhargava R, Chopra A, Mandal P, Rao R, et al. Substance use among school-going adolescents in India. Natl Med J India. 2025;38(6):332–338. doi:10.25259/NMJI_824_2022.
14. Beyond the puff: patterns and predictors of tobacco usage among adolescents and youth in Delhi, India [Internet]. 2025 [cited 2026 Feb 19]. Available from: https://doi.org/10.1515/ijamh-2025-0051
15. Wang M, Yu T. Global burden of disease among adolescents and young adults with drug use disorders, 1990–2021. Front Public Health. 2025;13:1583812. doi:10.3389/fpubh.2025.1583812.
16. Centers for Disease Control and Prevention. E-cigarette use among youth [Internet]. 2023 [cited 2026 Feb 19]. Available from: https://www.cdc.gov/media/releases/2023/s1102-e-cigarettes-down.html
17. Goodman S, Srugo SA, Krzeminska E, Abramovici H. Changes in patterns of cannabis use among students in Canada. Drug Alcohol Depend Rep. 2025;17:100399.
18. Genetic risk for substance abuse and addiction: family and twin studies [Internet]. [cited 2026 Feb 19]. Available from: https://www.researchgate.net/publication/291165825_Genetic_Risk_for_Substance_Abuse_and_Addiction_Family_and_Twin_Studies
19. Barry CM, Jagtiani A, Livingston MD, Talavera-Brown S, LaBounty H, Atkinson E, et al. Anxiety and depressive symptoms as predictors of substance use initiation among adolescents. Front Child Adolesc Psychiatry. 2024;3:1390793. doi:10.3389/frcha.2024.1390793.
20. Gujska JH, Silczuk A, Madejek R, Szulc A. ADHD and cannabis use disorders: review. Med Sci Monit. 2023;29:e939749.
21. Scales M, Monahan J, Rhodes N, Ewoldsen D, Johnson-Turbes A. Adolescents' perceptions of smoking and stress reduction. Health Educ Behav. 2008;36:746–758.
22. Bisset S, Markham WA, Aveyard P. School culture as an influencing factor on youth substance use. J Epidemiol Community Health. 2007;61(6):485–490.
23. Vogel E, Ramo D, Rubinstein M, Delucchi K, Darrow S, Costello C, et al. Effects of social media on adolescents' willingness to use e-cigarettes. Nicotine Tob Res. 2020;23.
24. King MT, Nielsen LB, Weinreich UM. Effects of alcohol consumption from early adolescence on lung function. Eur Clin Respir J. 2023;12(1):2476232.
25. Burggren AC, Shirazi A, Ginder N, London ED. Cannabis effects on brain structure and cognition. Am J Drug Alcohol Abuse. 2019;45(6):563–579.
26. Kiburi SK, Molebatsi K, Ntlantsana V, Lynskey MT. Cannabis use in adolescence and risk of psychosis: systematic review. Subst Abus. 2021;42(4):527–542.
27. Chan O, Daudi A, Ji D, Wang M, Steen JP, Parnian P, et al. Cannabis use and academic achievement: systematic review. JAMA Pediatr. 2024;178(12):1280–1289.
28. Smith CA, Elwyn LJ, Ireland TO, Thornberry TP. Impact of adolescent exposure to intimate partner violence on substance use. J Stud Alcohol Drugs. 2010;71(2):219–230.
29. Fardone E, Montoya ID, Schackman BR, McCollister KE. Economic benefits of substance use disorder treatment: systematic review. J Subst Use Addict Treat. 2023;152:209084.
30. Agabio R, Trincas G, Floris F, Mura G, Sancassiani F, Angermeyer MC. School-based alcohol and drug prevention programs: systematic review. Clin Pract Epidemiol Ment Health. 2015;11(Suppl 1):102–112.
31. Cotti C, Courtemanche C, Liang Y, Maclean JC, Nesson E, Sabia JJ. Effect of e-cigarette flavor bans on tobacco use. J Health Econ. 2025;102:103013.
32. Carrión-Valero F, Ribera-Osca JA, Martin-Moreno JM, Martin-Gorgojo A. Prevention of tobacco use in adolescents. Tob Prev Cessat. 2023;9:37.
33. Tanner-Smith EE, Risser MD. Brief alcohol interventions for adolescents: meta-analysis. Am J Drug Alcohol Abuse. 2016;42(2):140–151.
34. Rooke S, Thorsteinsson E, Karpin A, Copeland J, Allsop D. Computer-delivered interventions for alcohol and tobacco use. Addiction. 2010;105(8):1381–1390.
35. Kaminer Y, Burleson JA, Goldberger R. Cognitive-behavioral coping skills therapy for adolescent substance abuse. J Nerv Ment Dis. 2002;190(11):737–745.
36. Muramoto ML, Leischow SJ, Sherrill D, Matthews E, Strayer LJ. Bupropion for adolescent smoking cessation. Arch Pediatr Adolesc Med. 2007;161(11):1068–1074.
37. Holtrop JS, Estabrooks PA, Gaglio B, Harden SM, Kessler RS, King DK, et al. RE-AIM framework. J Clin Transl Sci. 2021;5(1):e126.
38. Miech RA, Johnston LD, Patrick ME, O'Malley PM. Monitoring the Future national survey results on drug use.
39. Mental health of young people: a global public health challenge [Internet]. [cited 2026 Feb 19]. Available from: ResearchGate.
40. Khaled SM, Hughes E, Bressington D, Zolezzi M, Radwan A, Badnapurkar A, et al. Prevalence of novel psychoactive substances use: systematic review protocol. Syst Rev. 2016;5:195.
41. The impact of social media and technology on child and adolescent mental health [Internet]. [cited 2026 Feb 19]. Available from: ResearchGate.

