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Characterizing the Followers and Tweets of a Marijuana-Focused Twitter Handle

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Abstract

Background

Twitter is a popular social media forum for sharing personal experiences, interests, and opinions. An improved understanding of the discourse on Twitter that encourages marijuana use can be helpful for tailoring and targeting online and offline prevention messages.

Objectives

The intent of the study was to assess the content of “tweets” and the demographics of followers of a popular pro-marijuana Twitter handle (@stillblazingtho).

Methods

We assessed the sentiment and content of tweets (sent from May 1 to December 31, 2013), as well as the demographics of consumers that follow a popular pro-marijuana Twitter handle (approximately 1,000,000 followers) using Twitter analytics from Demographics Pro. This analytics company estimates demographic characteristics based on Twitter behavior/usage, relying on multiple data signals from networks, consumption, and language and requires confidence of 95% or above to make an estimate of a single demographic characteristic.

Results

A total of 2590 tweets were sent from @stillblazingtho during the 8-month period and 305 (11.78%) replies to another Twitter user were excluded for qualitative analysis. Of the remaining 2285 tweets, 1875

(82.06%) were positive about marijuana, 403 (17.64%) were neutral, and 7 (0.31%) appeared negative about marijuana. Approximately 1101 (58.72%) of the positive marijuana tweets were perceived as jokes or humorous, 340 (18.13%) implied that marijuana helps you to feel good or relax, 294 (15.68%) mentioned routine, frequent, or heavy use, 193 (10.29%) mentioned blunts, marijuana edibles, or paraphernalia (eg, bongs, vaporizers), and 186 (9.92%) mentioned other risky health behaviors (eg, tobacco, alcohol, other drugs, sex). The majority (699,103/959,143; 72.89%) of @stillblazingtho followers were 19 years old or younger. Among people ages 17 to 19 years, @stillblazingtho was in the top 10% of all Twitter handles followed. More followers of @stillblazingtho in the United States were African American (323,107/759,407; 42.55%) or Hispanic (90,732/759,407; 11.95%) than the Twitter median average (African American 22.4%, inter-quartile ratio [IQR] 5.1-62.5%; Hispanic 5.4%, IQR 3.0-10.8%) and among Hispanics, @stillblazingtho was in the top 30% of all Twitter handles followed.

Conclusions

Young people are especially responsive to social media influences and often establish substance use patterns during this phase of development. Our findings underscore the need for surveillance efforts to monitor the pro-marijuana content reaching young people on Twitter.

Keywords: Twitter, social media, marijuana

Introduction

Social media use is common among young persons. The majority of Internet users in the United States (72%) use social media platforms like Facebook, Twitter, LinkedIn, MySpace, YouTube, and others [1]. The rate of social media use is even higher among young adults aged 18-29 years old in the United States (89%) [2,3]. Many US social media sites have high levels of user engagement: 63% of Facebook users check the site at least daily, followed by 57% of Instagram users, and 46% of Twitter users [3]. This is especially true for youth and young adults who are the most likely age group to use Twitter. Typical users of Twitter are quite young [4]: nearly half are under the age of 34 and only 30% are over 45. While Facebook continues to dominate social media engagement, more US teens rated Twitter (26%) as the most important social media site than Facebook (23%) [5]. Focus groups revealed that teens dislike the increasing adult presence, inane details, drama, and the need to maintain their reputation on Facebook, but can better express themselves on sites like Twitter [6]. Continued growth from 1.1 billion social media users worldwide in 2013 to 2.3 billion users in 2017 is projected [7].

The term “infodemiology” was coined by Eysenbach and underscores the communication patterns on the Internet that have important implications for the study of population health and public policy [8]. Emerging evidence in the infodemiology of online substance use risk behavior content that is being viewed and posted online via social media platforms is concerning. For instance, up to 83% of US college students’ social networking sites, such as Facebook and MySpace, reference alcohol use [9]. Also, a recent study found that 39% of 15-24 year olds reported having a friend who posted online pictures of themselves smoking marijuana on Facebook or MySpace [10]. In addition, findings suggest that explicit and/or illegal online content on social media is relatively common among adolescents who are 18 years of age and under. Specifically, studies of US college students have found that underage young adults commonly post pictures of themselves drinking alcohol on Facebook [11-13]. Related studies also found references to sexual risk-taking, alcohol use, and drug use behaviors on US adolescents’ (ages 16-18 years old) public online MySpace social media profiles [9,14]. Taken together, the studies indicate a high likelihood for youth and young adults to consume and create online content about risk behaviors via social media platforms.

Like Facebook and MySpace, Twitter is a popular social media forum among youth and young adults [15]. Tweets are messages that are ≤140 characters and are sent from a user profile (“handle”) to a network of “followers” who have chosen to “follow” that particular handle. Followers receive tweets in real time via

mobile phones and/or email. Twitter advertises itself as a freedom of speech social media platform and seldom removes tweets that are not illegal or spam. Therefore, it is possible for tweets that encourage deleterious health behaviors to reach youth and other vulnerable populations (eg, current substance abusers); yet, the research that addresses this topic is scant. In one study that examined exposure to alcohol beverage advertisements and marketing via Twitter, it was found that youth who were not yet of the legal drinking age could easily access alcohol marketing campaigns [16]. Similarly, underage youth were able to view and post tweets that promoted trendy tobacco products like hookah and e-cigarettes [17]. In a related study, Twitter users whose tweets identified them as prescription drug abusers tended to be "socially surrounded" (via tweets) with other Twitter users who similarly Tweeted about prescription drug abuse [18]. These findings suggest that Twitter users, even those who are young in age and cannot legally purchase substances like alcohol or tobacco, engage in Twitter activities that promote substance use behaviors.

Young people are responsive to social media influences and often establish substance use patterns during this phase of development [19-21]. In fact, the Media Practice Model (MPM) was developed to explain how individuals can use social media messages for guidance on life choices and accordingly disclose information on social media that reflects actual behaviors and traits or behavioral intent [22-25]. The MPM further postulates that youth and young adults consume and engage with media based on who they are and who they want to be at the moment [22-26]. It is therefore important to increase knowledge about the substance use-related online content that is connecting with youth and young adults.

The current study presents timely analysis of a popular Twitter handle that streams marijuana-related content. Marijuana is one of the most commonly used substances among young people in the United States. The US National Survey on Drug Use and Health (NSDUH) provides data on marijuana use across individuals ages 12 and older and the latest data indicate that past month marijuana use is highest for young adults ages 18-25 years old (18.7% in 2012 versus 19.0% in 2011) followed by 26-29 year olds (11.9% in 2012 and 12.3% in 2011) [27]. Marijuana use often begins in young adulthood with the average age being 17.9 years old in 2012.

Trends in marijuana use are important to monitor given the current shift in the marijuana policy landscape with the liberalizing of marijuana policies [28]. Currently, 19 US states and the District of Columbia now provide legal protection for the possession and supply of marijuana for medicinal purposes. A number of states and community jurisdictions have also reduced penalties for possession and use of small amounts of marijuana from criminal sanctions to fines or civil penalties. In November 2012, Colorado and Washington legalized the sale and possession of marijuana for recreational purposes. In addition, recent self-report data suggest more relaxed views toward marijuana use across both youth and adults. Specifically, population-level data indicate that most youth (60% of high school seniors) do not believe that regular marijuana use is harmful [29] and most Americans (52%) now favor legalizing the recreational use of marijuana [30].

In the US states where it is legal, medical marijuana can be used to treat various conditions including cachexia, cancer, glaucoma, human immunodeficiency virus infection/acquired immune deficiency syndrome, muscle spasms, seizures, severe nausea, severe pain, and sleep disorders [31]. Pain and muscle spasms are the most common reasons that medical marijuana is used: 89% (Arizona) and 94% (Colorado) of patients are registered for severe or chronic pain and 14% (Arizona) and 17% (Colorado) are registered for muscle spasms [32]. Nevertheless, the benefits of medical marijuana use remain uncertain with much of the evidence for marijuana's efficacy being anecdotal [33,34]. Therefore, marijuana regulation continues to be important from a medical perspective given the known risks that are associated with its use. In 2011, marijuana contributed to over 455,000 visits to the emergency department in the United States; 13% of these patients were between the ages of 12 and 17 [35]. Additionally, there are numerous harmful short-term and long-term effects of marijuana use including short-term memory damage, impairment in attention, judgment and other cognitive functions, worsened coordination and balance, and psychotic episodes

[36-39]. Persistent marijuana effects include impaired long-term memory, learning skills, and sleep, while chronic abuse can lead to addiction and increased risk for chronic cough, bronchitis, and several mental disorders including schizophrenia, anxiety, and depression [38,40].

Nevertheless, content about marijuana use is likely to have a presence on social media given its recent increased use among youth and both youths' and adults' more relaxed views toward marijuana use. In the present study, we assess the content of tweets and demographics of consumers who are following a popular Twitter handle (approximately 1,000,000 followers) that streams daily tweets about marijuana-related content.

Methods

Overview

The Twitter data in the current study is public. The Washington University Institutional Review Board reviewed our study protocol and our research was deemed exempt from human subjects review.

Twitter Handle

We searched Twitter for popular accounts related to "marijuana" or "weed" and chose the account with the most followers: "Weed Tweets" (@stillblazingtho) with approximately 1 million followers. The next most popular marijuana-related accounts had approximately 200,000 to 300,000 followers; thus, the above account had by far the highest number of followers. The profile summary of Weed Tweets, @stillblazingtho, is shown in Figure 1.

Tweet Engagement, Sentiment, and Content

Tweets from @stillblazingtho were collected historically for eight months (May 1, 2013-December 31, 2013). Analytics platform "SimplyMeasured" was used to access the Twitter "firehose" via Gnip (a social data firm that provides access to the Twitter "firehose" stream of every tweet ever sent) and collect all tweets sent from @stillblazingtho for the time period of interest [41]. A total of 2590 unique tweets (an average of 11 tweets per day) was sent from @stillblazingtho during the 8-month period. SimplyMeasured also provides a "Klout" score for the Twitter handle (the Klout score ranges from 1 to 100 with higher scores representing higher influence) and analysis of Twitter engagement, including the number of retweets and replies for each tweet and the number of potential impressions (total number of times a tweet from @stillblazingtho or a tweet mentioning @stillblazingtho appeared in someone's Twitter feed during the time period).

Tweets sent from @stillblazingtho were qualitatively analyzed for sentiment and topics/themes. Tweets that were replies to another Twitter user (305/2590, 11.78% of the total tweets) were removed from the dataset because the original tweets would also need to be reviewed in order to understand the context of replies. This resulted in 2285 tweets for qualitative analysis. Tweets were coded for sentiment: positive sentiment about marijuana, negative sentiment about marijuana, neutral/unknown. Topics or themes included in tweets were additionally coded, such as whether the tweet was a joke/humorous, implied that marijuana use is not harmful or dangerous (or less harmful than other substances like alcohol), explicitly encouraged legalization, included a motivational message or quote, implied that marijuana use is good for friendship/promotes getting along, implied that you can still be successful or a good person if you use marijuana, and whether it mentioned other risky health behaviors (eg, tobacco, alcohol, other drugs, sex), the relaxing or de-stressing effects of marijuana use, frequent, regular/routine, or heavy use, blunts, marijuana edibles, or paraphernalia (eg, bongs, vaporizers), and the health benefits of marijuana or medical marijuana use. The sentiment of each tweet was coded and the topic/theme of the tweet was subsequently coded when applicable. Each tweet could be coded for more than one topic/theme if necessary.

We used crowdsourcing to code the tweets with the services of "CrowdFlower" [42]. Crowdsourcing involves using a large network of workers to complete micro-tasks. Kim et al also used crowdsourcing via CrowdFlower to analyze sentiment of tweets about US health care reform, similar to methods used for this study, and found a high level of agreement between trained coders from the research team and crowdsourced coders (82.4% for positive sentiment, 100% for negative sentiment) [43]. The tweets to be analyzed and instructions with codebook and detailed definitions (including example tweets) were provided to the CrowdFlower contributors via the online CrowdFlower platform. All tweets were coded by at least three people. Sentiment codes were a Likert scale: 1=strongly negative, 2=slightly negative, 3=neutral/unknown, 4=slightly positive, 5=strongly positive. The presence of topics/themes of interest was coded as yes/no. A set of 108 tweets (from the total 2285 tweets) coded by two trained members of the research team was considered gold standard and these were used as test questions for the CrowdFlower contributors. Only coders who scored highly on a subset of the test sample questions could begin the project. Gold standard tweets were also intermingled throughout the tweets in order to monitor coder performance throughout the project. Coders who did not perform well were dropped from the project, all prior codes from those coders were discarded, and new coders were assigned in their place.

Because tweets were coded by multiple coders, the numeric values for sentiment coding were first averaged and then collapsed into negative (values 1 to 2.4), neutral/unknown (values 2.5 to 3.4), and positive (3.5 to 5.0). For the yes/no items, the response from the most "trusted" coder (based on coding accuracy compared to gold standard questions) was chosen; when "trust" scores among the coders were close, the most popular response was chosen. Based on our own coding of 108 test questions compared to final codes from CrowdFlower contributors, overall level of agreement was high. Percent agreement was 91% for sentiment, and ranged from 76% to 100% for topic codes (76% was for the joke/humorous code, which would be expected to have lower agreement due to the subjective nature of the code).

Hashtags (symbol #) are used before a relevant keyword or phrase in a tweet to categorize the tweet so that people can find them more easily in their Twitter search. We also extracted tweets that included hashtags and two members of the research team coded the hashtags as being related to marijuana or not related to marijuana.

Demographics of Followers

We used "Demographics Pro for Twitter" [44], described in detail below, to report on the predicted demographic characteristics of followers of @stillblazingtho and the characteristics of the average Twitter user. Inferred characteristics of followers included geographic location, gender, marital status, age, race, income, occupation, other likes and interests, and other Twitter handles followed. We also report on the followers' level of Twitter activity (eg, number of tweets/day, number of handles followed, number of their own followers), which is not inferred or predicted but rather taken from explicit Twitter data or metadata.

Inferred demographics data on current followers of @stillblazingtho on December 9, 2013 at 2:30pm EST were obtained from Demographics Pro [44], which provides analysis of followers of Twitter accounts for a fee. Demographics Pro estimates demographic characteristics based on Twitter behavior/usage, relying on multiple data signals from networks (signals imparted by the nature and strength of ties between individuals on Twitter), consumption (consumption of information on Twitter revealed by accounts followed and real-world consumption revealed by Twitter usage), and language (words and phrased used in tweets and bios). A random sample of 50,000 followers of @stillblazingtho was analyzed, regardless of whether they posted or commented to @stillblazingtho. The data signals were filtered and amplified using large proprietary knowledge bases of established correlations between data points and demographic characteristics. The multiple amplified signals were combined using a series of algorithms to estimate or infer the likely demographic characteristics. Demographics Pro has used their methodology to profile some 300 million Twitter users to date. The methodologies used in the prediction of demographic characteristics

of Twitter followers include big data, natural language processing, entity identification, image analyses, and network theory. Demographics Pro requires confidence of 95% or above to make an estimate of a single demographic characteristic [44]. For example, if 10,000 predictions are made, 9500 would need to be correct in order to accept the methodology used to make the prediction. The success of the Demographics Pro analytic predictions relies on the relatively low covariance of multiple amplified signals. Iterative evaluation testing the methodologies on training sets of established samples of Twitter users with verified demographics allows the calibration of balance between depth of coverage (the number of demographic predictions made) and required accuracy. The size of these established samples of Twitter users with verified demographics varies from 10,000 to 200,000 people depending on the specific demographic characteristic to be inferred. For comparison purposes, Demographics Pro also reports the distributions of the median average and inter-quartile range [IQR] for follower demographic characteristics across a sample of approximately 250,000 Twitter accounts from 10 million Twitter accounts analyzed by Demographics Pro. Inter-quartile ranges are not presented for age or income because the median averages for these categorical variables are weighted so that the sum of the weighted medians over all categories totals 100%.

Characteristics of @stillblazingtho followers were descriptively compared to the median average of the characteristics distributions for Twitter users. Finally, we also report on the popularity of the @stillblazingtho Twitter account within demographic groups based on rankings by Demographics Pro. To examine the popularity of the Twitter handle of interest within demographic groups, Demographics Pro ranks a subset (approximately 250,000 handles with 1000 or more followers) of the 10,000,000 Twitter handles they have analyzed by number of followers within specific demographic groups.

Results

Tweet Engagement, Sentiment, and Content

A total of 2590 tweets (2285 regular tweets and 305 replies) were sent from @stillblazingtho from May 1, 2013 to December 31, 2013 (average of 11 tweets per day). The Klout score for @stillblazingtho was 77.8. Regarding engagement, there were a total of 1,964,908 retweets of @stillblazingtho tweets and 135,797 replies to @stillblazingtho during the 8-month time period. Total potential impressions, or total number of times a tweet from @stillblazingtho or a tweet mentioning @stillblazingtho appeared in someone's Twitter feed, was 2,898,866,761 during the 8-month period.

Qualitative analysis was performed on the 2285 regular tweets sent from @stillblazingtho (305 replies representing 11.78% of total tweets were excluded). Of these tweets that excluded replies, 1875 (82.06%) were positive about marijuana, 403 (17.64%) were either neutral in sentiment or were not specifically about marijuana, and 7 (0.31%) appeared negative about marijuana. Percentages for sentiment of tweets included in the qualitative analysis (excluding replies) and also among total tweets (including replies) are presented in Table 1.

The distribution of specific topics for the positive marijuana tweets along with example tweets are presented in Figure 2. Most of the positive marijuana tweets were viewed as jokes or humorous (1101/1875, 58.72%) followed by tweets that implied that marijuana helps you to feel good, relax, or chill (340/1875, 18.13%); 15.68% (294/1875) of the tweets mentioned routine, frequent, or heavy use, and 193 (10.29%) mentioned blunts, marijuana edibles, or paraphernalia (eg, bongs, vaporizers). Approximately 186 (9.92%) of the 1875 positive marijuana tweets mentioned other risky health behaviors (eg, tobacco, alcohol, other drugs, sex). Additional results are shown in Figure 2.

Of the 403 neutral tweets, 70 (17.4%) were inspirational or motivational quotes/messages and 58 (14.4%) were jokes/humorous; for example, "If you are always worried about what others think of you, you will never be happy" or "Sitting there wondering why someone hasn't texted you back, and realizing you never

finished sending the message". Examples of the seven negative tweets include, "If you smoke weed to be cool, you're a fucking loser" or "I know too many people who have died from drug overdoses. When the fuck are people going to learn #RIP".

Of the total 2590 tweets sent from @stillblazingtho, 135 (5.21%) contained the use of a hashtag. Only 26 (19.26%) of these hashtags were marijuana specific (eg, #weed, #staystoned, and #stayhigh), while tweets including general hashtags that were non-marijuana related were 109 (80.74%) (eg, #ThingsIWillTeachMyChild, #firstdayofsummer, and #TheSecretToLifeIs).

Demographics of @stillblazingtho Followers

Characteristics of @stillblazingtho followers, other than Twitter activity (eg, tweets per day, number of followers, number of accounts followed), were inferred by Demographics Pro. Of the 959,143 followers of @stillblazingtho, 759,407 (79.17%) were in the United States, 60,211 (6.28%) in the United Kingdom, 41,716 (4.35%) in Canada, and <1% in each of South Africa (n=5460; 0.88%), Netherlands (n=7785; 0.81%), and Mexico (n=6885; 0.72%). Within the United States, @stillblazingtho was in the top 20% of all Twitter accounts. The Twitter followers were active: 34.01% (326,242/959,143) had >5 tweets/day and 36.71% (352,148/959,143) had 1-5 tweets/day. Approximately 82.19% (788,310/959,143) followed a total of 101-1000 of Twitter accounts, and 68.34% (655,489/959,143) of users had a high number of their own followers (101-1000). A total of 54.03% (518,184/959,143) of @stillblazingtho followers were female, which is similar to the Twitter median average (52.6%, IQR 40.7-67.6%). Approximately 81.14% (778,240/959,143) of the followers were single, compared to the Twitter median average of only 38.1% (IQR 9.5-75.1%).

Followers of @stillblazingtho were younger than the Twitter median average age distribution (Figure 3). Most followers of @stillblazingtho were 17-19 years old (518,430/959,143; 54.05%); 18.84% (180,673/959,143) were 16 years old or younger, 22.0% (210,799/959,143) were 20-24 years old, and only 5.11% (49,047/959,143) were 25 years old or older. The Twitter median average age distribution was: 14.2% were 16 years old or younger, 17.8% were 17 to 19 years old, 21.4% were 20-24 years old, 16.0% were 25-29 years old, 15.8% were 30-39 years old, 11.2% were 40-49 years old, and 3.5% ≥50 years old. Among people aged 17 to 19 years, @stillblazingtho was in the top 10% of all Twitter accounts followed.

More followers of @stillblazingtho in the United States were African American (323,107/759,407; 42.55%) or Hispanic (90,732/759,407; 11.95%) than the Twitter median average (African American 22.4%, IQR 5.1-62.5%; Hispanic 5.4%, IQR 3.0-10.8%) (Figure 4). Among Hispanics, @stillblazingtho was in the top 30% of all Twitter accounts followed. Personal income among all followers of @stillblazingtho was somewhat lower than the Twitter median average, with 93.53% (897,041/959,143) under US$30,000 per year (Twitter median average 76.9% under $30,000 per year).

More @stillblazingtho followers were students (267,855/959,143; 27.93%) and musicians (205,967/959,143; 21.47%) than the Twitter median average (9.1% students, IQR 4.9-15.0%; 8.2% musicians, IQR 3.3-17.7%). Among students and musicians, @stillblazingtho was in the top 10% and top 20%, respectively, of all Twitter accounts. Music (290,228/959,143; 30.26%) and basketball (274,514/959,143; 28.62%) were the most common interests of @stillblazingtho followers, compared to Twitter median averages of 14.0% music (IQR 9.0-22.9%) and 10.1% basketball (IQR 4.6-19.7%). Many followers of @stillblazingtho also followed rappers and recording artists such as Wiz Khalifa (453,477/959,143; 47.28%), Drake (327,645/959,143; 34.16%), Lil Wayne (323,616/959,143; 33.74%), Mac Miller (277,592/959,143; 28.94%), Nicki Minaj (256,961/959,143; 26.79%), Rihanna (248,927/959,143; 25.95%), and Eminem (234,884/959,143; 24.49%). Twitter median averages for the above recording artists ranged from 7.0% (for Mac Miller, IQR 4.9-8.8%) to 12.6% (for Rihanna, IQR 5.6-24.5%).

Discussion

Principal Findings

The @stillblazingtho is a popular Twitter handle with approximately 1 million followers. This Twitter handle sends an average of 11 tweets per day, the vast majority of which promote marijuana use. Most tweets generated from @stillblazingtho contain humorous content about marijuana use followed by tweets that suggested that marijuana helps you to feel good, relax, or chill. This Twitter handle encourages favorable attitudes toward marijuana by distributing a high number of tweets normalizing the routine use of marijuana and promoting its relaxation effects. It additionally engages followers about pro-marijuana culture by tweeting about such content as marijuana edibles (eg, recipes for brownies) and paraphernalia commonly used to smoke marijuana, like bongs and vaporizers. Tweets that minimize the harmful effects of marijuana use and associate its use with health benefits and/or stronger peer relationships are also distributed by @stillblazingtho. In addition, tweets that encourage the legalization of marijuana are sent by this Twitter handle, but this is done to a lesser degree. While tweets from @stillblazingtho comprised a number of themes and topics, most tweets were alike in their overarching positive sentiment toward marijuana use.

The majority of the followers of @stillblazingtho who are being exposed to this pro-marijuana content are predicted to be under 20 years of age (approximately 73%) and 19% are under 17 years old. The average age at which marijuana use begins in the United States is currently at 17.9 years old [27]; therefore, our results call attention to the majority of Twitter followers of @stillblazingtho who are either approaching or are very near the average age at which marijuana use is first initiated. Moreover, young people are especially responsive to social media influences and often establish substance use patterns during this phase of development [19-21]. Thus, it is of concern that so many youth and young adults are following a Twitter handle that depicts marijuana use as a popular and normal social activity. In addition, past research has found that young Twitter users can become exposed to tweets promoting alcohol use via interactive features such as hashtags on other unrelated sites [45-46]. The extent of hashtags in tweets from @stillblazingtho was relatively low. Nevertheless, the inclusion of general hashtags (non-marijuana related) in any of the tweets sent by this Twitter handle have the potential to reach a much wider audience of youth and young adults beyond the followers that we analyzed in the current study.

Another primary finding of our study is that African American and Hispanic Twitter users disproportionately follow @stillblazingtho versus Caucasians. This finding signals a disparity in exposure to social media promoting marijuana use in that the pro-marijuana tweets delivered by this handle are disproportionately consumed by minority Twitter users. Our findings match concerning differences in marijuana use by race/ethnicity reported in previous studies [47-49]. The frequency of marijuana abuse and dependence among African American adults is about twice the rate of Caucasians and Hispanics [50]. With regard to Hispanics, marijuana abuse and dependence rates are closer to the rates of Caucasians, but the latest reports show that Hispanic youth now have the highest rates of marijuana use versus Caucasians and African Americans [51]. Accordingly, our findings underscore the critical need to improve understanding on how African Americans and Hispanics engage with social media outlets like Twitter in ways that may exacerbate their marijuana use.

The @stillblazingtho followers receive pro-marijuana use content from this Twitter handle and could be receiving similar marijuana-related content from other handles. For instance, many of the @stillblazingtho followers are alike in that they follow the same celebrity Twitter handles. One or more of these celebrities could also be tweeting favorably about recreational marijuana use. To illustrate this point, we provide a sample tweet from Wiz Khalifa who is a recording artist followed by many of @stillblazingtho followers (47.3%). On February 8, 2014, Wiz Khalifa tweeted, “Those who don’t understand the beauty of weed, purchasing weed, rolling and sharing of weed are outsiders and have no business in our world.” This tweet

demonstrates the likelihood for pro-marijuana content to be distributed by multiple Twitter handles to a cluster of followers. A study of all the pro-marijuana content that is being consumed by the followers of @stillblazingtho is beyond the scope of this study; nevertheless, it is important for public health professionals to consider all of the tweets and Twitter handles that promote harmful norms toward substance use and are connecting with young people. Prevention efforts can use this information to connect with Twitter users in a strategic and meaningful way. One such strategy would be for public health professionals to consider partnering with a popular celebrity who is willing to tweet health promoting messages about the harms associated with marijuana use. Likewise, many of the followers of @stillblazingtho are students and/or musicians, and have interests in music and basketball. Perhaps, these data could be used to distinguish persons who are at increased risk for marijuana use and/or to identify appropriate settings where marijuana use prevention messages could be delivered (eg, music concerts).

Limitations

Some limitations should be considered when interpreting the results. First, demographics of followers are not actual reported demographics but rather inferred based on Twitter behavior/usage. However, Demographics Pro uses sophisticated methodology (reported in the Methods section) to make such inferences and requires confidence of 95% or above to make an estimate of a single demographic characteristic [44]. Second, we report on only one of many marijuana-related Twitter handles. Demographics of other specific marijuana-related handles could differ from the one we chose to analyze. Nevertheless, we reported on a very popular marijuana-related Twitter handle, whose followers greatly outnumbered those of other handles. Our study did not examine Twitter marijuana discourse in a general way, where both favorable and unfavorable tweets are considered in analysis. Such a study would entail a data collection and analysis of countless tweets that contain any and all marijuana-related terms, and is beyond the scope of our study. We nevertheless encourage future studies to work toward understanding marijuana-related communication on Twitter utilizing a more general approach where both favorable and unfavorable content is considered. Finally, we have no way of inferring whether followers of @stillblazingtho are themselves marijuana users or are non-marijuana users. Non-marijuana users might be different from marijuana users in their reasons for following @stillblazingtho; it is, therefore, challenging to make broad-stroke conclusions about why the followers of @stillblazingtho have opted to receive tweets from this handle.

Conclusions

Despite these limitations, our results stress the need for continued research and surveillance on the pro-marijuana content that is currently being delivered via Twitter. We found that youth and young adults as well as minority Twitter users are disproportionately more likely to follow @stillblazingtho, which is a popular Twitter handle that distributes a high number of tweets encouraging favorable attitudes toward marijuana use. Our findings provide a snapshot of the pro-marijuana content that is reaching young people. Twitter use has expanded exponentially, especially among youth and young adults; therefore, an improved understanding of the discourse on Twitter that encourages marijuana use can be helpful for tailoring and targeting online and offline prevention messages.

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Abbreviations

IQR	inter-quartile range
MPM	Media Practice Model

Footnotes

Conflicts of Interest:

Conflicts of Interest: Dr Bierut is listed as an inventor on Issued US Patent 8,080,371,“Markers for Addiction” covering the use of certain single nucleotide polymorphisms (SNPs) in determining the diagnosis, prognosis, and treatment of addiction.

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Figures and Tables

Figure 1

Profile summary of Weed Tweets @stillblazingtho.

Figure 2

Topic/theme	Pro-marijuana (N=1,875) n (%)	Example Tweets	
Joke/humorous	1,101 (58.72)	Happy Hump Day. Get high and hump someone.	Facebook makes me hate people I actually know. Twitter makes me want to smoke a lot of blunts with people I've never met.
Marijuana helps you to feel good, de-stress, relax, chill out	340 (18.13)	Stress can pull you down, but weed can lift you right back up.	A little herb can calm a lot of nerve.
Frequent, regular/routine, or heavy marijuana use	294 (15.68)	I need a joint. Or two. Or three.	Weed is my morning cup of coffee.
Blunts, marijuana edibles, or paraphernalia (e.g., bongs, vaporizers)	193 (10.29)	If at first you don't succeed, roll a blunt and smoke some weed.	
Other risky health behaviors (tobacco, alcohol, other drugs, sex)	186 (9.92)	Drugs tear friends apart. Weed brings them closer.	The best thing about getting high and having sex. Is getting high and having sex.
Inspiring or motivational message/quote	150 (8.00)	"Herb is the unification of mankind." — Bob Marley	Truth pic.twitter.com/4yyFmz2bt0 
Friendship/getting along when using marijuana	140 (7.47)	Relationships are better if there's weed involved.	"You smoke?" "Smoke what?" Boom, new friendship.
Marijuana is not harmful or dangerous.	94 (5.01)		Fast food kills more people than weed.
You can smoke marijuana and still be successful	92 (4.91)	Fact: You can be an educated, intelligent person and still smoke marijuana.	You can succeed & smoke weed.
Encourages legalization	83 (4.43)	Honestly though, just legalize weed already.	An accurate map of the U.S. pic.twitter.com/7eokchiasN 
Health benefits or medical marijuana use	30 (1.60)	Weed is my sleep medicine.	Marijuana saves lives. #medicine

Topics and themes present in positive marijuana Tweets.

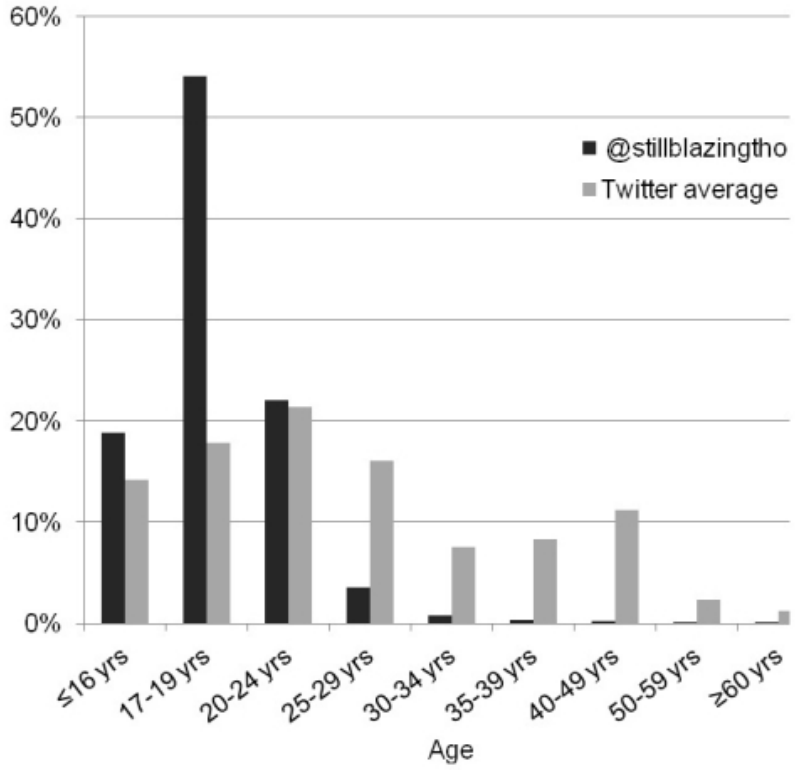
Table 1

Characteristics of "Weed Tweets @stillblazingtho" tweets, 5/1/2013-12/31/2013.

Sentiment of tweets[a]	Total tweets	Replies	Tweets excluding replies
	n=2590	n=305	n=2285
n (%)	n (%)		n (%)
Positive	1875 (72.39)	-	1875 (82.06)
Neutral	403 (15.56)	-	403 (17.64)
Negative	7 (0.27)	-	7 (0.31)

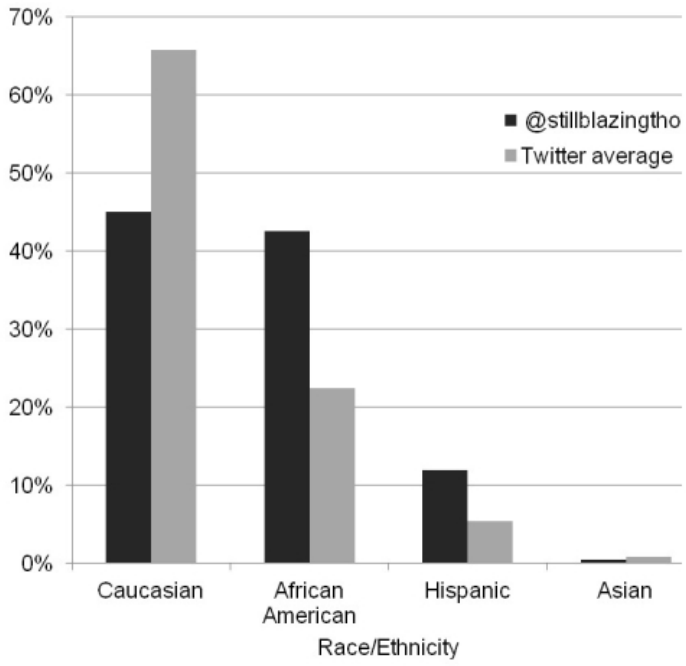
[a]Sentiment of tweets was determined only for regular tweets. Direct replies were excluded because the context of the conversation was difficult to determine without additional information.

Figure 3



Age distribution of @stillblazingtho followers and Twitter median average.

Figure 4



Race/ethnicity distribution of @stillblazingtho followers and Twitter median average.

Cognitive Harms Associated with Regular Adolescent Marijuana Use

Timmen Cermak, MD

Executive Summary

Most people use marijuana because it affects their brains, producing a pleasing mental experience. Social and recreational use fall into this category. Because the human brain is still developing throughout adolescence, until approximately one's mid-20's, the impact of marijuana is greater on the adolescent brain; and, regular marijuana use presents a significantly greater hazard for adolescents than for adults.

Brain maturation during adolescence makes the developing brain more vulnerable to cannabinoid effects on both structure and function. Heavy or regular marijuana use, especially before age 18 is often associated with negative consequences not routinely found in occasional users. The effects are dose-dependent, with more subtle and transient impacts in less heavy users. Major youth risk factors appear to be early age at onset of use, regular or heavy use, and total dose over many years.

The primary effects of importance to adolescents involve reduced working memory, reduced higher order executive functions (abstraction, sequencing, reasoning, judgment, task flexibility, problem solving, planning and execution) and impacts on emotion. Alterations in the structure and activity of areas of the brain underlying these mental functions (the hippocampus, frontal lobes and amygdala) have been found in humans. Adolescents are more sensitive to these effects of marijuana and recover from them more slowly once abstinence occurs.

The impact of regular marijuana use on cognitive functions in adolescents can have a major negative effect on academic performance whether DSM-V diagnostic criteria for Cannabis Use Disorder (CUD) have been met or not. Neither a safe dose nor a definitely harmful dose of marijuana has been determined for adolescents.

Several important caveats must be considered when evaluating research on cannabis effects on neurological development and on higher brain functions. First, most functional and neuroimaging studies describe differences between marijuana users and matched control groups that do not use marijuana. Such studies have generally not tracked individual changes over time, or brain-imaged what is recovered after abstinence.

Second, prospective studies that follow individuals over many decades of neurodevelopment and maturation are rare. At this time they are best established in Australia and New Zealand. These prospective cohort studies to date have assessed cognitive functions more than imaging or brain structure.

Although findings are still many years away, the National Institute of Health (NIH) has begun a large 10 year prospective Adolescent Brain and Cognitive Development (ABCD) study to answer

many of the unanswered questions about neurodevelopment under the impact of marijuana and other drug use.

> The ABCD Study is a national longitudinal study that will assess the short- and long-term impact of substance use on brain development. The project will recruit 10,000 youths before they begin using alcohol, marijuana, tobacco and other drugs, and follow them over 10 years into early adulthood. ABCD Study investigators will use advanced brain imaging as well as psychological and behavioral research tools to evaluate brain structure and function. The study will track substance use, academic achievement, IQ, cognitive skills and mental health over time.
>
> *(http://addictionresearch.nih.gov/adolescent-brain-cognitive-development-study)*

Scientific research presents a coherent pattern across many levels. Regular, heavy adolescent marijuana users do not perform academically as well as nonusers. Cognitive functions important for academic performance, especially memory and higher order executive functions, are consistently shown to be reduced by heavy marijuana use. Physiological and structural changes are found in areas of the brain sub-serving memory and executive functions in heavy marijuana users. No single piece of evidence is as concerning as the overall pattern running through structure, function and performance in the real world consistently found in regular, heavy adolescent marijuana users.

Conclusions:

Sufficient research data currently exists to support the following conclusions:

- Cannabis dependence is most commonly a self-limiting problem; and, most youth show a "maturing out" effect in decreasing use in their 20's and 30's. The risks of addiction are exaggerated by "lifetime" metrics quoted in many discussions; and, regular and heavy use markers are better indicators for possible marijuana-related problems.
- The risks to educational progress are greater than the risks of addiction. The harms done to education are often greater than the harms done to the brain. The impact of regular marijuana use on cognitive functions in adolescents is likely to have a major negative effect on academic performance, leading students to perform beneath their natural capacity, whether DSM-V criteria for Cannabis Use Disorder have been met or not.
- Major youth risk factors from marijuana appear to be age at onset of use, regular or heavy use, and total dose over many years.
- Ongoing brain maturation in adolescence makes youth more vulnerable to cannabinoid effects on both structure and function. Youth marijuana use before age 18 appears to be the most vulnerable period.
- Heavy, regular marijuana use is often associated with negative consequences not found with occasional use. Effects are dose-dependent, with more subtle impacts in less heavy users.
- Neither a safe dose nor a definitely harmful dose of marijuana has been determined for adolescents.
- Marijuana use by adolescents carries sufficient risk to warrant marijuana tax revenue support for increased availability of cognitive/learning assessments, drug education, and counseling services in high schools.

Review of Scientific Data

Adolescent Neurodevelopment:

The details of brain development in adolescence are an area of active research [1] and there is already clear evidence that the endocannabinoid system plays a significant role in normal neural development [2] and connectivity patterns [1, 3, 4].

The January 2015 American Academy of Pediatrics (AAP) technical report, *The Impact of Marijuana Policies on Youth: Clinical, Research, and Legal Update*, describes the significance of adolescent neurodevelopment in the following manner [5]:

> New research on adolescent brain development has found that brain maturation, particularly that of the prefrontal cortex, proceeds into the mid-20s. This maturation includes substantial changes in specialization and efficiency, which occur through myelination and synaptic pruning. Synaptic pruning or refining consists of a reduction in gray matter, primarily in the prefrontal and temporal cortex areas and in subcortical structures through the elimination of neural connections [6-8]. Increased myelination also occurs, which allows increased neural connectivity and efficiency and better integrity of white matter fiber tracts [9, 10]. The prefrontal lobes are the last areas of the adolescent brain to undergo these neuro-maturational changes, which, when complete, allow more efficient communication between the higher-order areas of the brain and the lower-order sensorimotor areas [11, 12].

The AAP Technical Report [5] summarized studies of regular marijuana use during adolescence as showing poorer performance "on tests of working memory, visual scanning, cognitive flexibility, and learning [13]." Furthermore, "the number of episodes of lifetime marijuana use reported by subjects correlated with overall lower cognitive functioning [14]." The strongest and most consistent evidence of memory deficits is marijuana's impact on episodic memory (the autobiographical memory of specific events, situations, and experiences), which remains adversely impacted for up to 28 days following monitored abstinence [15-17].

School Performance and Adult Income:

One consequence of daily or near-daily cannabis use is that adolescents will experience cognitive impairment on a continuous basis and this impairment is highly associated with lower educational attainment [18] Nora Volkow, Director of the National Institute of Drug Abuse (NIDA) summarizes cognition data by asserting that "Since marijuana use impairs critical cognitive functions, both during acute intoxication and for days after use, **many students could be functioning at a cognitive level that is below their natural capability for considerable periods of time** [emphasis added]." [19]

A 2014 study based on three large prospective cohorts in Australia and New Zealand (n=2,537-3,765) found "clear evidence of a dose-response association in which increasing frequency of adolescent cannabis use was associated with declining rates of high-school completion and degree attainment, and increasing risks of cannabis dependence, other illicit drug use, suicide attempt, depression, and welfare dependence." [20]

Silins investigated the association between the maximum frequency of cannabis use before age 17 years and developmental outcomes assessed up to age 30 years. Individuals who were daily users before age 17 years had odds of high-school completion that were 63% lower than those who had never used cannabis [20-22].

The consequences of heavy marijuana use are also found in economic disparities. Pope found that heavy marijuana users (5,000 times) were 50% more likely to earn less than their parents [18]. Fergusson found that individuals who used marijuana 400+ times between 14-21 earned 76% of the average income of non-users at 25 years old [23]. And, Brook found that only 36% of chronic marijuana users had achieved financial independence at age 29 compared to 58% of those who had never used marijuana [24].

An important caveat whenever discussing problematic youth behavior is to recognize that "at-risk" youth usually experience multiple stressors, including poverty, physical and sexual abuse, hunger, living in an environment of violence and racism, to list only a few. In addition, a child's ability to succeed in school depends, to a great extent, on factors affecting the child's life well before the child begins school. Marijuana use never exists in isolation from other behaviors and constitutes only one risk factor for impaired learning. It is extremely difficult to tease out cause and effect for complex problems. However, the association between heavy marijuana use and social and educational difficulties is real and strong. Marijuana policy reform has the opportunity to partially mitigate this early-onset risk factor by preferentially allocating tax revenues for school-based services and outreach support for school dropouts rather than merely to universal educational drug prevention campaigns (e.g., public service announcements, school presentations, and billboards).

Lynskey [21, 22] acknowledges the complexity of at-risk youth when he writes that the link between early cannabis use and educational attainment…

> arises because of the social context within which cannabis is used. In particular, early cannabis use appears to be associated with the adoption of an anti-conventional lifestyle characterized by affiliations with delinquent and substance using peers, and the precocious adoption of adult roles including early school leaving, leaving the parental home and early parenthood.
>
> Early cannabis use shares a common set of risk factors (such as, social disadvantage, family problems, familial conflict and parental drug and alcohol problems) with a wide range of adverse social outcomes, such as delinquency, early sexual activity, teenage pregnancy, depression and attempted suicide. This suggests that efforts to prevent cannabis use should be part of broadly targeted strategies rather than the sole focus of a specific intervention [21].

It is important to avoid politically divisive either/or frameworks in favor of a more nuanced mutually interacting both/and perspective. By analogy, the question of whether the chicken or the egg came first is an either/or framework that works against a deeper understanding that both the hen and the egg are necessary for the chicken species to exist. In other words, social context certainly increases the risk of heavy marijuana use, and heavy marijuana use can compromise the ability to cope effectively with disadvantageous social contexts.

IQ Studies*:*

The media has paid considerable attention to a recent long-term study of the impact of marijuana use on IQ but often without correctly interpreting the study's results.

Dunedin Birth Cohort: Decrements in executive functions measured as components of IQ were shown to be diminished at age 38 in Meier et al.'s often-quoted study of persistent heavy marijuana users in a Dunedin, New Zealand birth cohort of 1,037 children, *but only if their heavy use began in early adolescence* and continued into adulthood [25]. IQ scores are composed of multiple sub-tests and the overall score decrements were composed of reductions in scores in five areas:

- Executive functioning
- Working memory
- Processing speed
- Perceptual reasoning
- Verbal comprehension

Deficits were found to persist after cessation of use for over one year. General IQ scores were diminished an average of 6 points (and 8 points for the earliest marijuana users) at age 38, but both adolescent onset and almost two decades of persistent cannabis use may be needed to obtain the magnitude and pervasiveness of long-term neuropsychological deficits reported by Meier et al. "In fact, adult-onset cannabis users did not appear to experience IQ decline as a function of persistent cannabis use. " [14]

Avon Longitudinal Study: Not all studies find the same results. In 2014, a large U.K. study (The *Avon Longitudinal Study of Parents and Children*, based on data from 2,235 children born in the Bristol area in 1991 or 1992) tested IQ at age 8 and again at age 15 [26]. The researchers found that there was no relationship between cannabis use and lower IQ at age 15, but that heavier cannabis users (50 times or more by age 15) showed marginally impaired educational abilities as manifested by 3% lower school exam results at age 16.

Unfortunately, the *Avon Longitudinal Study* is not comparable to the Dunedin Study. Meier et al.'s finding was that adults with long-term dependence on cannabis starting during adolescence and continuing 4 or more times per week during the 20 years after adolescence had lost IQ points by age 38. Those who lost the most IQ points were those who had started their cannabis use youngest. There is no reason to expect that teens who have used cannabis only 50 times would already show a loss of IQ points by age 15. The ALSPAC study would need at least 20 more years of follow up, and data on cannabis dependence, before it could be compared to the Dunedin Study [personal communication with Madeline Meier, Feb 2015]. For the time being, the Dunedin Study cannot be considered conclusive, and the planned ABCD US study will not replicate it. It is, however, important evidence that fits consistently into the implications of research reviewed in this briefing.

Psychosis:

Although not strictly a cognitive impact from marijuana, psychotic symptoms characteristic of schizophrenia have been reported in marijuana users. The lifetime rate of schizophrenia in the general population is ~1% [27] and meta-analyses of prospective studies have found a roughly two-fold increase in the incidence of schizophrenia and/or schizophrenia-like psychotic symptoms associated with cannabis use [28-30] A dose response effect has been demonstrated [31-33], and use in adolescence has been associated with the greatest risk [34].

The relationship between schizophrenia and cannabis use can currently only be described as an association. Whatever cause and effect relationship may exist is likely bi-directional, although the proportion in either direction is not clear. Luisa Degenhardt a long-term investigator of this interaction, concluded in 2002 that,

> The evidence is more consistent with the hypotheses that cannabis use may precipitate psychosis among vulnerable individuals, increase the risk of relapse among those who have already developed the disorder, and may be more likely to lead to dependence in persons with schizophrenia." [35]

By 2006 Degenhardt's perspective had evolved further,

> A contributory causal relation is biologically plausible because psychotic disorders involve disturbances in the dopamine neurotransmitter systems with which the cannabinoid system interacts…. It is most plausible that cannabis use precipitates schizophrenia in individuals who are vulnerable because of a personal or family history of schizophrenia. [36]

This area of research is likely to remain fluid for the foreseeable future. Although the onset of schizophrenia can be devastating for the individuals and families involved, a potential doubling of a very low prevalence rate is unlikely to arouse sufficient public concern to significantly influence the current debate regarding marijuana policy reform.

Marijuana's Impact on Brain Structure & Mental Function:

A variety of measureable differences in cognitive functions and brain structure have been observed in marijuana users, especially in youth and in long-term heavy (daily, or almost daily) users [37-40], and especially in those with the earliest onset of marijuana use (before age 18). Exogenous cannabinoids appear to interact with the adolescent developing brain in ways that no longer occur in adults.

Human and animal studies reliably find anatomic differences compared to control subjects in several important brain structures when exposed to frequent marijuana stimulation. Studies also reliably find deficits in important mental functions associated with the altered brain structures. Functional impacts involve affect, temperament and dependence in addition to more easily measureable impacts on memory and cognition.

Three brain areas (hippocampus, frontal cortex and amygdala) with high concentrations of cannabinoid CB1 receptors appear to underlie most of the cognitive and affective impacts of heavy marijuana use. Regular use of marijuana reduces (down-regulates) CB1 receptors significantly [41-44], decreasing the normal cannabinoid tone and diminishing learning, memory and executive functions.

The Hippocampus and Memory:

Acute Effects: Short-term memory problems are among the most frequently self-reported consequences of cannabis use and are commonly cited as the reason for attempting to quit or reduce cannabis use [17]. While memory deficits are often the subject of numerous jokes and anecdotes about marijuana users, Fisk and Montgomery [45] have documented the reality of deficits in real-world measurements of everyday memory, cognitive failures and prospective memory in young adults consuming a mean of 4.5 joints per week for a mean of 4 years. In another

real world context, adult cannabis users exhibit poorer working memory than controls at the start of the work week, but only if they had used in the previous 24 hours [46].

Ranganathan and D'Souza detailed the acute effects of THC on memory as a transient deficit in

> …immediate and delayed free recall of information presented after, but not before, drug administration in a dose- and delay-dependent manner. In particular, cannabinoids increase intrusion errors. These effects are more robust with the inhaled and intravenous route and correspond to peak drug levels. This profile of effects suggests that cannabinoids impair all stages of memory including encoding, consolidation, and retrieval. [47]

Decrements in short-term, or working memory, defined as the ability to manipulate small amounts of information for a short period of time in order to facilitate a goal has been linked to lower academic performance[16]. Substantial impairment in working memory is found in treatment-seeking youth with primary cannabis dependence [48] Decreased learning, memory and the executive functions discussed below almost certainly make a major contribution to the reduced educational achievements documented in regular marijuana users.

Long-Term Effects: A review of the long-term effects on memory were reported by Solowij and Montgomery [17] as "not dissimilar to those associated with acute intoxication." Solowij's research shows that long-term cannabis users performed more poorly on tests of memory and attention than shorter-term users and controls, between which she found no difference. Decrements, but not severe problems, were found in learning, retention, and retrieval for chronic users with a mean of 24 years, but not 10 years. "The fact that the frequency of use was near daily among long- and shorter-term users suggests that the duration of cannabis use is a more salient contributor to the development of cognitive impairment than quantity or frequency of use."

Memory and Abstinence: Memory decrements after discontinuation of marijuana use do not appear to be permanent. Pope et al. [18] studied heavy cannabis users (5000 times) compared to individuals who had smoked no more than 50 times. Heavy users exhibited significant deficits on memory of word lists on Days 0, 1, and 7 of abstinence, but by Day 28 the differences between users and controls had narrowed and were mostly non-significant. He concluded that one consequence of ongoing daily or even near-daily cannabis use is that individuals will "effectively experience cognitive impairment on a continuous basis [and] this impairment might contribute to the lower educational attainment and household income of heavy cannabis users."

In a study of college students after a supervised overnight period of abstinence, heavy users (median of 29 out of the previous 30 days) showed decreased mental and reduced learning, as seen on the California Verbal Learning Test compared to light users (median of 1 time in the previous 30 days) [49].

Verbal Learning: Solowij [17, 50] compared performance indices from one of the most widely used measures of learning and memory—the *Rey Auditory Verbal Learning Test*—in adolescents aged 16–20 who were cannabis users, alcohol users and non-user controls matched for age, education and premorbid intellectual ability (assessed prospectively). Cannabis users performed significantly worse than alcohol users and non-users on all performance indices. They recalled significantly fewer words overall, demonstrating impaired learning, retention and retrieval The adolescent cannabis users learned fewer words across the five learning trials, recalled significantly fewer words in total over the five trials and after interference and a delay, forgot more words after interference and delay, and recognized fewer words from a less well-learned list than both alcohol users and controls.

The degree of impairment was associated with the duration, quantity, frequency and age of onset of cannabis use. Despite relatively brief exposure (less than 2.5 years on average), adolescent cannabis users relative to their age-matched counterparts demonstrated similar memory deficits to those reported in adult long-term heavy users. Light users who consumed on average 1.5 joints four times/month, did not exhibit impaired performance relative to alcohol users and non-users of any substance. The heavier cannabis users "were not seeking treatment, were not dependent on cannabis, nor were they using on a daily basis or particularly heavily; average use was approximately 3 days per week, 17.5 joints per month, equating to approximately 1.25 joints on each occasion of use. Our results show that this level of use (but not use at once/week) was sufficient to produce memory decrements in adolescents" [50]. The fact that the young cannabis users within the current study, with their far lesser exposure to cannabis (an average 2.4 years), showed similar significantly impaired performance relative to their age-matched counterparts as adult users with 24 years use, suggests indeed greater adverse effects of cannabis use on the developing brain [50].

Young adolescents are not only more quickly impacted by marijuana than adults; the impact also lasts longer after stopping use [51]. Schwartz demonstrated that 14-16-year-olds fail to show significant improvements in short term memory after 6 weeks of abstinence [51, 52] in contrast to Pope's finding recovery of 61% of the decrement in 7 days and complete recovery from memory decrements by day 28 [53]

Hippocampal Brain Volumes: Most people are more interested in the functional impacts of cannabis than on how marijuana alters the anatomy and physiology of the hippocampus – the brain structure most directly involved in memory and learning. Changes in hippocampal volume are the most consistently reported findings in a review of structural brain alterations in cannabis users. Long-term heavy cannabis users (most days of the week for 20 years) [42] sustain significant dose-related reductions in hippocampal volume. A study by Cheetham [54] puts these results in perspective by showing that the volume of the hippocampus at age 12 does not predict initiation of cannabis use by age 16. Therefore, structural changes in the hippocampus appear to be a consequence of chronic cannabis exposure rather than a premorbid vulnerability. This conclusion is consistent with before-and-after animal studies that demonstrate hippocampal changes in direct response to cannabis administration.

Detailed animal studies, impossible in human research, consistently show a wide variety of changes in the hippocampus when exposed to cannabinoid stimulation, from shrinkage of neural cell nuclei and bodies [55, 56], to reductions in cell density [57], dendritic length [58], number of CB1 receptors by 30% [43], and number of synapses (reduced by 44% even 7 months after THC is discontinued) [55, 59]. Caution needs to be observed in applying the effects of cannabis on other animals to humans. Nonetheless, rodents given THC five times a week for 8 months (approximately 30% of the rat life-span) sustain the same degree of reduction in hippocampal volume as humans who have heavily used marijuana for 20 years [58],

The amount known about the role of the hippocampus in memory and the details of the profound extent of marijuana's impact on hippocampal physiology occupy too many volumes to be ignored. For example, neural models form in the hippocampus during classical conditioning before evidence of behavioral learning appears [60], with the speed of learning directly related to the percentage of theta rhythm (3-7 Hz) present [61]. Cannabinoids alter theta rhythm, which has been shown to impair memory [62]. Cannabinoids also acutely reduce glutamate release in the hippocampus, thereby blocking long-term potentiation, considered to be the mechanism for strengthening neuronal connections to form the substrate for learning and memory [63]. After 7 days of

cannabinoid administration, the complete blockade of long-term potentiation persists for 3 days and full reversal does not occur for up to 14 days, thereby reducing synaptic plasticity. Administration of cannabinoid antagonists significantly increases long-term potentiation. Consistent with this impact on long-term potentiation, social recognition in rodents, a measure of short-term memory, has been shown to decrease with cannabinoid stimulation and increase with cannabinoid antagonism [64].

Finding one's way around an environment (spatial memory) and remembering the events that occur within it (episodic memory) are crucial cognitive abilities that most neuroscientists agree are linked to the hippocampus [65]. Differences in hippocampal structure, volume [42, 66, 67] and physiology all contribute to decrements in working memory for heavy marijuana users' memory [17, 48] compared to non-users, even during early abstinence.

The Frontal Lobes and Executive Functions:

The frontal lobes, which are the last portion of the brain to mature fully at approximately 24 years old, provide the substrate for our most advanced intellectual abilities, the executive functions, which include abstraction, sequencing, reasoning, judgment, task flexibility, problem solving, planning and execution. Daily use of marijuana reduces the natural cannabinoid receptors by 20% in the frontal lobes [7, 41]. Hirvonen demonstrated that the reversible down-regulation of brain cannabinoid CB_1 receptors in human subjects who chronically smoke cannabis correlates with years of cannabis. After ~4 weeks of continuously monitored abstinence from cannabis on a secure research unit, CB_1 receptor density returned to normal levels [41].

Adolescents using marijuana chronically score worse than controls on a battery of test assessing executive functions, with early onset users scoring worse than late-onset users, illustrated by the graph at right by Fontes of scores on a battery of executive function tests of early onset users, late onset and nonusers. [68]

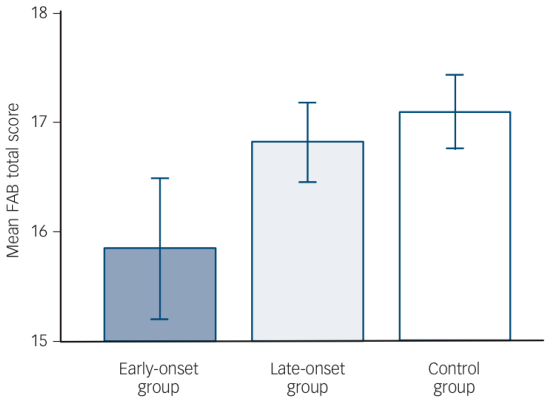


Fig. 4 Frontal Assessment Battery (FAB) total score in early-onset, late-onset and control groups.

Three studies illustrate decrements in executive function associated with regular marijuana use.

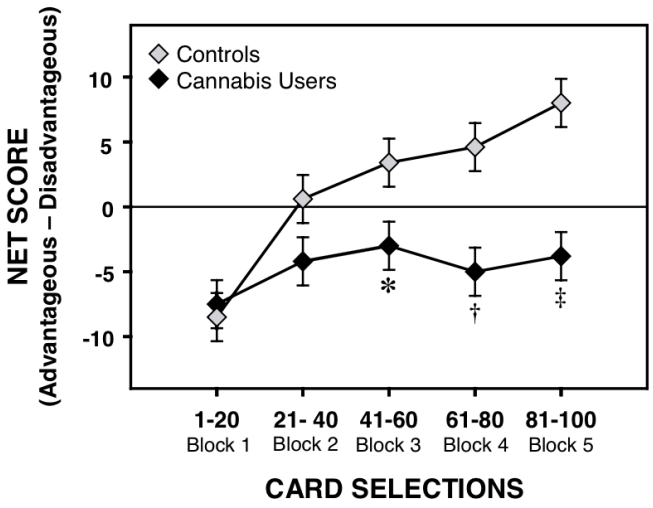
Wisconsin Card Sort: The Wisconsin Card Sort Test assesses abstract reasoning, strategy formation and the ability to shift cognitive strategies in response to changing contingencies. Test subjects are asked to discover the correct way to sort cards with symbols of different characteristics. After subjects demonstrate understanding of the correct way to sort the cards, the rules are arbitrarily changed, which requires abandoning the original strategy to discover the new correct one. The earlier someone has started using marijuana, even after 4 days of abstinence, the more difficulty they have discovering the correct strategy and the more frequently they perseverate with the old, incorrect strategy. [68]

Stroop Test: The Stroop Test is designed to demonstrate interference in the reaction time of a task. When the name of a color (e.g., "blue", "green", or "red") is printed in a color not denoted by the name (e.g., the word "red" printed in blue ink instead of red ink), naming the color of the word

takes longer and is more prone to errors than when the color of the ink matches the name of the color. After 4 days of abstinence, the earliest onset marijuana users demonstrated more intrusion errors, an indication of reduced ability to inhibit irrelevant stimuli. [68, 69]

Iowa Gambling Task: The Iowa Gambling Task was designed to simulate real-life decision-making. Subjects are presented with 4 virtual decks of cards on a computer screen. Each card chosen wins some game money except for an occasional card that causes them to lose some money. The goal is to win as much money as possible. The decks differ in the number of losses each contains. Thus, some decks are "bad decks" that lead to losses over the long run and other decks are "good decks" that lead to gain.

Most control subjects stick to the good decks after sampling about 40 or 50 cards from each deck. Subjects known to suffer frontal lobe damage, however, continue to perseverate with the bad decks, a sign of reduced judgment. Chronic cannabis consumption, produces similar decrements in performance on the Iowa Gambling Task. "Subjects focusing on the highest win are less aware of losses or simply underestimate losses" and this difference was related more to the amount of cannabis consumed than to measured personality traits [70].



MRI brain imaging shows greater frontal lobe activity in response to losses in controls compared to marijuana users, suggesting that marijuana users are less sensitive to negative feedback during strategy development [71]. Interestingly, subjects in both groups initially chose cards primarily from the decks with higher immediate rewards, but subjects in the control group change their deck preference as they experience the large monetary losses associated with the disadvantageous decks [72].

On the basis of demonstrated reductions in frontal lobe executive functioning, Fontes [68] concluded that "exposure to cannabis in early adolescence may lead to lower mental flexibility". The blunted response to negative stimuli leading to less advantageous decision making strategies is consistent with data presented in the amygdala section below, specifically regarding the tendency to forget aversive experiences and a blunted response to negative emotional stimuli found in chronic marijuana users.

Medina [13] focused her attention on adolescents to explore how long executive functions remain diminished after abstinence is established. She found decreased psychomotor speed, complex attention, story memory, planning and sequencing ability in adolescent marijuana users compared with controls after >23 days of monitored abstinence, even after controlling for lifetime alcohol use. Furthermore, dose-dependent relationships were observed between lifetime marijuana use and poorer cognitive performance. She states that her

> neuropsychological findings differ from those of Pope and colleagues [53], who found that deficits in attention, short-term memory, and psychomotor speed were no longer measurable among adult marijuana users following 28 days of abstinence. One possible explanation for this discrepancy is that marijuana use during adolescence may negatively

> impact neuromaturation and cognitive development, resulting in more severe cognitive consequences compared with use during adulthood. For example, introduction of cannabis during adolescence may interrupt pruning of gray matter or disruption of white matter myelination, especially in the prefrontal cortex [73-75], which continues to develop into early adulthood [6, 11, 76, 77]. The current findings are consistent with animal studies that found more severe cannabis-induced learning impairments among adolescents compared with adults [78-81] and findings that early onset use is associated with increased morphometric, electrophysiological, and cognitive abnormalities among adult marijuana users [82-85] .

Gruber demonstrated that adolescents who started smoking marijuana regularly prior to the age of 16 performed significantly more poorly on measures of executive function than controls. The early initiators in her study also smoked twice as often and nearly three times as much marijuana per week than their later smoking counterparts [86]. These findings further demonstrate that earlier marijuana onset is related to poorer cognitive function.

Amygdala and Attention*:*

Many of the effects of marijuana come from its stimulation of the highly concentrated cannabinoid receptors in the amygdala, a portion of the brain containing neural circuitry important in emotions, appetites, and attention to novel stimuli. Acute stimulation of the amygdala by marijuana contributes to increased appetite, lessened anxiety (in most people and at lower doses) and an interesting dis-habituation to sensory stimuli, leading people to notice sensations they had long ago stopped paying attention to.

Emotion: Chronic marijuana uses have been found to have reduced amygdala size of 7% compared to controls [42] and the number of cannabinoid receptors can be reduced as much as 25% [42, 43, 87]. Gruber demonstrated that these reductions lead regular users to process some emotional stimuli differently [88], When shown subliminal images of an angry face, the amygdala in non-users becomes active; but, no response to the emotional stimuli occurred in the amygdala of regular marijuana users. This reduced sensitivity to emotional cues is consistent with the typical complaint of partners that regular marijuana users are “stoned” or “less present.” The reduction of cannabinoid receptors in the amygdala may also contribute to boredom.

Anxiety, a documented symptom of withdrawal from marijuana [89], is characteristic of a cannabinoid deficiency state. After regular marijuana use reduces the number of cannabinoid receptors in the amygdala below normal, anxiety lasts up to 4-6 weeks while the full complement of receptors is rebuilt. During this early period of abstinence there is a risk of restarting marijuana use to keep the remaining receptors stimulated enough to reduce the anxiety [90-92]. The impacts outlined above happen to nearly all daily, or near-daily, marijuana users.

Temperament: Genetic variations in the density of CB1 receptors in the amygdala influence temperament [93]. The temperamental characteristic of novelty seeking is inversely correlated with global CB1R availability, most pronounced in the amygdala. The degree of receptor down-regulation observed in humans with regular marijuana use is well within the parameters underlying significant genetically-associated temperamental differences. High density of CB1 receptors in the amygdala leads to an inhibited temperament that tends to avoid novelty, while a low density of CB1 receptors leads to a more uninhibited novelty seeking temperament. Regular use of marijuana leads to a reduction of CB1 receptors in the amygdala of 25%, similar to the range of genetic variations.

The Importance of Forgetting: Increasing cannabinoid stimulation in the amygdala has also been shown to enhance the forgetting of aversive experience [94]. Extinction of aversive memories is an active process. Marsicano [94] used classical conditioning to teach rats that a shock soon follows a tone leading the rats to freeze when they heard the tone. Once he no longer administered the shock he measured how long it took for the animal to extinguish their fear response to the tone. Rats bred with a deficiency of CB1 receptors were unable to extinguish their fear response, demonstrating that a functioning cannabinoid system is necessary to forget aversive experiences. While the tone caused release of endocannabinoid in the amygdala, CB1 receptors are necessary for the neural circuitry to produce forgetting.

The chronic increased stimulation of CB1 receptors produced by regular marijuana use could reasonably be expected to complicate adolescent marijuana users' ability to develop effective coping strategies. While under the influence of marijuana, aversive memories are more easily forgotten and their lessons left unlearned.

Brain Imaging:

A vast literature documents decrements in frontal lobe based executive functions, but there is far less detailed evidence regarding structural or physiological changes associated with marijuana use.

Human research is limited to gross imaging of brain structure and activation. Chronic exposure to marijuana reduces gray mater in the frontal cortex, though the permanence of this change has not been determined [37, 67, 95]. Studies of frontal lobe volume in adolescents are few and yield differences based on gender still requiring exploration.

Inhibition of impulsivity is an important executive function. A quantitative estimate of white matter (the neural tracts connecting the left and right frontal lobes) integrity at the microstructural level (diffusion tensor imaging) reveals significant reductions in directional coherence in marijuana smokers relative to non-users. Age of onset of marijuana use was correlated with the degree of abnormalities. These data represent the first report of significant alterations in frontal white matter tracts and were associated with measures of impulsivity in chronic marijuana smokers [96].

Functional brain imaging (PET scans and fMRI) of the frontal lobes have shown altered activity in response to tasks that require executive functions. Marijuana users show less activity in the left frontal cortex compared to controls when administered the Stroop test, which requires inhibition of verbal stimuli and attention to the physical color, a task that marijuana users do more poorly [97].

In a go/no-go task requiring readiness to respond combined with the ability to inhibit a response to a defined stimulus, Tapert [98] demonstrated that adolescents who regularly use marijuana performed as well as controls. However, even after 28 days of abstinence, marijuana users showed increased areas of brain activity in the frontal lobes during the task relative to non-users. The study concluded that a pattern of increased activation with comparable performance is consistent with functional compensation, which supposes that loci of functional activity are spread to more and larger regions. Therefore, adolescent marijuana users appear to recruit more neural tissue in executive control areas to adequately perform the task.

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Endnotes (Annotated)

Ammerman, S., et al. (2015 (Mar)). "The Impact of Marijuana Policies on Youth: Clinical, Research, and Legal Update." Pediatrics **135**(3).

This technical report updates the 2004 American Academy of Pediatrics abstract technical report on the legalization of marijuana. Current epidemiology of marijuana use is presented, as are definitions and biology of marijuana compounds, side effects of marijuana use, and effects of use on adolescent brain development. Issues concerning medical marijuana specifically are also addressed. Concerning legalization of marijuana, 4 different approaches in the United States are discussed: legalization of marijuana solely for medical purposes, decriminalization of recreational use of marijuana, legalization of recreational use of marijuana, and criminal prosecution of recreational (and medical) use of marijuana. These approaches are compared, and the latest available data are presented to aid in forming public policy. The effects on youth of criminal penalties for marijuana use and possession are also addressed, as are the effects or potential effects of the other 3 policy approaches on adolescent marijuana use. Recommendations are included in the accompanying policy statement.

Arseneault, L., et al. (2002). "Cannabis use in adolescence and risk for adult psychosis: longitudinal prospective study." BMJ **325**(7374): 1212-1213.

Arseneault, L., et al. (2004). "Causal association between cannabis and psychosis: examination of the evidence." Br J Psychiatry **184**: 110-117.

Berry, S. D. and M. A. Seager (2001). "Hippocampal theta oscillations and classical conditioning." Neurobiol Learn Mem **76**(3): 298-313.

Burgess, N., et al. (2002). "The human hippocampus and spatial and episodic memory." Neuron **35**(4): 625-641.

Cheetham, A., et al. (2012). "Orbitofrontal volumes in early adolescence predict initiation of cannabis use: a 4-year longitudinal and prospective study." Biol Psychiatry **71**(8): 684-692.

BACKGROUND: There is growing evidence that long-term, heavy cannabis use is associated with alterations in regional brain volumes. Although these changes are frequently attributed to the neurotoxic effects of cannabis, it is possible that some abnormalities might predate use and represent markers of vulnerability. To date, no studies have examined whether structural brain abnormalities are present before the onset of cannabis use. This study aims to determine whether adolescents who have initiated cannabis use early (i.e., before age 17 years) show premorbid structural abnormalities in the amygdala, hippocampus, orbitofrontal cortex, and anterior cingulate cortex. METHODS: Participants (n = 121) were recruited from primary schools in Melbourne, Australia, as part of a larger study examining adolescent emotional development. Participants underwent structural magnetic resonance imaging at age 12 years and were assessed for cannabis use 4 years later, at age 16 years. At the follow-up assessment, 28 participants had commenced using cannabis (16 female subjects [57%]), and 93 had not (43 female subjects [46%]). RESULTS: Smaller orbitofrontal cortex volumes at age 12 years predicted initiation of cannabis use by age 16 years. The volumes of other regions (amygdala, hippocampus, and anterior cingulate cortex) did not predict later cannabis use. CONCLUSIONS: These findings suggest that structural abnormalities in the orbitofrontal cortex might contribute to risk for cannabis exposure. Although the results have important implications for understanding neurobiological predictors of cannabis use, further research is needed to understand their relationship with heavier patterns of use in adulthood as well as later abuse of other substances.

Cousijn, J., et al. (2012). "Approach-bias predicts development of cannabis problem severity in heavy cannabis users: results from a prospective FMRI study." PLoS One **7**(9): e42394.

Cousijn, J., et al. (2012). "Grey matter alterations associated with cannabis use: results of a VBM study in heavy cannabis users and healthy controls." Neuroimage **59**(4): 3845-3851.

Degenhardt, L. and W. Hall (2002). "Cannabis and psychosis." Curr Psychiatry Rep **4**(3): 191-196.

Degenhardt, L. and W. Hall (2006). "Is cannabis use a contributory cause of psychosis?" Can J Psychiatry **51**(9): 556-565.

ECNP (Claire Mokrysz) (2014). "No Relationship Between Moderate Adolescent Cannabis Use, Exam Results or IQ, Large Study Shows." Science Daily. from http://www.sciencedaily.com/releases/2014/10/141020212410.htm.

A large UK study has found that occasional adolescent cannabis use does not lead to poorer educational and intellectual performance, but that heavy cannabis use is associated with slightly poorer exam results at age 16. The results come from the Avon Longitudinal Study of Parents and Children (ALSPAC, also known as "Children of the 90's") a long-term study that follows the health of children born in the Bristol area (UK) in 1991 and 1992. The work is being presented at the annual congress of the European College of Neuropsychopharmacology (ECNP) in Berlin. The researchers analysed data from 2,612 children who had their IQ tested at the age of 8, and again at the age of 15. These children's examination results were then factored in via the National Pupil Database. At the age of 15, each person in the study completed a survey on cannabis use. The researchers then used

regression analysis to look at how cannabis use affected both intellectual and educational performance. A number of children could not be included in the final analyses (for example because they had experienced a head injury), leaving a total sample size of 2,235.

The researchers found two main points:

1. Cannabis use appeared to be associated with decreased intellectual performance. Cannabis use was, however, highly correlated with other risky behaviours such as alcohol, cigarette and other drug use. When the researchers took these other behaviours into account, they found there was no relationship between cannabis use and lower IQ at age 15.

2. Heavier cannabis users (at least 50 times by age 15) however, did show marginally impaired educational abilities. These children tended to have poorer exam results (3% lower) on compulsory school exams taken at age 16, even after adjusting for childhood educational performance, as well as alcohol, cigarette and other drug use.

Ferdinand, R. F., et al. (2005). "Cannabis use predicts future psychotic symptoms, and vice versa." Addiction **100**(5): 612-618.

Filbey, F. M., et al. (2014). "Long-term effects of marijuana use on the brain." Proc Natl Acad Sci U S A **111**(47): 16913-16918.

Fisk, J. E. and C. Montgomery (2008). "Real-world memory and executive processes in cannabis users and non-users." J Psychopharmacol **22**(7): 727-736.

The relationships between executive processes, associative learning and different aspects of real world memory functioning were explored in a sample of cannabis users and nonusers. Measures of executive component processes, associative learning, everyday memory, prospective memory, and cognitive failures were administered. Relative to nonusers, cannabis users were found to be impaired in several aspects of real world memory functioning. No other group differences were apparent. The absence of cannabis related deficits in those executive component processes and aspects of learning that are believed to support real world memory processes is surprising given that cannabis related deficits were obtained in real world memory. The present results are discussed within the context of neuroimaging evidence which suggests that cannabis users may exhibit different patterns of neural activation when performing executive tasks while not always exhibiting deficits on these tasks.

Fontes, M., et al. (2011). "Cannabis use before age 15 and subsequent executive functioning." The British Journal of Psychiatry **198**: 442–447.

Galve-Roper I., et al. (2008). "Mechanisms of control of neuron survival by the endocannabinoid system." Curr Pharm Des **14**(23): 2279-2288.

Giedd, J. N. (2004). "Structural magnetic resonance imaging of the adolescent brain." Ann N Y Acad Sci **1021**: 77-85.

Magnetic resonance imaging (MRI) provides accurate anatomical brain images without the use of ionizing radiation, allowing longitudinal studies of brain morphometry during adolescent development. Results from an ongoing brain imaging project being conducted at the Child Psychiatry Branch of the National Institute of Mental Health indicate dynamic changes in brain anatomy throughout adolescence. White matter increases in a roughly linear pattern, with minor differences in slope in the four major lobes (frontal, parietal, temporal, occipital). Cortical gray matter follows an inverted U-shape developmental course with greater regional variation than white matter. For instance, frontal gray matter volume peaks at about age 11.0 years in girls and 12.1 years in boys, whereas temporal gray matter volume peaks at about age at 16.7 years in girls and 16.2 years in boys. The dorsal lateral prefrontal cortex, important for controlling impulses, is among the latest brain regions to mature without reaching adult dimensions until the early 20s. The details of the relationships between anatomical changes and behavioral changes, and the forces that influence brain development, have not been well established and remain a prominent goal of ongoing investigations.

Gogtay, N., et al. (2004). "Dynamic mapping of human cortical development during childhood through early adulthood." Proc Natl Acad Sci U S A **101**(21): 8174-8179.

We report the dynamic anatomical sequence of human cortical gray matter development between the age of 4-21 years using quantitative four-dimensional maps and time-lapse sequences. Thirteen healthy children for whom anatomic brain MRI scans were obtained every 2 years, for 8-10 years, were studied. By using models of the cortical surface and sulcal landmarks and a statistical model for gray matter density, human cortical development could be visualized across the age range in a spatiotemporally detailed time-lapse sequence. The resulting time-lapse "movies" reveal that (i) higher-order association cortices mature only after lower-order somatosensory and visual cortices, the functions of which they integrate, are developed, and (ii) phylogenetically older brain areas mature earlier than newer ones. Direct comparison with normal cortical development may help understanding of some neurodevelopmental disorders such as childhood-onset schizophrenia or autism.

Gonzalez, R. (2007). "Acute and non-acute effects of cannabis on brain functioning and neuropsychological performance." Neuropsychol Rev **17**(3): 347-361.

Gonzalez, R. and J. M. Swanson (2012). "Long-term effects of adolescent-onset and persistent use of cannabis." Proc Natl Acad Sci U S A **109**(40): 15970-15971.

Grant, I., et al. (2003). "Non-acute (residual) neurocognitive effects of cannabis use: a meta-analytic study." J Int Neuropsychol Soc **9**(5): 679-689.

The possible medicinal use of cannabinoids for chronic diseases emphasizes the need to understand the long-term effects of these compounds on the central nervous system. We provide a quantitative synthesis of empirical research pertaining to the non-acute (residual) effects of cannabis on the neurocognitive performance of adult human subjects. Out of 1,014 studies retrieved using a thorough search strategy, only 11 studies met essential a priori inclusion criteria, providing data for a total of 623 cannabis users and 409 non- or minimal users. Neuropsychological results were grouped into 8 ability domains, and effect sizes were calculated by domain for each study individually, and combined for the full set of studies. Using slightly liberalized criteria, an additional four studies were included in a second analysis, bringing the total number of subjects to 1,188 (i.e., 704 cannabis users and 484 non-users). With the exception of both the learning and forgetting domains, effect size confidence intervals for the remaining 6 domains included zero, suggesting a lack of effect. Few studies on the non-acute neurocognitive effects of cannabis meet current research standards; nevertheless, our results indicate that there might be decrements in the ability to learn and remember new information in chronic users, whereas other cognitive abilities are unaffected. However, from a neurocognitive standpoint, the small magnitude of these effect sizes suggests that if cannabis compounds are found to have therapeutic value, they may have an acceptable margin of safety under the more limited conditions of exposure that would likely obtain in a medical setting.

Green, B., et al. (2005). "Cannabis use and misuse prevalence among people with psychosis." Br J Psychiatry **187**: 306-313.

Gruber, S. A., et al. (2009). "Altered affective response in marijuana smokers: an FMRI study." Drug Alcohol Depend **105**(1-2): 139-153.

More than 94 million Americans have tried marijuana, and it remains the most widely used illicit drug in the nation. Investigations of the cognitive effects of marijuana report alterations in brain function during tasks requiring executive control, including inhibition and decision-making. Endogenous cannabinoids regulate a variety of emotional responses, including anxiety, mood control, and aggression; nevertheless, little is known about smokers' responses to affective stimuli. The anterior cingulate and amygdala play key roles in the inhibition of impulsive behavior and affective regulation, and studies using PET and fMRI have demonstrated changes within these regions in marijuana smokers. Given alterations in mood and perception often observed in smokers, we hypothesized altered fMRI patterns of response in 15 chronic heavy marijuana smokers relative to 15 non-marijuana smoking control subjects during the viewing of masked happy and fearful faces. Despite no between-group differences on clinical or demographic measures, smokers demonstrated a relative decrease in both anterior cingulate and amygdalar activity during masked affective stimuli compared to controls, who showed relative increases in activation within these regions during the viewing of masked faces. Findings indicate that chronic heavy marijuana smokers demonstrate altered activation of frontal and limbic systems while viewing masked faces, consistent with autoradiographic studies reporting high CB-1 receptor density in these regions. These data suggest differences in affective processing in chronic smokers, even when stimuli are presented below the level of conscious processing, and underscore the likelihood that marijuana smokers process emotional information differently from those who do not smoke, which may result in negative consequences.

Harkany, T., et al. (2008). "Endocannabinoid functions controlling neuronal specification during brain development." Mol Cell Endocrinol **286**(1-2 Suppl 1): S84-90.

Heath, R. G., et al. (1980). "Cannabis sativa: effects on brain function and ultrastructure in rhesus monkeys." Biol Psychiatry **15**(5): 657-690.

Henquet, C., et al. (2005). "Prospective cohort study of cannabis use, predisposition for psychosis, and psychotic symptoms in young people." BMJ **330**(7481): 11.

Hirvonen, J., et al. (2012). "Reversible and regionally selective downregulation of brain cannabinoid CB1 receptors in chronic daily cannabis smokers." Mol Psychiatry **17**(6): 642-649.

Hoffman, A. F., et al. (2007). "Opposing actions of chronic Delta9-tetrahydrocannabinol and cannabinoid antagonists on hippocampal long-term potentiation." Learn Mem **14**(1-2): 63-74.

Huppi, P. S. and J. Dubois (2006). "Diffusion tensor imaging of brain development." Semin Fetal Neonatal Med **11**(6): 489-497.

Jacobus, J., et al. (2009). "Functional consequences of marijuana use in adolescents." Pharmacol Biochem Behav **92**(4): 559-565.

Lachenmeier, D. W. and J. Rehm (2015). "Comparative risk assessment of alcohol, tobacco, cannabis and other illicit drugs using the margin of exposure approach." Sci Rep **5**: 8126.

A comparative risk assessment of drugs including alcohol and tobacco using the margin of exposure (MOE) approach was conducted. The MOE is defined as ratio between toxicological threshold (benchmark dose) and estimated human intake. Median lethal dose values from animal experiments were used to derive the benchmark dose. The human intake was calculated for individual scenarios and population-based scenarios. The MOE was calculated using probabilistic Monte Carlo simulations. The benchmark dose values ranged from 2 mg/kg bodyweight for heroin to 531 mg/kg bodyweight for alcohol (ethanol). For individual exposure the four substances alcohol, nicotine, cocaine and heroin fall into the "high risk" category with MOE < 10, the rest of the compounds except THC fall into the "risk" category with MOE < 100. On a population scale, only alcohol would fall into the "high risk" category, and cigarette smoking would fall into the "risk" category, while all other agents (opiates, cocaine, amphetamine-type

stimulants, ecstasy, and benzodiazepines) had MOEs > 100, and cannabis had a MOE > 10,000. The toxicological MOE approach validates epidemiological and social science-based drug ranking approaches especially in regard to the positions of alcohol and tobacco (high risk) and cannabis (low risk).

Landfield, P. W., et al. (1988). "Quantitative changes in hippocampal structure following long-term exposure to delta 9-tetrahydrocannabinol: possible mediation by glucocorticoid systems." Brain Res **443**(1-2): 47-62.

Lawston, J., et al. (2000). "Changes in hippocampal morphology following chronic treatment with the synthetic cannabinoid WIN 55,212-2." Brain Res **877**(2): 407-410.

Luna, B. and J. A. Sweeney (2004). "The emergence of collaborative brain function: FMRI studies of the development of response inhibition." Ann N Y Acad Sci **1021**: 296-309.

Marsicano, G., et al. (2002). "The endogenous cannabinoid system controls extinction of aversive memories." Nature **418**(6897): 530-534.

Acquisition and storage of aversive memories is one of the basic principles of central nervous systems throughout the animal kingdom. In the absence of reinforcement, the resulting behavioural response will gradually diminish to be finally extinct. Despite the importance of extinction, its cellular mechanisms are largely unknown. The cannabinoid receptor 1 (CB1) and endocannabinoids are present in memory-related brain areas and modulate memory. Here we show that the endogenous cannabinoid system has a central function in extinction of aversive memories. CB1-deficient mice showed strongly impaired short-term and long-term extinction in auditory fear-conditioning tests, with unaffected memory acquisition and consolidation. Treatment of wild-type mice with the CB1 antagonist SR141716A mimicked the phenotype of CB1-deficient mice, revealing that CB1 is required at the moment of memory extinction. Consistently, tone presentation during extinction trials resulted in elevated levels of endocannabinoids in the basolateral amygdala complex, a region known to control extinction of aversive memories. In the basolateral amygdala, endocannabinoids and CB1 were crucially involved in long-term depression of GABA (gamma-aminobutyric acid)-mediated inhibitory currents. We propose that endocannabinoids facilitate extinction of aversive memories through their selective inhibitory effects on local inhibitory networks in the amygdala.

McGrath, J., et al. (2010). "Association between cannabis use and psychosis-related outcomes using sibling pair analysis in a cohort of young adults." Arch Gen Psychiatry **67**(5): 440-447.

Medina, K. L., et al. (2007). "Neuropsychological functioning in adolescent marijuana users: subtle deficits detectable after a month of abstinence." J Int Neuropsychol Soc **13**(5): 807-820.

In adults, studies examining the long-lasting cognitive effects of marijuana use demonstrate subtle deficits in attention, executive function, and memory. Because neuromaturation continues through adolescence, these results cannot necessarily generalize to adolescent marijuana users. The goal of this study was to examine neuropsychological functioning in abstinent marijuana using and demographically similar control adolescents. Data were collected from 65 adolescent marijuana users (n=31, 26% females) and controls (n=34, 26% females) 16-18 years of age. Extensive exclusionary criteria included independent psychiatric, medical, and neurologic disorders. Neuropsychological assessments were conducted after>23 days of monitored abstinence. After controlling for lifetime alcohol use and depressive symptoms, adolescent marijuana users demonstrated slower psychomotor speed ($p<.05$), and poorer complex attention ($p<.04$), story memory ($p<.04$), and planning and sequencing ability ($p<.001$) compared with controls. Post hoc analysis revealed that the number of lifetime marijuana use episodes was associated with poorer cognitive function, even after controlling for lifetime alcohol use. The general pattern of results suggested that, even after a month of monitored abstinence, adolescent marijuana users demonstrate subtle neuropsychological deficits compared with nonusers. It is possible that frequent marijuana use during adolescence may negatively influence neuromaturation and cognitive development.

Meier, M. H., et al. (2012). "Persistent cannabis users show neuropsychological decline from childhood to midlife." Proc Natl Acad Sci U S A **109**(40): E2657-2664.

Recent reports show that fewer adolescents believe that regular cannabis use is harmful to health. Concomitantly, adolescents are initiating cannabis use at younger ages, and more adolescents are using cannabis on a daily basis. The purpose of the present study was to test the association between persistent cannabis use and neuropsychological decline and determine whether decline is concentrated among adolescent-onset cannabis users. Participants were members of the Dunedin Study, a prospective study of a birth cohort of 1,037 individuals followed from birth (1972/1973) to age 38 y. Cannabis use was ascertained in interviews at ages 18, 21, 26, 32, and 38 y. Neuropsychological testing was conducted at age 13 y, before initiation of cannabis use, and again at age 38 y, after a pattern of persistent cannabis use had developed. Persistent cannabis use was associated with neuropsychological decline broadly across domains of functioning, even after controlling for years of education. Informants also reported noticing more cognitive problems for persistent cannabis users. Impairment was concentrated among adolescent-onset cannabis users, with more persistent use associated with greater decline. Further, cessation of cannabis use did not fully restore neuropsychological functioning among adolescent-onset cannabis users. Findings are suggestive of a neurotoxic effect of cannabis on the adolescent brain and highlight the importance of prevention and policy efforts targeting adolescents.

Moore, T. H., et al. (2007). "Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review." Lancet **370**(9584): 319-328.

BACKGROUND: Whether cannabis can cause psychotic or affective symptoms that persist beyond transient intoxication is unclear. We systematically reviewed the evidence pertaining to cannabis use and occurrence of psychotic or affective mental health outcomes. METHODS: We searched Medline, Embase, CINAHL, PsycINFO, ISI Web of Knowledge, ISI Proceedings, ZETOC, BIOSIS, LILACS, and MEDCARIB from their inception to September, 2006, searched reference lists of studies selected for inclusion, and contacted experts. Studies were included if longitudinal and population based. 35 studies from 4804 references were included. Data extraction and quality assessment were done independently and in duplicate. FINDINGS: There was an increased risk of any psychotic outcome in individuals who had ever used cannabis (pooled adjusted odds ratio=1.41, 95% CI 1.20-1.65). Findings were consistent with a dose-response effect, with greater risk in people who used cannabis most frequently (2.09, 1.54-2.84). Results of analyses restricted to studies of more clinically relevant psychotic disorders were similar. Depression, suicidal thoughts, and anxiety outcomes were examined separately. Findings for these outcomes were less consistent, and fewer attempts were made to address non-causal explanations, than for psychosis. A substantial confounding effect was present for both psychotic and affective outcomes. INTERPRETATION: The evidence is consistent with the view that cannabis increases risk of psychotic outcomes independently of confounding and transient intoxication effects, although evidence for affective outcomes is less strong. The uncertainty about whether cannabis causes psychosis is unlikely to be resolved by further longitudinal studies such as those reviewed here. However, we conclude that there is now sufficient evidence to warn young people that using cannabis could increase their risk of developing a psychotic illness later in life.

Mulder, J., et al. (2008). "Endocannabinoid signaling controls pyramidal cell specification and long-range axon patterning." Proc Natl Acad Sci U S A **105**(25): 8760-8765.

Nutt, D. J., et al. (2010). "Drug harms in the UK: a multicriteria decision analysis." Lancet **376**(9752): 1558-1565.

BACKGROUND: Proper assessment of the harms caused by the misuse of drugs can inform policy makers in health, policing, and social care. We aimed to apply multicriteria decision analysis (MCDA) modelling to a range of drug harms in the UK. METHODS: Members of the Independent Scientific Committee on Drugs, including two invited specialists, met in a 1-day interactive workshop to score 20 drugs on 16 criteria: nine related to the harms that a drug produces in the individual and seven to the harms to others. Drugs were scored out of 100 points, and the criteria were weighted to indicate their relative importance. FINDINGS: MCDA modelling showed that heroin, crack cocaine, and metamfetamine were the most harmful drugs to individuals (part scores 34, 37, and 32, respectively), whereas alcohol, heroin, and crack cocaine were the most harmful to others (46, 21, and 17, respectively). Overall, alcohol was the most harmful drug (overall harm score 72), with heroin (55) and crack cocaine (54) in second and third places. INTERPRETATION: These findings lend support to previous work assessing drug harms, and show how the improved scoring and weighting approach of MCDA increases the differentiation between the most and least harmful drugs. However, the findings correlate poorly with present UK drug classification, which is not based simply on considerations of harm. FUNDING: Centre for Crime and Justice Studies (UK).

Power, R. A., et al. (2014). "Genetic predisposition to schizophrenia associated with increased use of cannabis." Mol Psychiatry **19**(11): 1201-1204.

Ranganathan, M. and D. C. D'Souza (2006). "The acute effects of cannabinoids on memory in humans: a review." Psychopharmacology (Berl) **188**(4): 425-444.

RATIONALE: Cannabis is one of the most frequently used substances. Cannabis and its constituent cannabinoids are known to impair several aspects of cognitive function, with the most robust effects on short-term episodic and working memory in humans. A large body of the work in this area occurred in the 1970s before the discovery of cannabinoid receptors. Recent advances in the knowledge of cannabinoid receptors' function have rekindled interest in examining effects of exogenous cannabinoids on memory and in understanding the mechanism of these effects. OBJECTIVE: The literature about the acute effects of cannabinoids on memory tasks in humans is reviewed. The limitations of the human literature including issues of dose, route of administration, small sample sizes, sample selection, effects of other drug use, tolerance and dependence to cannabinoids, and the timing and sensitivity of psychological tests are discussed. Finally, the human literature is discussed against the backdrop of preclinical findings. RESULTS: Acute administration of Delta-9-THC transiently impairs immediate and delayed free recall of information presented after, but not before, drug administration in a dose- and delay-dependent manner. In particular, cannabinoids increase intrusion errors. These effects are more robust with the inhaled and intravenous route and correspond to peak drug levels. CONCLUSIONS: This profile of effects suggests that cannabinoids impair all stages of memory including encoding, consolidation, and retrieval. Several mechanisms, including effects on long-term potentiation and long-term depression and the inhibition of neurotransmitter (GABA, glutamate, acetyl choline, dopamine) release, have been implicated in the amnestic effects of cannabinoids. Future research in humans is necessary to characterize the neuroanatomical and neurochemical basis of the memory impairing effects of cannabinoids, to dissect out their effects on the various stages of memory and to bridge the expanding gap between the humans and preclinical literature.

Robbe, D. and G. Buzsaki (2009). "Alteration of theta timescale dynamics of hippocampal place cells by a cannabinoid is associated with memory impairment." J Neurosci **29**(40): 12597-12605.

Rolles, S. and F. Measham (2011). "Questioning the method and utility of ranking drug harms in drug policy." Int J Drug Policy **22**(4): 243-246.

In a 2010 Lancet paper Nutt et al. propose a model for evaluating and ranking drug harms, building on earlier work by incorporating multi criteria decision analysis. It is argued that problems arise in modelling drug harms using rankable single figure indices when determinants of harm reflect pharmacology translated through a complex prism of social and behavioural variables, in turn influenced by a range of policy environments. The delphic methodolgy used is highly vulnerable to subjective judgements and even the more robust measures, such as drug related death and dependence, can be understood as socially constructed. The failure of the model to dissaggregate drug use harms from those related to the policy environment is also highlighted. Beyond these methodological challenges the utility of single figure index harm rankings is questioned, specifically their role in increasingly redundant legal frameworks utilising a harm-based hierarchy of punitive sanctions. If analysis is to include the capacity to capture the complexity relating to drug using behaviours and environments; specific personal and social risks for particular using populations; and the broader socio-cultural context to contemporary intoxication, there will need to be acceptance that analysis of the various harm vectors must remain separate - the complexity of such analysis is not something that can or should be over generalised to suit political discourse or outdated legal frameworks.

Romero, J., et al. (1998). "Time-course of the cannabinoid receptor down-regulation in the adult rat brain caused by repeated exposure to delta9-tetrahydrocannabinol." Synapse **30**(3): 298-308.

Recent studies have demonstrated that the pharmacological tolerance observed after prolonged exposure to plant or synthetic cannabinoids in adult individuals seems to have a pharmacodynamic rather than pharmacokinetic basis, because down-regulation of cannabinoid receptors was assessed in the brain of cannabinoid-tolerant rats. In the present study, we have examined the time-course of cannabinoid receptor down-regulation by analyzing cannabinoid receptor binding, using autoradiography, and mRNA expression, using in situ hybridization, in several brain structures of male adult rats daily exposed to delta9-tetrahydrocannabinol (delta9-THC) for 1, 3, 7, or 14 days. With only the exception of a few number of areas, most of the brain regions exhibited a progressive decrease in cannabinoid receptor binding. Two facts deserve to be mentioned. First, the pattern of this down-regulation process presented significant regional differences in terms of onset of the decrease and magnitude reached. Second, the loss of cannabinoid receptor binding was usually accompanied by no changes in its mRNA expression. Thus, some structures, such as most of the subfields of the Ammon's horn and the dentate gyrus in the hippocampus, exhibited a rapid (it appeared after the first injection) and marked (it reached approximately 30% of decrease after 14 days) reduction of cannabinoid receptor binding as a consequence of the daily delta9-THC administration. However, no changes occurred in mRNA levels. Decreased binding was also found in most of the basal ganglia, but the onset of this reduction was slow in the lateral caudate-putamen and the substantia nigra (it needed at least three days of daily delta9-THC administration), and, in particular, in the globus pallidus (more than 3 days). The magnitude of the decrease in binding was also more moderate, with maximal reductions always less than 28%. No changes were seen in the entopeduncular nucleus and only a trend in the medial caudate-putamen. However, the decrease in binding in some basal ganglia was, in this case, accompanied by a decrease in mRNA levels in the lateral caudate-putamen, but this appeared after 7 days of daily delta9-THC administration and, hence, after the onset of binding decrease. In the limbic structures, cannabinoid receptor binding decreased in the septum nuclei (it needed at least 3 days of daily delta9-THC administration), tended to diminish in the nucleus accumbens and was unaltered in the basolateral amygdaloid nucleus, with no changes in mRNA levels in these last two regions. Binding also decreased in the superficial and deep layers of the cerebral cortex, but only accompanied by trends in mRNA expression. The decrease in binding was initiated promptly in the deep layer (after the first injection) and it reached more than 30% of reduction after 14 days of daily delta9-THC administration, whereas, in the superficial layer, it needed more than 3 days of daily delta9-THC administration and reached less than 30% of reduction. Finally, no changes in binding and mRNA levels were found in the ventromedial hypothalamic nucleus. In summary, the daily administration of delta9-THC resulted in a progressive decrease in cannabinoid receptor binding in most of the brain areas studied, and it was a fact that always occurred before the changes in mRNA expression in those areas where these existed. The onset of the decrease in binding exhibited regional differences with areas, such as most of the hippocampal structures and the deep layer of the cerebral cortex, where the decrease occurred after the first administration. Other structures, however, needed at least 3 days or more to initiate receptor binding decrease. Two structures, the entopeduncular nucleus and the ventromedial hypothalamic nucleus, were unresponsive to chronic delta9-THC administration, whereas others, the medial caudate-putamen and the basolateral amygdaloid nucleus, only exhibited trends.

Romero, J., et al. (1995). "Changes in rat brain cannabinoid binding sites after acute or chronic exposure to their endogenous agonist, anandamide, or to delta 9-tetrahydrocannabinol." Pharmacol Biochem Behav **51**(4): 731-737.

Romero, J., et al. (1997). "Effects of chronic exposure to delta9-tetrahydrocannabinol on cannabinoid receptor binding and mRNA levels in several rat brain regions." Brain Res Mol Brain Res **46**(1-2): 100-108.

Rubino, T. and D. Parolaro (2008). "Long lasting consequences of cannabis exposure in adolescence." Mol Cell Endocrinol **286**(1-2 Suppl 1): S108-113.

SAMHSA (2000). "National Household Survey on Drug Abuse, 2000 (ICPSR 3262)." National Survey on Drug Use and Health (NSDUH) Series. from http://www.icpsr.umich.edu/icpsrweb/SAMHDA/studies/3262.

SAMHSA Center for Behavioral Health Statistics and Quality (2014). "The NSDUH Report: Substance Use and Mental Health Estimates from the 2013 National Survey on Drug Use and Health: Overview of Findings." The NSDUH Report (Sept 4, 2014). from http://www.icpsr.umich.edu/icpsrweb/SAMHDA/studies/35509.

Scallet, A. C. (1991). "Neurotoxicology of cannabis and THC: a review of chronic exposure studies in animals." Pharmacol Biochem Behav **40**(3): 671-676.

> Several laboratories have reported that chronic exposure to delta-9-tetrahydrocannabinol (THC) or marijuana extracts persistently altered the structure and function of the rat hippocampus, a paleocortical brain region involved with learning and memory processes in both rats and humans. Certain choices must be made in designing experiments to evaluate cannabis neurotoxicity, such as dose, route of administration, duration of exposure, age at onset of exposure, species of subjects, whether or how long to allow withdrawal, and which endpoints or biomarkers of neurotoxicity to measure. A review of the literature suggests that both age during exposure and duration of exposure may be critical determinants of neurotoxicity. Cannabinoid administration for at least three months (8-10% of a rat's lifespan) was required to produce neurotoxic effects in peripubertal rodents, which would be comparable to about three years exposure in rhesus monkeys and seven to ten years in humans. Studies of monkeys after up to 12 months of daily exposure have not consistently reported neurotoxicity, and the results of longer exposures have not yet been studied.

Scallet, A. C., et al. (1987). "Morphometric studies of the rat hippocampus following chronic delta-9-tetrahydrocannabinol (THC)." Brain Res **436**(1): 193-198.

> Persistent behavioral effects resembling those of hippocampal brain lesions have been reported following chronic administration of marijuana or its major psychoactive constituent, delta-9-tetrahydrocannabinol (THC) to rats. We used morphometric techniques to investigate the effects of chronic THC on the anatomical integrity of the hippocampus. Rats dosed orally for 90 days with 10 to 60 mg/kg THC or vehicle were evaluated by light and electron microscopy up to 7 months after their last dose of drug. Electron micrographs revealed a striking ultrastructural appearance and statistically significant decreases in mean volume of neurons and their nuclei sampled from the hippocampal CA3 region of rats treated with the highest doses of THC. A 44% reduction in the number of synapses per unit volume was demonstrated in these same rats. Golgi impregnation studies of additional groups of rats treated with 10 or 20 mg/kg/day THC and sacrificed 2 months after their last treatment with THC revealed a reduction in the dendritic length of CA3 pyramidal neurons, despite normal appearing ultrastructure and no changes in synaptic density. The hippocampal changes reported here may constitute a morphological basis for behavioral effects after chronic exposure to marijuana.

Seager, M. A., et al. (2002). "Oscillatory brain states and learning: Impact of hippocampal theta-contingent training." Proc Natl Acad Sci U S A **99**(3): 1616-1620.

Silins, E. H., J.; Patton, G.C.; Fergusson, D,M.; Olsson, C.A.; Hutchinson, D.M.; Spry, E.; Tpumbourou, J.W.; Degenhardt, L.;Swift, W.; Coffey, C.; Tait, R.J.; Letcher, P.; Copeland, J.; Mattick, R.P. (2014). "Young adult sequelae of adolescent cannabis use: an integrative analysis." Lancet Psychiatry **1**(4): 286-293.

Solowij, N. and R. Battisti (2008). "The chronic effects of cannabis on memory in humans: a review." Curr Drug Abuse Rev **1**(1): 81-98.

> Memory problems are frequently associated with cannabis use, in both the short- and long-term. To date, reviews on the long-term cognitive sequelae of cannabis use have examined a broad range of cognitive functions, with none specifically focused on memory. Consequently, this review sought to examine the literature specific to memory function in cannabis users in the nontoxicated state with the aim of identifying the existence and nature of memory impairment in cannabis users and appraising potentially related mediators or moderators. Literature searches were conducted to extract well-controlled studies that investigated memory function in cannabis users outside of the acute intoxication period, with a focus on reviewing studies published within the past 10 years. Most recent studies have examined working memory and verbal episodic memory and cumulatively, the evidence suggests impaired encoding, storage, manipulation and retrieval mechanisms in long-term or heavy cannabis users. These impairments are not dissimilar to those associated with acute intoxication and have been related to the duration, frequency, dose and age of onset of cannabis use. We consider the impact of not only specific parameters of cannabis use in the manifestation of memory dysfunction, but also such factors as age, neurodevelopmental stage, IQ, gender, various vulnerabilities and other substance-use interactions, in the context of neural efficiency and compensatory mechanisms. The precise nature of memory deficits in cannabis users, their neural substrates and manifestation requires much further exploration through a variety of behavioural, functional brain imaging, prospective and genetic studies.

Solowij, N. Y. c., M.; Lorenzetti, V.; Lubman, D. (2009). Structural Brain Alterations in Cannabis Users: Association with Cognitive Deficits and Psychiatric Symptoms. The Handbook of Neuropsychiatric Biomarkers, Endophenotypes and Genes. M. S. Ritsner, Springer Science**:** 215-225.

Sowell, E. R., et al. (1999). "In vivo evidence for post-adolescent brain maturation in frontal and striatal regions." Nat Neurosci **2**(10): 859-861.

Sowell, E. R., et al. (2004). "Longitudinal mapping of cortical thickness and brain growth in normal children." J Neurosci **24**(38): 8223-8231.

Taylor, M., et al. (2012). "Quantifying the RR of harm to self and others from substance misuse: results from a survey of clinical experts across Scotland." BMJ Open **2**(4).

OBJECTIVE: To produce an expert consensus hierarchy of harm to self and others from legal and illegal substance use. DESIGN: Structured questionnaire with nine scored categories of harm for 19 different commonly used substances. SETTING/PARTICIPANTS: 292 clinical experts from across Scotland. RESULTS: There was no stepped categorical distinction in harm between the different legal and illegal substances. Heroin was viewed as the most harmful, and cannabis the least harmful of the substances studied. Alcohol was ranked as the fourth most harmful substance, with alcohol, nicotine and volatile solvents being viewed as more harmful than some class A drugs. CONCLUSIONS: The harm rankings of 19 commonly used substances did not match the A, B, C classification under the Misuse of Drugs Act. The legality of a substance of misuse is not correlated with its perceived harm. These results could inform any legal review of drug misuse and help shape public health policy and practice.

Terranova, J. P., et al. (1996). "Improvement of memory in rodents by the selective CB1 cannabinoid receptor antagonist, SR 141716." Psychopharmacology (Berl) **126**(2): 165-172.

van Amsterdam, J., et al. (2010). "Ranking the harm of alcohol, tobacco and illicit drugs for the individual and the population." Eur Addict Res **16**(4): 202-207.

Drug policy makers continuously face a changing pattern of drug use, i.e. new drugs appear on the market, the popularity of certain drugs changes or drugs are used in another way or another combination. For legislative purposes, drugs have mostly been classified according to their addictive potency. Such classifications, however, lack a scientific basis. The present study describes the results of a risk assessment study where 19 recreational drugs (17 illicit drugs plus alcohol and tobacco) used in the Netherlands have been ranked by a Dutch expert panel according to their harm based on the scientific state of the art. The study applies a similar approach as recently applied by Nutt et al. [Lancet 2007;369:1047-1053], so that the results of both studies could be compared. The harm indicators scored are acute and chronic toxicity, addictive potency and social harm. The aim of this study is to evaluate whether the legal classification of drugs in the Netherlands corresponds with the ranking of the drugs according to their science-based ranking of harm. Based on the results, recommendations are formulated about the legal classification of recreational drugs at national and international level which serves a rational approach for drug control.

Van Laere, K., et al. (2009). "Relationship of type 1 cannabinoid receptor availability in the human brain to novelty-seeking temperament." Arch Gen Psychiatry **66**(2): 196-204.

CONTEXT: Brain neurochemistry can partially account for personality traits as a variance of normal human behavior, as has been demonstrated for monoamine neurotransmission. Positron emission tomography using fluorine 18-labeled MK-9470 now enables quantification of type 1 cannabinoid receptors (CB1R) in the brain. OBJECTIVE: To investigate whether there is a relationship between human temperament traits and regional cerebral CB1R availability. DESIGN: Forty-seven [(18)F]MK-9470 baseline scanning sessions were performed and correlated with the temperament dimensions and subdimensions of the 240-item Cloninger Temperament and Character Inventory. SETTING: Academic brain imaging center. PARTICIPANTS: Forty-seven nonsmoking, healthy volunteers (paid). Main Outcome Measure Voxel-based correlation of temperament variables of the inventory with regional CB1R availability. RESULTS: Novelty seeking was inversely correlated with global CB1R availability ($r = -0.33$, $P = .02$), with the most significant correlation in the left amygdala ($r = -0.41$, $P = .005$). In particular, the subdimension extravagance showed a highly significant inverse correlation to global CB1R availability ($r = -0.53$, $P < .001$), most pronounced in the amygdala, anterior cingulate, parietal cortex, and precuneus. Also, disorderliness was inversely correlated with global CB1R availability ($r = -0.31$, $P = .04$). CONCLUSIONS: Low baseline cerebral CB1R availability is related to a high novelty-seeking personality, in particular to extravagance, most pronounced in the amygdala. Further investigation of the functional role of the CB1R is warranted in pathological behavior known to be strongly related to novelty seeking, such as addiction and eating disorders.

van Os, J., et al. (2002). "Cannabis use and psychosis: a longitudinal population-based study." Am J Epidemiol **156**(4): 319-327.

Viveros, M. P., et al. (2012). "The endocannabinoid system in critical neurodevelopmental periods: sex differences and neuropsychiatric implications." J Psychopharmacol **26**(1): 164-176.

Vo, H. T., et al. (2014). "Working memory impairment in cannabis- and opioid-dependent adolescents." Subst Abus **35**(4): 387-390.

Volkow, N. D., et al. (2014). "Adverse health effects of marijuana use." N Engl J Med **370**(23): 2219-2227.

Weinstein, A., et al. (2008). "A study investigating the acute dose-response effects of 13 mg and 17 mg Delta 9- tetrahydrocannabinol on cognitive-motor skills, subjective and autonomic measures in regular users of marijuana." J Psychopharmacol **22**(4): 441-451.

Wesley, M. J., et al. (2011). "Poor decision-making by chronic marijuana users is associated with decreased functional responsiveness to negative consequences." Psychiatry Res **191**(1): 51-59.

Chronic marijuana users (MJ Users) perform poorly on the Iowa Gambling Task (IGT), a complex decision-making task in which monetary wins and losses guide strategy development. This functional magnetic resonance imaging (MRI) study sought to determine if the poor performance of MJ Users was related to differences in brain activity while evaluating wins and losses during the strategy development phase of the IGT. MJ Users (16) and Controls (16) performed a modified IGT in an MRI scanner.

Performance was tracked and functional activity in response to early wins and losses was examined. While the MJ Users continued to perform poorly at the end of the task, there was no difference in group performance during the initial strategy development phase. During this phase, before the emergence of behavioral differences, Controls exhibited significantly greater activity in response to losses in the anterior cingulate cortex, medial frontal cortex, precuneus, superior parietal lobe, occipital lobe and cerebellum as compared to MJ Users. Furthermore, in Controls, but not MJ Users, the functional response to losses in the anterior cingulate cortex, ventral medial prefrontal cortex and rostral prefrontal cortex positively correlated with performance over time. These data suggest MJ Users are less sensitive to negative feedback during strategy development.

Yakovlev, P. I. L., A.R. (1967). The myelogenetic cycles of regional maturation of the brain. Boston, MA, Blackwell Scientific.

Yucel, M., et al. (2008). "Regional brain abnormalities associated with long-term heavy cannabis use." Arch Gen Psychiatry **65**(6): 694-701.

CONTEXT: Cannabis is the most widely used illicit drug in the developed world. Despite this, there is a paucity of research examining its long-term effect on the human brain. OBJECTIVE: To determine whether long-term heavy cannabis use is associated with gross anatomical abnormalities in 2 cannabinoid receptor-rich regions of the brain, the hippocampus and the amygdala. DESIGN: Cross-sectional design using high-resolution (3-T) structural magnetic resonance imaging. SETTING: Participants were recruited from the general community and underwent imaging at a hospital research facility. PARTICIPANTS: Fifteen carefully selected long-term (>10 years) and heavy (>5 joints daily) cannabis-using men (mean age, 39.8 years; mean duration of regular use, 19.7 years) with no history of polydrug abuse or neurologic/mental disorder and 16 matched nonusing control subjects (mean age, 36.4 years). MAIN OUTCOME MEASURES: Volumetric measures of the hippocampus and the amygdala combined with measures of cannabis use. Subthreshold psychotic symptoms and verbal learning ability were also measured. RESULTS: Cannabis users had bilaterally reduced hippocampal and amygdala volumes (P = .001), with a relatively (and significantly [P = .02]) greater magnitude of reduction in the former (12.0% vs 7.1%). Left hemisphere hippocampal volume was inversely associated with cumulative exposure to cannabis during the previous 10 years (P = .01) and subthreshold positive psychotic symptoms (P < .001). Positive symptom scores were also associated with cumulative exposure to cannabis (P = .048). Although cannabis users performed significantly worse than controls on verbal learning (P < .001), this did not correlate with regional brain volumes in either group. CONCLUSIONS: These results provide new evidence of exposure-related structural abnormalities in the hippocampus and amygdala in long-term heavy cannabis users and corroborate similar findings in the animal literature. These findings indicate that heavy daily cannabis use across protracted periods exerts harmful effects on brain tissue and mental health.

Zammit, S., et al. (2002). "Self reported cannabis use as a risk factor for schizophrenia in Swedish conscripts of 1969: historical cohort study." BMJ **325**(7374): 1199.

OBJECTIVES: An association between use of cannabis in adolescence and subsequent risk of schizophrenia was previously reported in a follow up of Swedish conscripts. Arguments were raised that this association may be due to use of drugs other than cannabis and that personality traits may have confounded results. We performed a further analysis of this cohort to address these uncertainties while extending the follow up period to identify additional cases. DESIGN: Historical cohort study. SETTING: 1969-70 survey of Swedish conscripts (>97% of the country's male population aged 18-20). PARTICIPANTS: 50 087 subjects: data were available on self reported use of cannabis and other drugs, and on several social and psychological characteristics. MAIN OUTCOME MEASURES: Admissions to hospital for ICD-8/9 schizophrenia and other psychoses, as determined by record linkage. RESULTS: Cannabis was associated with an increased risk of developing schizophrenia in a dose dependent fashion both for subjects who had ever used cannabis (adjusted odds ratio for linear trend of increasing frequency 1.2, 95% confidence interval 1.1 to 1.4, P<0.001), and for subjects who had used only cannabis and no other drugs (adjusted odds ratio for linear trend 1.3, 1.1 to 1.5, P<0.015). The adjusted odds ratio for using cannabis >50 times was 6.7 (2.1 to 21.7) in the cannabis only group. Similar results were obtained when analysis was restricted to subjects developing schizophrenia after five years after conscription, to exclude prodromal cases. CONCLUSIONS: Cannabis use is associated with an increased risk of developing schizophrenia, consistent with a causal relation. This association is not explained by use of other psychoactive drugs or personality traits relating to social integration.

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Gateway to Curiosity: Medical Marijuana Ads and Intention and Use During Middle School

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Over the past several years, medical marijuana has received increased attention in the media, and marijuana use has increased across the United States. Studies suggest that as marijuana has become more accessible and adults have become more tolerant regarding marijuana use, adolescents perceive marijuana as more beneficial and are more likely to use if they are living in an environment that is more tolerant of marijuana use. One factor that may influence adolescents' perceptions about marijuana and marijuana use is their exposure to advertising of this product. We surveyed sixth- to eighth-grade youth in 2010 and 2011 in 16 middle schools in Southern California (n = 8,214; 50% male; 52% Hispanic; mean age = 13 years) and assessed exposure to advertising for medical marijuana, marijuana intentions, and marijuana use. Cross-lagged regressions showed a reciprocal association of advertising exposure with marijuana use and intentions during middle school. Greater initial medical marijuana advertising exposure was significantly associated with a higher probability of marijuana use and stronger intentions to use 1 year later, and initial marijuana use and stronger intentions to use were associated with greater medical marijuana advertising exposure 1 year later. Prevention programs need to better explain medical marijuana to youth, providing information on the context for proper medical use of this drug and the potential harms from use during this developmental period. Furthermore, as this is a new frontier, it is important to consider regulating medical marijuana advertisements, as is currently done for alcohol and tobacco products.

Keywords: adolescents, medical marijuana, advertising, marijuana use

Teen marijuana use is rising across the United States (Johnston, O'Malley, Bachman, & Schulenberg, 2013), and the number of frequent marijuana users (e.g., four or more times in a month) among youth and adults in the United States swelled 40% from 2006 (14.2 million people) to 2010 (17.6 million people; Caulkins, Kilmer, Reuter, & Midgette, 2015). This general increase in marijuana use mirrors changes in how adolescents perceive the drug. For example, one recent study found that among people ages 17–19 years, the popular promarijuana Twitter handle @stillblazingtho was in the top 10% of all Twitter handles followed (Cavazos-Rehg, Krauss, Grucza, & Bierut, 2004). A recent focus group study with at-risk youth found that most of these youth perceived marijuana use as "normal," with 90% voicing positive attitudes toward marijuana use (Sanders, 2012). Similarly, youth with a first-time alcohol or marijuana offense viewed using marijuana as less risky than drinking, and they also associated marijuana use with fewer negative consequences compared to drinking (D'Amico et al., 2015).

In this study, we focus on advertising for *medical marijuana.* People who have a medical marijuana card typically have a doctor's recommendation to use marijuana and are afforded some protection from arrest and criminal sanctions. Some studies have begun to assess how legalization of medical marijuana has affected attitudes toward marijuana. In a large study in Montana across several counties, Friese and Grube (2013) assessed 17,482 adolescents aged 13–19 years and examined the association between adolescent marijuana use and voter approval of medical marijuana and number of medical marijuana cards issued. They found that youth were more likely to report greater lifetime and past 30-day use of marijuana when they lived in counties with a higher percentage of voters approving legalization of medical marijuana; the number of medical marijuana cards was not related to marijuana use (Friese & Grube, 2013). Furthermore, states that have legalized medical marijuana report higher rates of marijuana use; however, from these data, it is not clear whether this is due to the actual legalization of medical marijuana or to community norms supportive of the legalization of medical marijuana (Cerdá, Wall, Keyes, Galea, & Hasin, 2012). Pacula and colleagues (Pacula, Powell, Heaton, & Sevigny, 2013) discuss the complexity of the effects of medical marijuana laws on marijuana use given that many states have different nuances to their policies that may affect this association. For example, they found that marijuana dependence was higher in states that had more lenient access to medical marijuana, such as home cultivation and state acceptance of dispensaries (Pacula et al., 2013). Overall, these recent studies suggest that as

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marijuana has become more accessible and adult views on marijuana have become more tolerant, adolescents are beginning to perceive marijuana as more beneficial and are more likely to use if they are living in an environment that is more tolerant of marijuana use.

Exposure to medical marijuana advertising may be an important influence on adolescents' perceptions about marijuana and marijuana use. Many studies have shown, for example, that there is a strong association between alcohol advertising and subsequent drinking among youth (Grenard, Dent, & Stacy, 2013; McClure, Stoolmiller, Tanski, Engels, & Sargent, 2013). Anderson, de Bruijn, Angus, Gordon, and Hastings (2009) conducted a systematic review of exposure to media and commercial communications of alcohol and found 13 longitudinal studies that followed up a total of more than 38,000 youth under the age of 21 years. These studies consistently found that exposure to alcohol advertising was related to both initiation of drinking among nondrinkers and increased drinking among those who already reported drinking at baseline. Over the past several years, medical marijuana has received increased attention in the media, billboards advertise medical marijuana, medical marijuana dispensaries now outnumber Starbucks stores in Denver (Dickson, 2011), and in March 2014, the first TV ad for medical marijuana appeared on Fox, CNN, and ESPN in New Jersey (Steinmetz, 2014). In California, there are more than 1,000 dispensaries, delivery services, and cooperatives throughout the state (National Organization for the Reform of Marijuana Laws, California Chapter, 2012). Furthermore, discussion of medical marijuana on TV (e.g., *60 Minutes: Will Colorado's Green Rush Last?* aired in December 2013) and advertising for medical marijuana have increased. Despite the increased attention on this drug, no studies to date have examined how medical marijuana advertising may affect younger adolescents' intentions to use and actual marijuana use. Of note, one recent study found that adolescents aged 12–18 years with more positive appraisals of the *antimarijuana* TV ads used in the National Youth Antidrug Media Campaign were less likely report intention to use marijuana and to continue marijuana use at 1-year follow-up (Alvaro et al., 2013).

It is well known that marijuana use during the important developmental period of adolescence is associated with a host of problems, such as poor school performance and psychological outcomes, use of other illicit drugs (including heroin and cocaine), and a higher likelihood of abuse or dependence in adulthood (Brook, Lee, Brown, & Finch, 2012; D'Amico, Ellickson, Collins, Martino, & Klein, 2005; Juon, Fothergill, Green, Doherty, & Ensminger, 2011). In addition, marijuana use is associated with neurocognitive deficits, such as poorer psychomotor speed, sustained attention, and cognitive inhibition (Lisdahl & Price, 2012). Furthermore, given that the brain is still developing, even after adolescents stop using marijuana and are abstinent for >23 days, they still have memory, attention, and reaction time deficits compared to youth who have never used marijuana (Medina et al., 2007).

Given the potential problems that marijuana use during adolescence can cause in later life, we need to better understand the factors that may affect intentions to use and initiation during this developmental period. We know of no prior research in this area; therefore, the current longitudinal study takes an important first look at the cross-lagged associations of advertising for medical marijuana on younger adolescents' intentions to use marijuana in the next 6 months and their actual marijuana use. We examined cross-lagged associations longitudinally because the *reinforcing spirals* model of media exposure and risk behavior has shown that exposure and behavior can mutually reinforce each other and potentially increase risk-taking behavior over time (Slater, 2007; Tucker, Miles, & D'Amico, 2013). For example, this dynamic process suggests that exposure to media may increase interest in that particular behavior and/or trying out that behavior (e.g., alcohol use, cigarette use, having sex), which can then lead to greater interest in pursuing that media content and increased chances of engaging in that behavior (Environmental Systems Research Institute, 2008; Slater, 2007; Task Force on Community Preventive Services, 2009).

Method

The sample comprised sixth- to eighth-grade students initially recruited in 2008 in 16 middle schools across three school districts in Southern California to evaluate the CHOICE substance use prevention program for middle school students (D'Amico et al., 2012). Schools were selected and matched to their nearest neighbor school based on the squared Euclidean distance measure, estimated using publicly available information on ethnic diversity, approximate size, and standardized test scores (D'Amico et al., 2012).

Across all schools, 92% of parents returned a consent form at the baseline, and approximately 71% of parents gave permission for their child to participate in the original study. Ninety-four percent of consented students completed the baseline survey, which is higher or comparable to other school-based survey completion rates with this population (Johnson & Hoffmann, 2000; Johnston, O'Malley, Bachman, & Schulenberg, 2009; Kandel, Kiros, Schaffran, & Hu, 2004). Surveys were administered on a prescheduled day during physical education class and took approximately 45 min to complete. Trained staff described the survey to students, reviewed confidentiality, and answered questions. Spanish-speaking staff members were available to answer student questions; survey booklets were available in Spanish and Korean. More information is available in previous publications (D'Amico et al., 2012; Shih, Miles, Tucker, Zhou, & D'Amico, 2010). The current study analyzes data from Wave 4 (June 2010) and Wave 5 (June 2011) of the study (2–3 years after the intervention took place); we retained approximately 84% of the baseline sample. Dropout was not associated with substance use outcomes.

We began to collect data on exposure to medical marijuana advertising at Wave 4 because a proposition to legalize marijuana was being discussed in the California Senate in January 2010 and was added to the California ballot in November 2010 (California Proposition 19, also known as the Regulate, Control & Tax Cannabis Act). The mean age of the sample at this time was 13 years. Youth were ethnically and racially diverse (e.g., 52% Hispanic; 17% Asian), and rates of substance use across waves were comparable to national samples (see Table 1). Specifically, in Monitoring the Future, 16.4% of eighth graders reported lifetime marijuana use in 2011 (Johnston, O'Malley, Bachman, & Schulenberg, 2012), compared with 15.8% in our eighth-grade sample.

Table 1
Demographics of the Sample (N = 8,214)

	Value
Male, %	50.2
Age, *M* (*SD*)	13.0 (0.95)
Race/ethnicity, %	
Asian	16.8
African American	3.2
Hispanic	52.2
Non-Hispanic White	15.8
Other/multiethnic	12.0
Past-month marijuana use, %	
Wave 4: 2010	3.3
Wave 5: 2011	4.8
Marijuana use intentions, *M* (*SD*)	
Wave 4: 2010	1.41 (0.95)
Wave 5: 2011	1.48 (0.98)
Exposed to advertising	
Wave 4: 2010	0.22
Wave 5: 2011	0.30

Note. Marijuana use intentions: 1 = *definitely no* to 4 = *definitely yes*; exposure to advertising: 1 = *not at all* to 7 = *every day*.

Surveys

Responses were protected by a Certificate of Confidentiality from the National Institutes of Health; procedures were approved by the individual schools and the institution's internal review board. Covariates included age, gender, race/ethnicity, academic performance, and intervention status. Of note, there were no intervention effects on marijuana use, and initial intervention effects on alcohol use were no longer significant after Wave 3 of the study (when we began collecting data on exposure to medical marijuana advertising); nonetheless, we controlled for CHOICE participation in the present analyses. *Exposure to medical marijuana advertising:* "In the past three months, how often have you seen advertisements for *medical* marijuana on billboards, in magazines, or somewhere else?" (response options ranged from 1 = *not at all* to 7 = *every day*). Advertising exposure was highly skewed and dichotomized as no exposure versus any exposure. Youth who were exposed reported seeing ads on average about once a month. *Intention to smoke marijuana:* "Do you think you will use any marijuana in the next six months?" (response options ranged from 1 = *definitely no* to 4 = *definitely yes*). *Marijuana use:* "During the past month, how many times did you use marijuana (pot, weed, grass, hash)?" (response options ranged from 1 = *0 days* to 7 = *20–30 days*). We dichotomized marijuana use into "any use" versus "no use" given that past-month use rates were low, as expected for this age group, and models would not converge using the continuous measure.

Results

The analytic sample comprised 8,214 individuals who responded at Wave 4 or 5. Maximum likelihood (ML) estimation was employed using Mplus 6.11 (Muthén & Muthén, 2011) with standard errors corrected for clustering at the school level. ML was used rather than the default WLSMV for several reasons. First, the assumptions that must be made when estimating models with missing data are more restrictive with WLSMV than with ML (Asparouhov & Muthén, 2010). Second, with ML estimation, we estimate the odds ratios, rather than the polychoric correlations; hence, there is a more direct link between the estimates in the model and the predicted probability of a behavior. One disadvantage of ML is that model fit indices are not available; however, this is not an issue as our models were saturated. We used cross-lagged regression (Finkel, 1995) to examine the association between (a) marijuana intentions and ad exposure and (b) marijuana use and ad exposure. The outcome variable and exposure at Wave 5 were both regressed on the outcome and exposure at Wave 4. Both measures, at both time points, were regressed on the covariates: age, gender, race/ethnicity, academic performance, and intervention status. The model is shown in path diagram format in Figure 1. Conventionally in a cross-lagged model, one correlates measures within time. This is not possible with categorical data (because the variances are not part of the model). Instead, we used the approach of adding a factor with loadings to both variables at each time point, which is an equivalent model to that with correlations and does not require the use of correlated error variances.

Twenty-two percent of adolescents at Wave 4 and 30% at Wave 5 reported seeing at least one advertisement for medical marijuana on billboards, in magazines, or somewhere else in the past 3 months. With regard to demographic and academic covariates, higher academic performance was associated with greater exposure to advertising ($p < .01$), and being male ($p = .014$) and of Asian descent (relative to white; $p < .01$) were associated with being exposed to fewer advertisements. For marijuana use at Wave 4, higher academic performance was associated with a greater likelihood of use ($p < .01$), and being of Asian descent or other race was associated with a lower likelihood of use ($p < .01$ and $p = .03$, respectively). For intentions to use, higher academic performance was associated with higher intentions ($p < .01$), and being of Asian descent ($p < .01$) was associated with lower intentions.

For the cross-lagged regression models, at both waves, as expected, these younger adolescents reported fairly low levels of past-month marijuana use (Wave 4: 3.3%; Wave 5: 4.8%) and low intentions to use in the next 6 months (Wave 4: $M = 1.41$, $SD = 0.95$; Wave 5: $M = 1.48$, $SD = 0.98$). Exposure to medical marijuana ads at Wave 4 predicted stronger intentions to use ($b = 0.73$, $SE = 0.06$, OR = 2.07, $p < .001$) and actual use ($b = 0.79$, $SE = 0.25$, OR = 2.20, $p = .002$) at Wave 5. Thus, youth who reported seeing any ads for medical marijuana were twice as likely as youth who reported never seeing an ad to use marijuana and to report higher intentions to use marijuana 1 year later. Marijuana use at Wave 4 ($b = 1.07$, $SE = 0.10$, OR = 2.92, $p < .001$) and intentions to use ($b = 0.09$, $SE = 0.03$, OR = 1.09, $p = .008$) also predicted exposure to medical marijuana ads at Wave 5. For example, youth who reported marijuana use were almost three times as likely to report seeing ads 1 year later.

Discussion

This study is the first step in a line of research to examine whether any exposure to medical marijuana advertising was associated with younger adolescents' marijuana intentions and actual use. Similar to the literature on alcohol advertising (Anderson et al., 2009), seeing advertisements for medical marijuana was related to middle school adolescents' intentions to use marijuana and

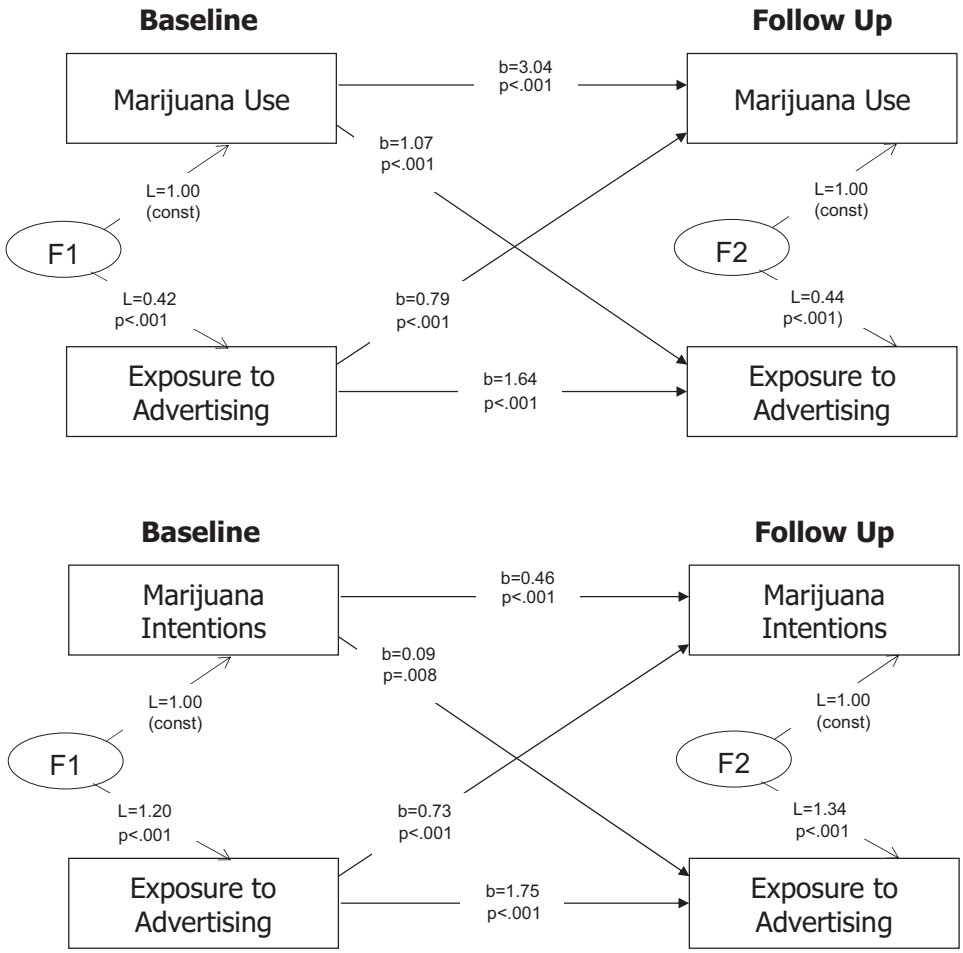

Figure 1. Cross-lagged regression models showing the longitudinal association between exposure to advertising and marijuana use, as well as exposure to advertising and marijuana intentions. F1 and F2 are latent variables used to represent the within-time covariance. Const. = constrained for identification purposes. Estimates are log(OR).

their actual marijuana use 1 year later. This is particularly important given that the mean age of our sample was 13 years, and initiation of marijuana use during early adolescence is associated with poor school performance, neuropsychological performance deficits, and further use of other illicit drugs, such as heroin and cocaine (Hall, 2009; Wittchen et al., 2008). Marijuana use in adolescence has also been linked with future problems in young adulthood, including increased risk for dependence (Ellickson, D'Amico, Collins, & Klein, 2005).

Given that advertising typically only tells one side of the story, prevention efforts must begin to better educate youth about medical marijuana while also emphasizing the negative effects that marijuana can have on the brain and performance (Lisdahl, Gilbart, Wright, & Shollenbarger, 2013; Medina et al., 2007). For example, in our intervention work with adolescents who have a first-time drug or alcohol offense, one of the sessions involves discussing how marijuana use can change the brain and affect memory and concentration (D'Amico, Hunter, Miles, Ewing, & Osilla, 2013). We found that addressing questions and discussing this type of information in a nonjudgmental way in the adolescent group setting can increase change talk, or talk that argues for decreasing marijuana use (D'Amico et al., 2015). This is important because change talk among can decrease initiation rates of both alcohol and marijuana use (Magill, Apodaca, Barnett, & Monti, 2010; Walker et al., 2011). In addition, prevention work with younger teens who have not yet initiated use has shown that discussing norms can decrease both initiation rates of alcohol and marijuana use (D'Amico & Edelen, 2007; D'Amico et al., 2012). Finally, programs could educate parents about medical marijuana so that they can better address questions that their teens may have regarding this drug; prevention programs have shown that when parents are more involved in their teens' lives, teens are less likely to use substances (Britt, Toomey, Dunsmuir, & Wagenaar, 2006; Scribner et al., 2008).

Of note, being a current marijuana user was strongly associated with adolescents' reports of seeing medical marijuana ads 1 year later. Youth who had higher intentions to use marijuana also reported seeing more ads. It may be that adolescents who use, or

are intending to use marijuana, report seeing more ads because they pay more attention to this type of advertising due to their interest in the drug and perhaps as a way to validate their use. For example, one study found that adolescents who used marijuana were more likely than nonusers to define marijuana as a "useful plant" and a "medical drug" and less likely to define it as an illegal drug (Plancherel et al., 2005). Furthermore, the *reinforcing spirals* model of media exposure and risk behavior indicates that exposure and behavior may be a mutually influencing process that could potentially increase participation in risk behaviors over time. For example, exposure to marijuana media content may influence youth to smoke marijuana, which may in turn increase the chances that they seek out marijuana media content as it fits with their interest in the drug. Support for this reciprocal model has been shown for adolescents' exposure to violent media content and aggression (Slater, 2007) and alcohol media content and drinking (Tucker et al., 2013).

As with most research of this nature, we relied on self-report from adolescents, the limitations of which are well known, although possibly exaggerated (Chan, 2008). We feel confident that our rates of use are accurate given that rates of marijuana use in our sample are similar to national norms (D'Amico et al., 2012). Furthermore, our study procedures (e.g., discussing confidentiality, using Scantrons, ensuring teachers were removed from data collection by having specific staff on the project collect surveys) provided a safe space for youth to complete their questionnaires. Another study limitation is that we only had two assessments that were spaced 1 year apart. Future work in this area could begin to examine this association over the long term with more frequent assessments as youth transition into high school and young adulthood. In addition, our measure of exposure was retrospective. We know of no validity checks or information relating to reports of exposure to advertising; however, this type of data collection is common in studies measuring advertising exposure (e.g., Anderson et al., 2009; Grenard et al., 2013; Rootman & Oakey, 1973). Of note, other methods, such as ecological momentary assessment (EMA), could be used to obtain more proximal data to gauge exposure to advertising (Scharf, Martino, Setodji, Staplefoote, & Shadel, 2013). EMA might be helpful for measuring daily exposure in this area, for example, particularly as different states begin the discussion of the legalization of marijuana, which may affect the amount of advertising that youth are exposed to in the United States. Many other potential variables also may have led to exposure to ads and/or marijuana use that we did not include in this study. For example, use of medical marijuana by a parent or by peers might have increased the chances that adolescents saw an advertisement and/or that they would subsequently use marijuana. Future work could include these variables to better tease apart these associations. In addition, research from the alcohol advertising literature over the past two decades has shown that there are more alcohol advertisements in low-income neighborhoods (Bryden, Roberts, McKee, & Petticrew, 2012; Merline, Jager, & Schulenberg, 2008). It is important to address whether certain geographic areas are also targeted for medical marijuana advertising.

Despite these limitations, results provide an important first look at the association of advertising for medical marijuana with younger adolescents' future marijuana use. Given the recent increase in media attention on marijuana, as well as the continuing changes in state laws regarding medical use of this drug, researchers must continue to assess how medical marijuana advertising may influence the way youth view marijuana and also how it may affect their usage of this drug. Researchers must also begin to think about the effects of advertising recreational marijuana as more states enact legislation legalizing recreational use. Because this is a new frontier, it is important to think about whether regulations should be put in place on medical marijuana and recreational marijuana advertising, similar to regulations that are in place for the advertising of alcohol and tobacco products.

In sum, professionals "on the front line" working with adolescents (e.g., pediatricians, clinicians, educators) must begin to educate young people about medical marijuana. First, they need to provide youth with an accurate understanding of what medical marijuana is and how it is used. This means explaining to youth that there are no efficacy studies for many conditions that marijuana is routinely used to treat. Furthermore, although there is some evidence that marijuana may help with certain ailments, much larger clinical trials with more varied groups of patients are needed (Sisson, 2014). It is also important to discuss the potential harms of this drug so youth understand how the drug may affect their developing brain and how the drug can affect performance in both adolescence and adulthood. Finally, from a public health standpoint, it is crucial that we begin to address regulatory standards for this industry given that it is in the early stages; we have a unique opportunity to shape the industry practices as legislation continues to evolve. This could help decrease potentially numerous problems similar to those that have occurred with both alcohol and tobacco advertising.

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Screening in Primary Care: What Is the Best Way to Identify At-Risk Youth for Substance Use?

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abstract

BACKGROUND: It is important to improve primary care providers' capability to identify youth at risk for alcohol and other drug use. To our knowledge, this is the first study to use *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* criteria to compare screeners for youth for both alcohol and marijuana, given that these are the most frequently used substances by this age group.

METHODS: We compared the psychometric performance of 4 screeners: the National Institute on Alcohol Abuse and Alcoholism Screening Guide (NIAAA SG), the Alcohol Use Disorders Identification Test, the Car–Relax–Alone–Forget–Family and Friends–Trouble (CRAFFT) screener, and the Personal Experience Screening Questionnaire Problem Severity Scale (PESQ-PS) in identifying alcohol and marijuana use outcomes. Youth age 12 through 18 (N = 1573; 27% black, 51% Hispanic) were screened with the NIAAA SG, followed by a Web survey that included the other screeners and outcomes.

RESULTS: Sensitivity for alcohol outcomes indicated that the NIAAA SG (0.87) did not perform as well as the CRAFFT (0.97) or PESQ-PS (0.97) screeners but performed better than the Alcohol Use Disorders Identification Test (0.70). The pattern for sensitivity across screeners for marijuana outcomes was similar.

CONCLUSIONS: An important tradeoff in primary care settings is precision versus practicality. Because of brevity and focus on frequency of drinking, the NIAAA SG offers ease of administration and is good at identifying youth with probably problematic drinking levels. The PESQ-PS and the CRAFFT correctly identify more at-risk youth for alcohol and marijuana than the NIAAA SG. Future work is needed to elucidate how to efficiently and accurately identify at-risk youth in the primary care setting, including determining the best cutoff points to use to increase sensitivity.

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This trial has been registered at www.clinicaltrials.gov (identifier NCT01797835).

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WHAT'S KNOWN ON THIS SUBJECT: Most adolescents are not screened for substance use in primary care because of time constraints or insufficient training. Providers need a screener that can be easily incorporated into an appointment; however, there is a tradeoff between precision and practicality.

WHAT THIS STUDY ADDS: We examined sensitivity, specificity, and positive and negative predictive value for the new National Institute on Alcohol Abuse and Alcoholism screener and 3 widely used adolescent screeners for various levels of alcohol and marijuana use and impairment in a large, racially and ethnically diverse sample of adolescents.

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It is important to improve the capability of primary care providers and associated health care staff to identify youth at risk for alcohol and other drug (AOD) use because use during adolescence is associated with academic problems, poorer mental health, future use of other illicit drugs (including heroin and cocaine), and a higher likelihood of abuse or dependence in adulthood.[1–3] The primary care setting provides a unique opportunity to screen significant numbers of adolescents[4] and identify those at risk for problematic use. Guidelines propose that providers screen for AOD use and provide brief counseling and referrals where appropriate[5] and that doctors screen all patients for alcohol use starting in middle school.[6]

Unfortunately, most adolescents are not screened for AOD use in primary care settings,[7–11] and significant numbers of at-risk youth remain unidentified and never receive appropriate preventive or treatment services.[12–14] Lack of screening and preventive services is even more profound among younger adolescents age 11 to 14 and socioeconomically disadvantaged youth.[15,16] Lack of primary care screening typically is caused by provider time constraints, discomfort discussing AOD use, insufficient training, or lack of referral options.[9,10,17,18]

Given these concerns, providers need an easy-to-administer screener that takes little time or training, can be incorporated into a primary care appointment to determine an adolescent's risk level, and will facilitate appropriate referral or treatment. There is a difficult tradeoff between precision and practicality in the primary care setting. To increase screening in pediatric settings, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) developed a brief 2-item screening guide (SG) with 2 age-specific screening questions about friend and self-drinking.[19] Age-sensitive cutoff points can assist providers in determining whether brief advice, counseling, or referral is appropriate. For example, any report of drinking if the youth is ≤15 years old warrants brief advice and counseling. For youth ≥16 years old, the threshold is a bit higher, and drinking ≥6 days in the past year is considered moderate or high risk.

In 2014, Kelly et al[11] evaluated the NIAAA SG in a sample of 525 youth age 12 to 17 years (54% female) who were mainly black (92.8%). Their focus was on expanding the NIAAA SG to include drug and tobacco questions for a total of 10 questions and determining cutoff points for their Brief Screener for Tobacco, Alcohol and Other Drugs. They established cutoff points for this new screener for each substance and compared the Brief Screener for Tobacco, Alcohol and Other Drugs cutoff points with the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) criteria.[11] In 2016, Clark et al[20] examined cutoff points for the NIAAA SG and found that ≤3 days of alcohol use in the past year yielded optimal psychometric performance.

Several studies[21–25] have reviewed adolescent screeners to determine performance against DSM-4 and DSM-5 criteria. Some screeners focus only on alcohol, such as the NIAAA SG, whereas others address AOD more broadly. A comparison of the Alcohol Use Disorders Identification Test (AUDIT; 10 items; alcohol only), Car–Relax–Alone–Forget–Family and Friends–Trouble (CRAFFT; 6 items; AOD), Cut Down, Annoyed, Guilty, Eye-Opener (CAGE; 4 items; alcohol only), and Tolerance, Worry, Eye-Opener, Cutoff (TWEAK; 5 items; alcohol only) in a sample of youth recruited in an emergency department found that Cut Down, Annoyed, Guilty, Eye-Opener items were reported infrequently by adolescents and that the AUDIT performed the best across the range of cutoff scores.[21] The Problem Severity Scale on the Personal Experience Screening Questionnaire (PESQ-PS; 18 items; AOD)[23,26,27] had the highest reliability estimates when compared with several other screening measures that address behavior and consequences for youth, such as the Rutgers Alcohol Problem Index.[28] Furthermore, the 2011 American Academy of Pediatrics guidelines recommended routine use of the CRAFFT, which measures AOD use,[29] has been validated in diverse populations,[30,31] and has good sensitivity and specificity with new DSM-5 criteria.[32]

Thus, across diverse studies, the AUDIT, CRAFFT, and PESQ-PS appear to be the most sensitive and reliable screeners with adolescents. They are short, taking ~5 to 10 minutes to complete and score. The NIAAA SG[19] could also easily be integrated into primary care practice given its brevity,[11] and studies have shown that asking youth about alcohol use frequency is often the best predictor of their alcohol use over time.[33,34] We therefore compared these 4 screeners in identifying both alcohol and marijuana use among adolescents because these substances are the most frequently reported substances for this age group.[35]

This study moves the field forward by comparing 4 screeners in a large racially and ethnically diverse sample of adolescents, ages 12 through 18, recruited across 4 primary care clinics in Los Angeles, California and Pittsburgh, Pennsylvania. The study's purpose was to inform primary care providers seeking to screen adolescents for alcohol and marijuana use about the 4 screeners' strengths and weaknesses; we compared screeners with respect to sensitivity, specificity, positive

predictive value (PPV), and negative predictive value (NPV) for various levels of alcohol and marijuana use and impairment.

METHODS

Procedures

This study involved 4 clinics (1 in Los Angeles, 3 in Pittsburgh). We obtained a certificate of confidentiality; procedures were approved by both the RAND institutional review board and the 4 clinics. Every youth age 12 through 18 who came for an appointment during the 2.5-year study period (April 2013–November 2015) was asked to be in the project. We obtained parental consent and youth assent (<18 years old) or consent (18 years old). Youth were screened with the NIAAA SG, completed a survey via the Web, and paid $25.

Setting, Participants, and Surveys

The Pittsburgh and Los Angeles area clinics are family-based community health clinics that provide care for ethnically and racially diverse and underserved populations of youth. Sites offer both longitudinal, continuity-based care and episode-based urgent care to their patients. Clinics in both cities have a large percentage of minority patients and serve a high proportion of low-income patients. Approximately 3309 youth were approached to be in the project. Of these youth, 27% (n = 892) were ineligible because of age, lack of English proficiency, being present for an appointment other than their own, or disability status; 18.5% (n = 614) declined to participate, mostly because of time constraints or youth being at the clinic for family planning and not wanting their parents to know they were there. This process yielded a total sample of 1803 youth who enrolled or provided consent to contact. Of the 1803 youth, 230 did not complete the baseline within the field period or had unreliable contact information. The final enrolled sample included 1573 youth. Screening and surveys were completed in a private clinic space without a parent present. RAND staff first screened youth in person by using the NIAAA SG; youth then completed a Web-based survey comprising other screeners and outcome variables on a laptop immediately after completion of the NIAAA SG (see Supplemental Information for screener questions).

Screeners

NIAAA SG

Two screening questions were asked in a different order depending on age[19]: "In the past year, on how many days have you had more than a few sips of beer, wine, or any drink containing alcohol?" and "Do any of your friends drink alcohol?" Youth age 12 to 14 years were first asked about friend drinking and then self-drinking as a less threatening way to gauge use, whereas youth age ≥15 years (and 14-year-olds in high school) were first asked about self-drinking and then friend drinking. Adolescents were categorized based solely on the days of use question according to the published NIAAA risk assessment guide, which results in 4 risk categories: no risk, lower risk, moderate risk, and highest risk. For example, youth age 12 to 15 years were categorized as moderate risk if they reported 1 to 5 days of use; adolescents 16 years old were categorized as moderate risk if they reported 6 to 11 days of use.

CRAFFT

The 6-item CRAFFT[29] addresses both alcohol and other drugs (eg, "Do you ever use AOD to *Relax,* feel better about yourself, or fit in?"). Response options are "yes" or "no," and a "yes" response to ≥2 questions indicates risk.

PESQ-PS

The 18-question PESQ-PS[26] assesses AOD use rated on a 4-point response scale (never, once or twice, sometimes, often). The summed score categorizes adolescents into 3 groups, no AOD problem ("Green Flag"), mild or moderate AOD problem ("Yellow Flag"), and severe AOD problem ("Red Flag"), by using established thresholds. Thresholds vary depending on sex and age.

AUDIT

The AUDIT[36] focuses on frequency and consequences of drinking. It was modified slightly to be developmentally appropriate for youth.[21] Youth are categorized into Zone I (alcohol education), Zone II (simple advice), Zone III (simple advice plus brief intervention and follow-up), or Zone IV (referral to specialist).

Outcomes

Youth with an alcohol use disorder (AUD) or cannabis use disorder (CUD) were identified via the Diagnostic Interview Schedule for Children Version IV (DISC-IV)[37] computerized version, valid and reliable in adolescent populations.[38–40] We used DSM-5 criteria available in this version (eg, the craving item was included; see Supplemental Figure) to identify subjects with AUD or CUD. Adolescents were classified as having an AUD or CUD if they reported ≥2 of the 11 criteria for AUD or CUD. Past-year alcohol and marijuana use was assessed via well-established measures with adolescents.[41] We asked, "During the past year, how many times did you [drink at least one full drink of alcohol] [use marijuana]?" Responses ranged from 1 = "0 times" to 6 = "11–20 times" and were dichotomized (1 = "any use" versus 0 = "no use").

TABLE 1 Sample Characteristics by Age Group

	Overall, *N* = 1573, Mean (SD) or *N* (%)	Age 12–14, *N* = 498, Mean (SD) or *N* (%)	Age 15–18, *N* = 1075, Mean (SD) or *N* (%)
Age	15.5 (1.9)	13.2 (0.8)	16.6 (1.1)
Sex			
Male	662 (42.5%)	235 (48%)	427 (40.1%)
Female	894 (57.5%)	255 (52%)	639 (59.9%)
Race or ethnicity			
White	232 (14.7%)	78 (15.7%)	154 (14.3%)
Black	420 (26.7%)	166 (33.3%)	254 (23.6%)
Hispanic	808 (51.4%)	209 (42%)	599 (55.7%)
Other or multiracial	113 (7.2%)	45 (9%)	68 (6.3%)
Prevalence: past-year use			
Alcohol use	655 (41.7%)	66 (13.3%)	589 (54.9%)
Heavy alcohol use	347 (22.1%)	24 (4.8%)	323 (30.1%)
Marijuana use	575 (36.6%)	77 (15.5%)	498 (46.4%)
Heavy marijuana use	302 (19.3%)	38 (7.7%)	264 (24.7%)
Prevalence: DSM-5 diagnosis			
AUD	61 (3.9%)	4 (0.8%)	57 (5.4%)
CUD	211 (13.6%)	23 (4.7%)	188 (17.8%)

Percentages are among nonmissing values; 17 missing sex, 10 missing past-year alcohol or marijuana use responses, 35 missing responses needed to determine DSM-5 Diagnostic Interview Schedule for Children diagnosis category.

For past-year heavy alcohol use, respondents were asked, "During the past year, how many times have you tried five or more drinks of alcohol in a row, that is, within a couple of hours?" with the same response options and dichotomization. For past-year heavy marijuana use, respondents were asked, "On days you use marijuana, how often do you use it?" Responses were "Once," "Twice," and "3 or more times," and responses of "twice" and "3 or more" were considered heavy marijuana use.

Statistical Analysis

We examined the proportion of youth identified as at risk for each screener. We estimated sensitivity, specificity, PPV, and NPV against DSM-5 diagnoses of AUD and CUD, past-year any use, and past-year heavy alcohol and marijuana use. Sensitivity is the probability that the screener correctly identifies at-risk youth (as at risk), whereas specificity is the probability that the screener correctly identifies no-risk youth (as low or no risk). PPV is the probability of a case screened as positive actually being positive; this depends on specificity of the test and prevalence of the condition. NPV is the probability of a negative diagnosis indicating a true negative. For screeners with multiple risk categories, we used the lowest established risk threshold to dichotomize adolescents into low- and high-risk categories. Specifically, for the AUDIT, youth categorized in Zone II or above were considered at risk, for the PESQ-PS, youth categorized in the yellow or red flag categories were considered at risk, and for the NIAAA SG screener, youth categorized as moderate or high risk were considered at risk. We had <2.5% of data missing for any 1 variable; pairwise deletion was used to handle missingness. We performed analyses via R version 3.2.4 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

More than half the sample was female; youth were racially and ethnically diverse, with a mean age of 15.5 years (Table 1). More than 40% of adolescents reported drinking >1 time in the past year, with almost a quarter reporting heavy use. About 37% reported using marijuana >1 time in the past year, with 1 in 5 reporting heavy marijuana use. According to DSM-5 criteria, 3.6% of youth were identified with an AUD; 13.6% were identified with a CUD.

Table 2 shows number and proportion of adolescents in each risk category by screener, stratified by age. Older youth were more likely to be identified as at risk. Overall, the NIAAA SG, CRAFFT, PESQ-PS, and AUDIT identified 19%, 30%, 31%, and 8% of adolescents as at risk, respectively.

Table 3 presents sensitivity, specificity, PPV, and NPV and associated 95% confidence intervals for screeners by AUD, past-year alcohol use, and past-year heavy alcohol use. For sensitivity, for all alcohol outcomes, the NIAAA SG did not perform as well as the CRAFFT or PESQ-PS screeners but performed better than the AUDIT. For AUD, the sensitivity was 0.87 for the NIAAA SG, 0.98 for the CRAFFT, 0.97 for the PESQ-PS, and 0.70 for the AUDIT. Specificity tended to be high, but it was lowest for the CRAFFT and PESQ-PS when AUD was used as the outcome. For PPV, among adolescents identified as at risk on the NIAAA SG,

TABLE 2 Number and Percentage of Youth Identified at Risk for Alcohol or Drug Use by Screener

	Overall, *N* = 1573, *N* (%)	Age 12–14, *N* = 498, *N* (%)	Age 15–18, *N* = 1075, *N* (%)
NIAAA			
No risk	992 (63.1%)	445 (89.4%)	547 (50.9%)
Lower risk	287 (18.2%)	0 (0%)	287 (26.7%)
Moderate risk	199 (12.7%)	46 (9.2%)	153 (14.2%)
Highest risk	95 (6%)	7 (1.4%)	88 (8.2%)
CRAFFT			
<2	1100 (70.2%)	445 (89.7%)	655 (61.2%)
≥2	467 (29.8%)	51 (10.3%)	416 (38.8%)
PESQ-PS			
Green Flag	1064 (69%)	432 (89.8%)	632 (59.6%)
Yellow Flag	227 (14.7%)	28 (5.8%)	199 (18.8%)
Red Flag	250 (16.2%)	21 (4.4%)	229 (21.6%)
AUDIT			
Zone I: Education	1440 (91.8%)	490 (98.6%)	950 (88.6%)
Zone II: Simple Advice	106 (6.8%)	4 (0.8%)	102 (9.5%)
Zone III: Advice and Counseling	13 (0.8%)	2 (0.4%)	11 (1%)
Zone IV: Referral	10 (0.6%)	1 (0.2%)	9 (0.8%)

Percentages are among nonmissing values; 6 youth missing ≥1 response needed to calculate CRAFFT score, 32 youth missing ≥1 response needed to calculate PESQ-PS score, 4 youth missing ≥1 response needed to calculate AUDIT score.

TABLE 3 Sensitivity, Specificity, PPV, and NPV for Each Screener, With 95% Confidence Intervals, for 3 Different Outcomes: DSM-5 Diagnosis of AUD, Past-Year Alcohol Use, and Past-Year Heavy Alcohol Use

	Sensitivity	Specificity	PPV	NPV
AUD				
NIAAA	0.87 (0.76–0.94)	0.84 (0.82–0.86)	0.19 (0.14–0.24)	0.99 (0.99–1.00)
CRAFFT	0.98 (0.91–1.00)	0.73 (0.71–0.76)	0.13 (0.10–0.17)	1.00 (0.99–1.00)
PESQ-PS	0.97 (0.88–1.00)	0.72 (0.70–0.74)	0.12 (0.09–0.15)	1.00 (0.99–1.00)
AUDIT	0.70 (0.57–0.81)	0.94 (0.93–0.96)	0.34 (0.26–0.43)	0.99 (0.98–0.99)
Past-year alcohol use				
NIAAA	0.40 (0.37–0.44)	0.97 (0.95–0.98)	0.90 (0.86–0.93)	0.69 (0.67–0.72)
CRAFFT	0.61 (0.57–0.65)	0.93 (0.91–0.94)	0.85 (0.82–0.88)	0.77 (0.74–0.79)
PESQ-PS	0.64 (0.60–0.67)	0.93 (0.91–0.94)	0.86 (0.83–0.89)	0.78 (0.75–0.80)
AUDIT	0.19 (0.16–0.22)	0.99 (0.98–1.00)	0.94 (0.88–0.97)	0.63 (0.61–0.66)
Past-year heavy alcohol use				
NIAAA	0.56 (0.51–0.61)	0.92 (0.90–0.93)	0.66 (0.60–0.71)	0.88 (0.86–0.90)
CRAFFT	0.81 (0.76–0.85)	0.84 (0.82–0.86)	0.59 (0.55–0.64)	0.94 (0.92–0.95)
PESQ-PS	0.85 (0.80–0.88)	0.84 (0.82–0.86)	0.61 (0.56–0.65)	0.95 (0.94–0.96)
AUDIT	0.33 (0.28–0.39)	0.99 (0.98–0.99)	0.89 (0.82–0.94)	0.84 (0.82–0.86)

95% confidence intervals obtained by using exact binomial confidence limits.[42]

19% had an AUD, 90% reported past-year alcohol use, and 66% reported heavy past-year alcohol use.

Table 4 parallels Table 3 for marijuana outcomes. Similar to alcohol, the NIAAA SG performed better than the AUDIT but did not perform as well as the CRAFFT or PESQ-PS in terms of sensitivity. For example, among adolescents with CUD, the CRAFFT, PESQ-PS and NIAAA SG correctly identified 88%, 91%, and 54% as at risk, whereas the AUDIT correctly identified 32%. For PPV, among adolescents identified as at risk on the NIAAA SG, 40% had a CUD, 77% reported past-year marijuana use, and 50% reported past-year heavy marijuana use. For both PPV and NPV, the NIAAA SG performed similarly to the CRAFFT and PESQ-PS when CUD and heavy marijuana use were examined.

DISCUSSION

To our knowledge, this is the first study to use the DSM-5 AUD and CUD criteria to compare several different screeners for youth. We compared 4 adolescent screeners for various levels of alcohol and marijuana use and impairment with a large, racially and ethnically diverse multisite primary care population. The CRAFFT and PESQ-PS, which address AOD, identified about one-third of youth as at risk, the NIAAA SG identified ~19%, and the AUDIT identified ~8%. The CRAFFT and PESQ-PS had excellent sensitivity for detecting an AUD and also did well for CUD. The NIAAA SG, briefer and focused exclusively on alcohol, was better at identifying youth with an AUD

TABLE 4 Sensitivity, Specificity, PPV, and NPV for Each Screener, With 95% Confidence Intervals, for 3 Different Outcomes: DSM-5 Diagnosis of CUD, Past-Year Marijuana Use, and Past-Year Heavy Marijuana Use

	Sensitivity	Specificity	PPV	NPV
CUD				
NIAAA	0.54 (0.47–0.60)	0.87 (0.85–0.89)	0.40 (0.34–0.46)	0.92 (0.91–0.94)
CRAFFT	0.88 (0.83–0.92)	0.80 (0.78–0.82)	0.41 (0.36–0.45)	0.98 (0.97–0.99)
PESQ-PS	0.91 (0.86–0.94)	0.79 (0.77–0.81)	0.41 (0.37–0.46)	0.98 (0.97–0.99)
AUDIT	0.32 (0.26–0.39)	0.96 (0.94–0.97)	0.54 (0.44–0.62)	0.90 (0.88–0.92)
Past-year marijuana use				
NIAAA	0.39 (0.35–0.44)	0.93 (0.92–0.95)	0.77 (0.72–0.82)	0.73 (0.70–0.75)
CRAFFT	0.68 (0.64–0.72)	0.92 (0.90–0.94)	0.84 (0.80–0.87)	0.83 (0.81–0.86)
PESQ-PS	0.72 (0.68–0.75)	0.93 (0.91–0.94)	0.85 (0.81–0.88)	0.85 (0.83–0.87)
AUDIT	0.20 (0.17–0.24)	0.99 (0.98–0.99)	0.91 (0.84–0.95)	0.68 (0.66–0.71)
Past-year heavy marijuana use				
NIAAA	0.48 (0.42–0.54)	0.88 (0.87–0.90)	0.50 (0.44–0.56)	0.88 (0.86–0.89)
CRAFFT	0.84 (0.79–0.88)	0.83 (0.81–0.85)	0.54 (0.49–0.59)	0.96 (0.94–0.97)
PESQ-PS	0.86 (0.81–0.90)	0.82 (0.80–0.84)	0.54 (0.49–0.59)	0.96 (0.95–0.97)
AUDIT	0.29 (0.24–0.34)	0.97 (0.96–0.98)	0.67 (0.59–0.75)	0.85 (0.83–0.87)

95% confidence intervals obtained by using exact binomial confidence limits.[42]

versus a CUD, and the AUDIT had lower sensitivity for both disorders. Screeners had higher sensitivity for identifying youth who reported past-year heavy alcohol use compared with any past-year drinking. This result is not surprising given that one would generally expect youth with heavy drinking to be easier to identify as high risk compared with youth who have had any past drinking in the last year (which may include very light drinkers). In addition, screeners that addressed AOD versus only alcohol did better at identifying youth who reported heavy past-year marijuana use and any past-year marijuana use.

Overall, specificity was lower than sensitivity for all screeners for AUD and CUD, although it was still good. Given that the potential harm of a false positive is low in this setting, whereas risks associated with a false negative are high, providers might be more willing to accept lower specificity for high sensitivity to ensure that at-risk youth are identified. As expected, the PPV was better for all screeners in identifying past-year use for alcohol and marijuana use versus AUD and CUD because the PPV depends on both specificity of the test and prevalence of the condition. The NPV was also high for all screeners.

An important tradeoff in primary care settings is precision versus practicality. Incorporating screening into everyday practice can be difficult if the screener is long or not intuitive. Because of its brevity and focus on frequency of drinking, the NIAAA SG offers ease of administration, and results show that it is good at identifying youth with problematic drinking levels. However, the PESQ-PS and the CRAFFT correctly identify more at-risk youth for alcohol than the NIAAA SG. One recent study found that computer self-entry for the CRAFFT was valid and time-efficient.[43] Other work has also shown that brief screens can be completed electronically as part of routine care.[44] Future work is needed to elucidate how to most efficiently and accurately identify more at-risk youth in the primary care setting, including determining the best cutoff points to use to increase sensitivity.

Although the NIAAA SG performed well for alcohol outcomes, it did not do as well identifying youth who report marijuana use. This result is not surprising because the NIAAA SG questions focus on alcohol. However, identifying youth at risk for marijuana use is also important, particularly because it affects more domains of functioning in adolescence than alcohol.[45] Furthermore, in this sample, 72% of youth who reported past-year alcohol use also reported past-year marijuana use, and CUD in this sample was >3 times as common as AUD, emphasizing the importance of asking about marijuana use in primary care settings. If a positive screen occurs, providers need to discuss potential harms of marijuana so youth better understand how the drug can affect functioning in both adolescence and adulthood. This discussion is particularly important because many youth view marijuana use as less harmful than alcohol use,[46] perhaps because of continuing changes in state laws regarding medical and recreational use of marijuana. Interventions as brief as 15 minutes can lead to subsequent reductions in youth AOD use,[47,48] but time constraints, issues of confidentiality, and knowledge of what to do after a positive a screen remain common barriers to screening in the primary care setting.[49–51] Training designed to increase provider confidence in screening and discussing AOD use with at-risk youth[52,53] and addressing confidentiality concerns[51] is 1 approach to

decreasing barriers, as is incorporating technology and providing computerized brief interventions in primary care settings for at-risk youth.[54]

Limitations of the current study include self-report, although self-report limitations are often exaggerated,[55] and rates of AOD use in our sample were similar to national rates.[41] The sample may also not be generalizable to all adolescents in primary care clinics; however, clinics did cross 2 states, and the sample was racially and ethnically diverse, with a wide range of ages. We also always administered the NIAAA SG to youth first, which could be a reason for lower sensitivity.[43] Finally, we cannot speak to performance of these screeners as clinical tools. For example, knowing their doctor will see their answers might change an adolescent's likelihood of disclosure. Future studies should examine screener performance under more realistic clinical conditions.

CONCLUSIONS

In sum, many youth were identified as at risk by these 4 screeners; however, some screeners performed better than others, depending on the substance and severity (eg, frequency of use versus a disorder). Future work could focus on quantifying tradeoffs in precision and practicality of these screeners in primary care.

ABBREVIATIONS

AOD: alcohol and other drug
AUD: alcohol use disorder
AUDIT: Alcohol Use Disorders Identification Test
CRAFFT: Car–Relax–Alone–Forget–Family and Friends–Trouble
CUD: cannabis use disorder
DISC-IV: Diagnostic Interview Schedule for Children Version IV
DSM-5: *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*
NIAAA SG: National Institute on Alcohol Abuse and Alcoholism Screening Guide
NPV: negative predictive value
PESQ-PS: Personal Experience Screening Questionnaire Problem Severity Scale
PPV: positive predictive value

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Screening in Primary Care: What Is the Best Way to Identify At-Risk Youth for Substance Use?

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Alcohol and marijuana use trajectories in a diverse longitudinal sample of adolescents: examining use patterns from age 11 to 17 years

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ABSTRACT

Aims We tested race/ethnic differences in alcohol and marijuana (AM) trajectories (comprising an intercept term, reflecting overall probability of use, and a slope term, reflecting change in probability of use) during adolescence, whether AM use trajectories predicted high school outcomes, and whether outcomes differed by race/ethnicity after controlling for trajectory of AM use. **Design** This longitudinal study involved 6509 youth from 16 middle schools in Southern California surveyed from age 11.5 (2008) to age 17 (2015) years; all surveys assessed AM use, and the final survey also examined high school outcomes. **Setting** Youth completed five surveys in middle school and two on-line surveys in high school. **Participants** The sample was 50% male and 80% non-white. **Measurements** Intercept (at 2.75 years post-baseline) and slope of AM use were examined as outcomes for race/ethnic differences. AM use trajectories were examined as predictors of academic performance and unpreparedness, social functioning, mental and physical health and delinquency. **Findings** We found differences in trajectories of use by race/ethnicity, with white youth reporting a higher overall intercept of alcohol use compared to all other groups (versus Asian $P < 0.001$, black $P = 0.001$, multi-ethnic $P = 0.008$). Overall, examination of trajectories of use showed that adolescents with a higher alcohol use intercept term reported greater academic unpreparedness ($P < 0.001$) and delinquency ($P < 0.001$) at wave 7 in high school. In addition, youth with a higher intercept for marijuana use reported greater academic unpreparedness ($P < 0.001$) and delinquency ($P < 0.001$), and poorer academic performance ($P = 0.032$) and mental health ($P = 0.002$) in high school. At wave 7, compared to white youth, Hispanic and multi-ethnic youth reported poorer academic performance ($P < 0.001$ and $P = 0.034$, respectively); Asian, black and Hispanic youth reported higher academic unpreparedness ($P < 0.001$, $P = 0.019$, and $P = 0.001$); and Asian youth and multi-ethnic youth reported poorer physical health ($P = 0.012$ and $P = 0.018$) controlling for AM use. **Conclusions** Greater AM use was associated with worse functioning in high school for all youth. After controlling for AM use, non-white youth reported worse outcomes in high school for academics and health.

Keywords Adolescents, alcohol, marijuana, race/ethnicity, substance use, trajectories.

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INTRODUCTION

The period from middle school to high school is associated with important developmental changes that occur physically, socially and mentally [1–3]. Initiation of alcohol and/or marijuana (AM) during this time-period can affect functioning significantly, especially if youth initiate at a younger age. For example, AM use during this time-period is associated with academic problems, poorer mental health, use of other illicit drugs in the future (including heroin and cocaine) and a higher likelihood of abuse or dependence in adulthood [4–6]. Furthermore, given that the brain is still developing, adolescents can still have memory, attention and reaction-time deficits even after they stop using compared to youth who have never used AM [7,8].

Studies in the United States examining trajectories of alcohol use during adolescence have shown a consistent pattern. Initiation occurs typically in early adolescence (roughly ages 11–15) with drinking rates increasing steadily during mid- and late adolescence before peaking in early young adulthood [9]. Marijuana use trajectories

follow a similar pattern, albeit with a later average age of initiation (i.e. 17). However, not all individuals follow this general pattern; thus research has focused on identifying distinct developmental trajectories of AM use. Most of these studies identify a group of persistent or high users, a declining group where use starts off heavy and gradually declines over time, an increasing group where use gradually escalates over time, and a moderate/infrequent group that uses occasionally over time [9–14]. Persistent or high AM users typically have the worst outcomes [15–19]. For example, youth in high marijuana use groups during high school also reported higher rates of both mental health and drug problems at age 21 [20]; membership in higher alcohol use groups in 6th grade was associated with greater use of other substances and violent behavior in 8th grade [21]; youth in the heaviest drinking trajectory group at age 18 had more problems with verbal memory and monitoring 2 years later [22]; and youth who initiated alcohol and cigarettes concurrently early on reported worse physical health, a higher likelihood of selling drugs and the highest rates of self-reported problems compared to groups that did not initiate use in early adolescence [23].

Few studies have examined trajectories of alcohol and other drug (AOD) use among diverse ethnic and racial samples across middle school and high school [9,11,24]. However, the face of the United States is changing. During the next 15 years, Asian American, Hispanic American, African American, and Native American populations are expected to rapidly grow in size, with each of these cultures subsequently comprising a significant proportion of the nation [17,25]. In addition, multi-racial Americans are the fastest-growing population under age 18 [26]. Research has shown that non-whites often have worse health outcomes [11,27,28] and more interpersonal problems and other negative outcomes from AOD use [8,29–31] compared to whites, even with less AOD use. To date, there are no studies that longitudinally address when these disparities may start; for example, whether we may see disparities in functioning due to AOD use begin as early as adolescence. It is imperative that we assess when disparities in functioning may begin to occur and in what domains so that clinicians and providers can better determine the best time and way to intervene.

A small body of research has assessed racial/ethnic differences in AOD use; however, studies focus typically on one substance and do not address potential disparities in outcomes. Results indicate that whites and Hispanics are more likely than blacks and Asians to drink alcohol [32,33], smoke cigarettes [34–36] and use marijuana [37,38]. Four recent studies have examined racial/ethnic differences in more than one substance across adolescence into adulthood [2,39,40]. They all used data from the National Longitudinal Study of Adolescents and Adults (Add Health) to examine use of cigarettes, alcohol and marijuana. Although these studies examined use from adolescence to adulthood, they only had four waves of data that were spaced over a 14-year period. Setoh and colleagues [2] examined differences between whites and Hispanics; Keyes *et al.* [40] compared whites and blacks; Chen & Jacobson [41] compared whites, blacks, Hispanics and Asians; and Evans-Polce *et al.* [39] examined differences between whites, Hispanics and blacks. Three studies found that white youth had higher rates of AOD use initially and increased their use more rapidly over time than non-white youth; however, racial/ethnic differences lessened as youth aged, indicating that non-white youth 'caught up' in their 20s and 30s. Chen & Jacobson [41] found that Hispanics had the highest rate of use for all substances at age 12, with whites increasing the most rapidly, and peak levels of use for blacks occurring at later ages.

These studies have advanced our knowledge in this area significantly; however, several gaps need to be addressed. First, few longitudinal studies examine trajectories for more than one substance. Given that AM are the two substances initiated and used most frequently during adolescence, it is important to examine how trajectories of AM use during this time-period may affect outcomes differentially. Second, none of these studies measure AM use with regular assessments during both middle school and high school. These are important developmental time-periods to measure consistently. More regular assessments allow examination across critical transitions, including from age 11 to 14, when use rates increase dramatically [42,43], and from 14 to 17 when youth begin to gain more independence from parents and may have more opportunities to engage in risk behaviors [44,45]. Third, studies tend to focus upon differences between just a few racial/ethnic groups. Longitudinal research with diverse groups of youth is needed, including multi-ethnic youth, so we can examine how use in middle school and high school may affect functioning in high school. Fourth, most studies that examine how trajectories affect outcomes tend to focus upon one outcome, such as mental health or academic achievement. It is important to assess several different domains, such as academics, physical and mental health, social functioning and behavior as findings could shed light on what domains may be most affected during this important developmental period, which could help to inform prevention efforts. Most importantly, these studies do not typically address potential disparities in functioning that may occur given the same rates of use during this time-period. One cross-sectional study found that Latino high school-aged youth who reported drinking also reported a higher likelihood of getting into trouble with the police compared to white and Asian youth who drank alcohol [30]. The current study moves the field forward significantly in this area by (a) testing slope and intercept differences for AM use by race/ethnicity to determine whether

differences exist in probability of use and rate of change in probability of use, (b) testing whether the intercept and slope (average and change) of probability of AM use from age 11 to 16 predict outcomes across several key domains of functioning at age 17 and (c) adjusting for level of AM use and comparing outcomes for white, black, Hispanic, Asian and multi-ethnic youth to understand whether functioning in high school differs for these groups after controlling for AM use.

METHOD

Participants and procedures

This study focuses upon two cohorts of youth who were in 6th and 7th grades (age 11–12) in 2008 and were followed until 2015 (age 17). Participants were part of an AOD use prevention program, CHOICE, conducted in 16 middle schools in the greater Los Angeles area [46]. Schools were selected initially to participate across three districts to obtain a diverse sample and to have similar AM use rates at baseline. A total of 14 979 students across all 16 schools received parental consent forms; 92% of parents returned this form ($n = 13\,785$). Approximately 71% of parents gave permission for their child to participate ($n = 9828$) and 94% of consented students completed the first survey ($n = 8932$). The study has a Certificate of Confidentiality; all procedures were approved by the institution's review board. Youth completed waves 1–5 in middle school during physical education class (wave 1: fall 2008, wave 2: spring 2009, wave 3: fall 2009, wave 4: spring 2010, and wave 5: spring 2011), and follow-up rates ranged from 74 to 90%, excluding new youth who could have come in at a subsequent wave. Procedures are reported more extensively elsewhere [46]. As youth graduated from middle school to high school between waves 5 and 6, they transitioned from 16 middle schools to more than 200 high schools nationally and internationally. The cohort was re-contacted and re-consented to complete four annual web-based surveys; we utilize the first two waves in the current study, as this is what is available at this time. Wave 6 occurred between May 2013 and April 2014 when participants were in 9–12th grades. Of the 4366 youth who were eligible for the wave 6 survey (i.e. in 6–7th grade at wave 1, could be located, were re-consented), 2653 (61%) of those completed the survey. Retention from waves 6 to 7 was 80%. Dropout was not associated significantly with demographics or risk behaviors, such as drinking and marijuana use. The trajectory sample of 6509 youth includes original 6th and 7th graders from wave 1 and youth who completed a survey at any other wave from waves 2–7; 77% of youth completed four or more survey waves. See Table 1 for descriptive statistics and Table 2a,b for sample information at each wave.

Table 1 Descriptive information.

	N/mean	*%/SD*	*Minimum*	*Maximum*
Demographics				
Age (years)	17.31	0.67	14.00	18.00
Race				
White	502	20.14		
African American	57	2.29		
Hispanic	1146	45.97		
Asian	512	20.54		
Multiracial/other	276	11.06		
Male	1142	45.81		
Mother's highest level of education				
< High school	337	14.60		
High school	407	17.63		
Some college	313	13.56		
College	1252	54.22		
Outcomes				
Academic performance	0.00	2.17	−12.72	2.49
Academic unpreparedness	7.56	2.69	0	12
Delinquency	13.79	4.88	1	66
Physical ailments	1.91	1.41	0	4
Physical health	12.95	2.06	0	12
Mental health (MHI-5)	65.84	20.32	0	100
Social functioning	43.39	7.56	17.68	64.44
Substance use—past month			Skewness	
Alcohol use				
Wave 1	200	3.45	10.69	
Wave 2	288	5.20	7.48	
Wave 3	236	4.56	8.73	
Wave 4	354	7.22	5.70	
Wave 5	357	9.18	5.12	
Wave 6	433	17.07	3.25	
Wave 7	696	28.03	1.99	
Marijuana use				
Wave 1	41	0.71	22.16	
Wave 2	153	2.76	10.99	
Wave 3	129	2.49	9.33	
Wave 4	229	4.67	7.29	
Wave 5	239	6.15	5.95	
Wave 6	299	11.79	3.88	
Wave 7	416	16.73	2.78	

For academic performance each individual item was standardized [mean = 0, standard deviation (SD) = 1], which results in possible negative scores. Social function scores of 0–35 were converted to Z-scores per the scoring instructions for the Peer Relationships Short Form item bank (PROMIS). Skewness: a skewness of 0 indicates a symmetric distribution. Positive skewness values such as we see here indicate a positively skewed distribution. Wave 3 use rates were lower because new 6th graders were added to the sample that fall.

Measures

Demographics at wave 1

Students were asked about their age, race/ethnicity and gender. Students were classified into one of five racial/ethnic groups: non-Hispanic white (reference group), non-Hispanic black, Hispanic, Asian or Pacific Islander and multi-ethnic (indicated more than race)/other (Native American, Native Hawaiian).

Table 2a Sample size at each wave.

Wave	*n*
1	5826
2	5566
3	5196
4	4946
5	3903
6	2539
7	2493

Response rates cannot be computed from the *n* at each wave alone, as youth could come in and out of the study (e.g. complete waves 1, 3, 5 and 7, but not waves 2, 4 and 6) and still be retained in the sample. Response rates from waves 1–5 when youth were in middle school ranged from 74 to 90%, excluding new youth who could have come in at a subsequent wave. Sixty-one per cent of youth ($n = 2653$ of the 4366 youth who were eligible for the wave 6 survey) completed the survey at wave 6. They were eligible for the wave 6 survey if they were in 6th–7th grade at wave 1, could be located and were re-consented. Retention from wave 6 to wave 7 was 80%.

Table 2b Wave completion rate.

Waves completed	*Frequency*	*Percentage of youth*
1 wave	471	7.24
2 waves	419	6.44
3 waves	626	9.62
4 or more waves	4993	76.7

Youth had to complete two or more waves to be included in trajectory analyses.

Alcohol and marijuana use at waves 1–7

Alcohol and marijuana use were assessed using well-established measures with adolescents [47,48]. For past month use, we asked: 'During the past month, how many days did you [drink at least one full drink of alcohol] [use marijuana]?'. Responses ranged from 1 = '0 days' to 8 = '20–30 days' and were dichotomized (1 = 'any use' versus 0 = 'no use') due to infrequent responses at high levels of use.

Academic performance and unpreparedness at wave 7

Academic performance was based on three items: self-reported grades in past year [48] (1 = mostly Fs to 8 = mostly As), highest level of school they plan to finish [49] (1 = I may not finish high school to 6 = I plan to go to graduate school or professional school), and how much they agree with the statement 'Getting good grades is important to you' (1 = strongly disagree to 5 = strongly agree). Items were standardized (mean = 0; standard deviation = 1) to account for a difference in item scales and summed ($\alpha = 0.57$), with higher scores indicating stronger academic performance. Academic unpreparedness [50] had four items that evaluated how often the respondent went to class without homework completed, without paper and pencil, without books, and how often they went to class late (0 = never to 3 = often). Items were summed with higher scores indicating more unpreparedness ($\alpha = 0.75$).

Physical health at wave 7

A physical ailments scale [51] had four items from the Physical Health Questionnaire–15 on how bothered the respondent had been in the previous 4 weeks by stomach pain, headaches, feeling tired or having low energy and trouble sleeping. Original responses were dichotomized, such that 0 = not at all bothered and 1 = bothered a little or a great deal. Responses were summed with higher scores indicating more symptoms ($\alpha = 0.69$). Physical health [52] included three items: general health (0 = excellent to 4 = poor), physically able to carry out activities that one enjoys (0 = with no trouble to 4 = not able to do), and could participate in sports/activities similar to their peers (0 = with no trouble to 4 = not able to carry out). Items were reverse-scored and summed with higher scores indicating better health ($\alpha = 0.69$).

Mental health at wave 7

General mental health status was assessed using the Mental Health Inventory (MHI)-5 [53], a subscale of the SF-36; $\alpha = 0.75$ [14]. Five items reflecting mood in the past 30 days were rated on a six-point scale (1 = none of the time to 6 = all the time) and reflected domains related primarily to anxiety and depression (e.g. 'How much of the time have you been a very nervous or anxious person?', 'How much of the time have you felt downhearted or blue?'). Items were summed and then, following scoring instructions, items were transformed linearly to a 0–100 scale, such that higher scores indicate better mental health.

Social functioning at wave 7

Respondents rated seven items from the PROMIS Peer Relationships Short Form item bank [22] on a five-point scale (0 = never to 4 = always). Raw scores ranged from 0 to 32. Following PROMIS scoring instructions, we transformed raw scores to a *t*-score ($\alpha = 0.92$), with higher scores indicating better social functioning. Sample items include: 'I was able to count on my friends', 'I felt accepted by other kids my age' and 'Other kids wanted to talk to me'.

Delinquency at wave 7

Eight items [32] rated on a six-point scale (1 = not at all to 6 = 20 or more times) and summed ($\alpha = 0.80$) assessed how often the respondent engaged in various problem behaviors (e.g. school misbehavior, fighting, stealing) in the

past year. In adolescent populations this measure is associated with AM use and mental health [54–56].

Statistical analysis

We used latent growth modeling to examine AM use over time employing a structural equation modeling framework, using Mplus version 6.11 [57] as this approach allows us to treat change as both an outcome (as in conventional growth models) and a predictor. The intercept represents the predicted value of the outcome when the predictor is equal to zero. This was set at 2.75 years, because waves were not spaced evenly. There were 5.5 total years between waves 1 and 7 (wave 1 = 0 years, wave 2 = 0.5 years, wave 3 = 1 year, wave 4 = 1.5 years, wave 5 = 2.5 years, wave 6 = 4.5 years and wave 7 = 5.5 years); the intercept therefore represents the average use; thus we refer to the intercept as the average in later sections. The slope represents the change in the probability of use as the individual ages. We used the weighted least squares with mean and variance adjusted estimator (WLSMV). This estimator (as implemented in Mplus) can provide consistent and unbiased estimates in the presence of missing data under some general assumptions [58], hence we are able to use information for all individuals, regardless of the number of surveys they completed. Because of convergence problems caused by dissimilar variances, the MHI-5 score was divided by 10. Structural equation models are tested for fit to data using the χ^2 test; however, this test can be over-powered, suggesting statistically significant misfit when discrepancies are negligible. Hence, we use two additional measures of fit: the comparative fit index (CFI) [59] and the root mean square error of approximation (RMSEA) [60,61]. Values of RMSEA less than 0.05 indicate good fit, as do CFI values greater than 0.95.

We first examined race/ethnicity as a predictor of the slope and average (dummy-coded, with white as the reference, compared to categories of Asian, black, Hispanic, multi-ethnic/other; average represented as the intercept); we controlled for age, gender and whether the individual attended an intervention school. We estimated separate models for alcohol and marijuana. We next examined a sequelae of change model [62]. This is a feature possible within a structural equation modeling framework in which the random effect of the rate of change can function not just as an outcome (as it is modeled conventionally), but also as a predictor of downstream outcomes; thus we tested whether the slope and intercept for AM were associated with outcomes measured at wave 7. Finally, we examined race/ethnic differences in outcomes after controlling for use by estimating a single model with slope and intercept of both AM, and estimating the direct effect from race/ethnicity to each outcome.

RESULTS

Predictors of slope and intercept of use

The first models we estimated included the latent growth to examine race/ethnic differences in the slope and intercept for alcohol and marijuana using two separate models. The intercept represents average probability of use, and slope represents change in probability of use over time, both modeled as a logistic function. Overall fit was good; for marijuana, $\chi^2 = 109$, df = 63, RMSEA = 0.011, CFI = 0.982; for alcohol, $\chi^2 = 161$, df = 63, RMSEA = 0.016 and CFI = 0.971. Fit statistics indicate that the logistic-linear model of change in probability of use was a good description of the data (Table 3).

We found statistically significant effects for race/ethnicity predicting the average probability of use (intercept) and the change in the probability of use (slope) Table 3). The averages of Asian teens were lower than white teens for both alcohol and marijuana, meaning that they used significantly less AM than whites. Similarly, black and multi-ethnic groups had lower averages than whites for alcohol use, but these groups did not differ significantly on marijuana averages. For slopes, Hispanic youth had less steep slopes than did whites for both AM, indicating that their rate of increase in the probability of use was less than that of white youth.

Effects of use on wave 7 outcomes

We next fitted models where the intercepts and slopes of AM predicted outcomes measured at wave 7.[1] To avoid collinearity problems, we again fitted separate models for alcohol and marijuana. Model fit was again very good, indicating that the linear logistic model fit the data; for marijuana, $\chi^2 = 146$; df = 99, RMSEA = 0.009, CFI = 0.995; for alcohol, $\chi^2 = 215$, df = 101, RMSEA = 0.013, CFI = 0.989. A higher average (intercept) of alcohol use was associated with greater academic unpreparedness and delinquency scores (Table 4). For marijuana, a higher average was associated with greater academic unpreparedness, lower academic performance, poorer mental health and greater delinquency. The slopes for AM were also predictive of delinquency (with positive slopes associated with greater delinquency) and for alcohol with social functioning (with a positive slope associated with higher social functioning scores).

Table 3 Parameter estimates predicting alcohol and marijuana intercept and slope.

		Alcohol		*Marijuana*	
		Intercept	*Slope*	*Intercept*	*Slope*
Race/ethnicity	White (reference category)				
	Asian	−0.62 (−0.74, −0.49)***	0.01 (−0.04, 0.06)	−0.57 (−0.71, −0.43)***	−0.01 (−0.07, 0.06)
	Black	−0.35 (−0.55, −0.14)**	−0.07 (−0.16, 0.03)	−0.08 (−0.31, 0.15)	0.00 (−0.12, 0.13)
	Hispanic	−0.06 (−0.15, 0.02)	−0.13 (−0.17, −0.10)***	0.02 (−0.08, 0.11)	−0.12 (−0.16, −0.08)***
	Multi-ethnic	−0.17 (−0.29, −0.04)**	−0.01 (−0.06, 0.04)	−0.09 (−0.23, 0.06)	0.00 (−0.06, 0.07)
	Other	−0.33 (−2.67, 2.01)	−0.1 (−2.06, 1.86)	−0.25 (−7.22, 6.73)	−0.04 (−3.96, 3.88)
Age (years)		0.17 (0.12, 0.21)***	−0.01 (−0.02, 0.01)	0.15 (0.10, 0.21)***	−0.04 (−0.06, −0.02)**
Male		−0.15 (−0.21, −0.09)***	−0.01 (−0.04, 0.02)	0.05 (−0.02, 0.12)	0.01 (−0.02, 0.05)

Table shows estimate (95% confidence intervals). **$P < .01$, ***$P < .001$.

Table 4 Parameter estimates of alcohol and marijuana use predicting outcomes at wave 7.

	Academic performance		*Academic unpreparedness*		*Delinquency (no DUI)*		*MHI-5*		*Physical ailments*		*Physical health*		*Social functioning*	
	Intercept	*Slope*	*Intercept*	*Slope*	*Intercept*	*Slope*	*Intercept*	*Slope*	*Intercept*	*Slope*	*Intercept*	*Slope*	*Intercept*	*Slope*
Alcohol	−0.17	0.8	0.65	0.8	2.49	5.78	−0.13	0.96	−0.02	0.2	−0.14	0.96	−0.02	8.64
	(−0.25, 0.09)	(−0.27, 1.87)	(0.44, 0.85)***	(−0.40, 1.99)	(2.29, 2.70)***	(4.40, 7.16)***	(−0.31, 0.04)	(−0.08, 2.00)	(−0.09, 0.04)	(−0.19, 0.58)	(−0.31, 0.02)	(−0.06, 1.98)	(−0.63, 0.58)	(4.64, 12.63)***
Marijuana	−0.2	−0.78	0.7	0.03	2.47	6.74	−0.29	0.42	0.03	0.07	−0.09	0.54	−0.3	1.93
	(−0.38, −0.02)*	(−1.76, 0.32)	(0.51, 0.95)***	(−1.15, 1.21)	(2.25, 2.68)***	(5.03, 8.45)***	(−0.47, −0.11)**	(−0.57, 1.40)	(−0.04, 0.10)	(−0.32, 0.46)	(−0.28, 0.09)	(−0.46, 1.53)	(−0.99, 0.40)	(−1.88, 5.74)

Table shows estimate (95% confidence intervals). MHI = Mental Health Inventory; DUI = driving under the influence. *$P < .05$, **$P < .01$, ***$P < .001$.

Table 5 Parameter estimates for race/ethnicity controlling for alcohol and marijuana use.

	Academic performance	*Academic unpreparedness*	*Delinquency*	*MHI-5*	*Physical ailments*	*Physical health*	*Social functioning*
White (reference category)							
Asian	0.06	0.8	0.55	−0.3	−0.18	−0.36	−0.92
	(−0.28, 0.40)	(0.42, 1.19)***	(−0.05, 1.15)	(−0.51, 0.07)	(−0.18, 0.03)	(−0.64, −0.08)*	(−2.22, 0.34)
Black	−0.42	1	−0.57	0.41	0.01	0.03	1.31
	(−1.24, 0.40)	(0.16, 1.85)*	(−2.34, 1.21)	(−0.24, 1.06)	(−0.27, 0.29)	(−0.56, 0.75)	(−1.57, 4.25)
Hispanic	−0.61	0.56	0.19	0.3	−0.06	−0.24	0.51
	(−0.93, −0.28)***	(0.22, 0.90)**	(−0.30, 0.69)	(−0.01, 0.55)	(−0.16, 0.04)	(−0.50, 0.03)	(−0.71, 1.76)
Multi-ethnic	−0.42	0.23	−0.55	−0.35	−0.1	−0.38	−1.12
	(−0.80, −0.03)*	(−0.20, 0.67)	(−1.27, 0.18)	(−0.68, 0.01)	(−0.21, 0.01)	(−0.69, −0.07)*	(−2.49, 0.23)
Other	−0.08	0.49	−0.51	0.26	0.21	0.2	3.81
	(−5.75, 5.58)	(−6.49, 7.46)	(−13.10, 12.07)	(−2.71, 3.24)	(−1.01, 1.43)	(−1.08, 1.49)	(−13.25, 21.05)

Table shows estimate (95% confidence intervals). MHI = Mental Health Inventory. *$P < .05$, **$P < .01$, ***$P < .001$.

Race/ethnic differences for wave 7 outcomes controlling for use

Finally we fitted a model with AM use, and examined direct effects from race/ethnicity to the outcomes, controlling for both the average (intercept) and slope (rate of increase) of probability of use. The final model provided a good fit: $\chi^2 = 417$, df = 238, CFI = 0.991, RMSEA = 0.011. Table 5 shows results of this model, with the direct effects from race/ethnicity to outcomes, controlling for use. Hispanic and multi-ethnic youth reported lower academic performance than white youth, and Asian, black and Hispanic youth reported significantly higher academic unpreparedness than white youth. Asian and multi-ethnic youth also reported significantly poorer physical health than white youth. There were no statistically significant differences for delinquency, mental health, physical ailments or social functioning.

DISCUSSION

The current study moves the field forward in the area of trajectory research by examining how AM use among a diverse sample of youth across this developmental period affects functioning for a variety of domains, including physical and mental health, academics, social functioning and behavior. In addition, we assessed whether there were racial/ethnic differences in functioning for white, black, Hispanic, Asian and multi-ethnic youth after controlling for level of AM use.

Similar to previous work in this area [38,63], Asian youth reported less alcohol and marijuana use than white youth, and black and multi-ethnic youth reported less alcohol than white youth. Furthermore, the rate of increase in the probability of drinking and marijuana use for whites during adolescence was greater than the rate of increase in the probability for Hispanics, which corresponds with recent research on the Add Health data set [2,39,40]. Thus, white youth continue to be at higher risk for substance use during middle school and high school.

Marijuana and alcohol use both affected functioning in high school; however, marijuana use was associated with poorer functioning across more domains. Specifically, youth who had a higher probability of marijuana use also reported lower academic functioning, were less prepared for school, engaged in more delinquent behavior and had poorer mental health. In addition, delinquent behavior in high school was more likely among youth who showed a greater increase in their probability of marijuana use from middle school to high school. These findings are important, because teen marijuana use is rising across the United States [64]. In addition, many youth tend to think that alcohol use has more consequences than marijuana use and therefore view marijuana use as 'safer' than drinking [65]

which may be due, in part, to changing views of marijuana use that have occurred due to changing marijuana policies [66]. Prevention efforts must begin to address these changing views by educating youth about marijuana's effects and how, although marijuana may help with certain ailments, larger clinical trials with more varied groups of patients are needed [40]. In addition, youth need to understand the potential harms of this drug such as its potential effect on their developing brain and how it can affect performance in both adolescence and adulthood [67].

Similar to marijuana use, delinquent behavior and academic unpreparedness in high school were more likely among youth who showed a greater increase in their probability of alcohol use from middle school to high school. These youth also reported higher social functioning in high school. Of note, some items on the social functioning measure focused on acceptance (other people my age want to be with me; want to talk with me) and popularity (I am good at making friends; other people want to be my friend). Alcohol use is often driven by social motives [68], and youth who view themselves as more popular tend to report heavier drinking [69]. This is in contrast to youth who report use of other drugs, such as prescription drug use; these youth view themselves as less popular and therefore report lower social functioning [56]. Thus, it may be that during this time-period drinking is associated with being more social and feeling more accepted and popular. Tucker and colleagues suggest that more work is needed in this area to gain a clearer understanding of why adolescents with a larger number of school-based friendship ties are more likely to drink [69].

When we examined functioning in high school by race/ethnicity while controlling for level of AM use, we found differences in academic functioning and physical health. Specifically, Asian and multi-ethnic youth reported more problems with physical health than white youth when using at the same level; Asian, black and Hispanic youth reported being less prepared academically, and Hispanic and multi-ethnic youth reported lower academic performance compared to white youth. The difference that showed up most frequently was in regard to academic performance, which is developmentally applicable given that most youth are still in school, and this may be one of the first domains to show problems due to AM use. However, Asian and multi-ethnic youth also reported poorer physical health even when controlling for level of AM use, which is something that has been shown in adult populations. Thus, it is crucial to address AM use early on for non-white youth, especially in light of findings, perhaps by increasing protective factors such as parental support [70], enhancing culture [71] or improving resistance skills [72].

The current study is limited by the nature of the survey data being self-report; however, AM data from these youth have matched AM self-reported data from national surveys [46,67]. We had larger samples of white, Asian, Hispanic and youth of mixed ethnicity compared to black youth, yet we still found statistically significant differences for black youth compared to white youth. Finally, we were unable to re-contact many youth as they transitioned from middle school to high school; however, youth who completed the survey at wave 6 in high school did not differ demographically or on their AM use compared to those who did not complete the survey. In addition, we retained most of the sample once in high school, from waves 6 to 7, which occurred 1 year later.

In sum, findings suggest that, during adolescence, non-white youth who report similar likelihood of AM use as white youth also report worse outcomes across several domains. One explanation for our findings is that similar levels of AM use affect diverse groups differently, and may be more problematic for non-white groups of youth. Thus, intervention programs that target AM use during this developmental period among those at-risk for negative outcomes might be one viable approach to ameliorating disparities in functioning. However, there are other pre-existing factors that we did not include in the current study that could, potentially, have contributed to either AM use or lower functioning during this time-period, such as discrimination, parental involvement or neighborhood quality. In addition, although we did not find differences on demographics or AM use between those youth who dropped out of the study and those who continued to complete surveys, they could have differed on characteristics that we were unable to measure. Future work must continue to survey diverse groups of youth longitudinally and measure a variety of factors so that we can obtain a clearer understanding of how functioning may be affected by AM use during adolescence and emerging young adulthood and whether disparities in functioning may differ across different developmental milestones.

Declaration of interests

None.

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ADOLESCENT / YOUNG ADULT ADDICTION (T CHUNG, SECTION EDITOR)

Understanding Rates of Marijuana Use and Consequences Among Adolescents in a Changing Legal Landscape

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Abstract
Purpose of Review There is not one answer to address whether marijuana use has increased, decreased, or stayed the same given changes in state legalization of medical and non-medical marijuana in the USA.
Recent Findings Evidence suggests some health benefits for medical marijuana; however, initiation of marijuana use is a risk factor for developing problem cannabis use. Though use rates have remained stable over recent years, about one in three 10th graders report marijuana use, most adolescents do not view the drug as harmful, and over 650,000 youth aged 12 to 17 struggle with cannabis use disorder.
Summary Although the health benefits of medical marijuana are becoming better understood, more research is needed. Intervention and prevention programs must better address effects of marijuana, acknowledging that while there may be some benefits medically, marijuana use can affect functioning during adolescence when the brain is still developing.

Keywords Marijuana · Medical marijuana · Adolescents · Legislation · Cannabis use disorder · Prevention · Intervention

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Introduction

Since 1996, when California became the first state to pass a comprehensive medical marijuana law (MML), 29 states in the USA have legalized marijuana for medical purposes as of 2017. Eight states have expanded marijuana laws that allow for legalized recreational, production, and for-profit sales among adults aged 21 and older. Washington DC also has legalized marijuana possession for recreational purposes, but not production or sales. It has been speculated that more states will begin passing recreational marijuana laws in the coming elections. The current paper provides a brief overview of marijuana use and consequences among adolescents given the changing legal landscape in the USA. We first discuss overall trends of marijuana use and consequences from use. We next address the benefits and harms associated with the use of medical marijuana given the current state of research. Third, we provide a brief review of the evidence regarding effects of MMLs on perceptions of risk, use, and consequences. Finally, we discuss the challenge of reducing marijuana use among adolescents and policy implications for prevention and intervention for this age group.

According to one of the biggest national studies, Monitoring the Future [1], rates of lifetime marijuana use among adolescents over the last 5 years have remained fairly steady among 12th graders (45% report lifetime use); whereas among younger ages, initiation of use has declined somewhat. For example, in 2012, about 16% of eighth graders had

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initiated marijuana use, but in 2016, 13% reported initiation of the drug. Likewise, about 35% of 10th graders reported lifetime use of marijuana in 2012, which decreased to 30% in 2016 [1]. Despite these decreases in lifetime use, it is important to note that these percentages still reflect a significant number of teens that report trying marijuana (e.g., one in three 15–16-year-olds). In addition, another large national study, the National Survey on Drug Use and Health (NSDUH), estimated that approximately 650,000 youth aged 12 to 17 met criteria for cannabis use disorder (CUD) in 2015 [2].

Problematic marijuana use continues to be an issue for young people. One recent study by D'Amico and colleagues [3•] examined rates of both marijuana and alcohol use, as well as alcohol use and cannabis use disorders in a large and diverse sample of 1573 youth age 12–18 (21% Black, 51% Hispanic) attending a primary care appointment in either California or Pennsylvania. Past-year marijuana use was slightly lower than alcohol use (37% and 42%, respectively), as was past-year heavy marijuana use (e.g., using two or more times in 1 day; 19%) compared to heavy alcohol use (e.g., five or more drinks; 22%); however, CUD was three times more prevalent than alcohol use disorder (14% and 4%, respectively). Thus, although rates of use for alcohol and marijuana were fairly similar among these adolescents, they were more likely to report problematic use of marijuana [3•]. For example, on the Diagnostic Interview Schedule for Children Version IV (DISC-IV), which included updated DSM-5 criteria for CUD, 48% of youth reported that they had tried to quit or cut down their marijuana use compared to 16% of adolescents who reported that they tried to quit or cut back on their drinking. In addition, 32% of teens in this study reported going to school or work when they were high or smoking marijuana while at school or work compared to 14% who reported going to school or work after drinking or drinking while at school or work. Other problems youth reported included smoking more marijuana than they thought they would (40%), getting into arguments with family members or friends because of using marijuana (23%), and that marijuana caused them to get sad, depressed, or irritable (14%).

There is growing evidence that marijuana use may cause more problems in functioning during adolescence than alcohol use. One 2016 large longitudinal school-based study found that marijuana use was associated with poorer functioning in high school across more domains compared to alcohol use [4]. Specifically, our team examined how marijuana and alcohol use trajectories from age 11 to 17 years were associated with key domains of functioning during high school. Teens with greater marijuana use indicated more academic unpreparedness and poorer academic performance, increased delinquency, and worse mental health in high school. Youth that reported higher alcohol use also indicated poorer functioning, but only in two domains: greater academic unpreparedness and delinquency. Furthermore, non-white youth appeared to be disproportionately affected by marijuana use (as well as alcohol use), reporting worse outcomes for academics and health compared to white youth, even at the same levels of use [4]. Overall, research documents that adolescent marijuana use and resulting consequences are a public health concern that need to be addressed.

Medical Marijuana: Benefits and Harms

The health benefits of medical marijuana are becoming better understood, though there is still much research to be done, and the majority of work in this area has been established with adults. A recent report from the National Academies of Sciences, Engineering, and Medicine [5] concluded that there is moderate to substantial evidence supporting marijuana use as an effective treatment for chronic pain, alleviating chemotherapy-induced nausea and vomiting, improving spasticity symptoms among patients with multiple sclerosis, and improving short-term sleep outcomes among those with obstructive sleep apnea syndrome. Importantly, however, the same report concluded that there is substantial evidence that marijuana use has negative long-term effects such as worsening respiratory symptoms (e.g., chronic cough, bronchitis), increased risk of motor vehicle accidents when driving under the influence, lower birth rates of offspring from mothers who use the drug, and increased risk for developing schizophrenia or other psychoses [5]. Overall, it is important to note that studies are typically limited by a lack of standardization of dosing and potency, including cannabidiol (CBD) to tetrahydrocannabinol (THC) ratios, which makes marijuana a challenging substance to regulate for medical purposes [6].

The report from the National Academies of Sciences, Engineering, and Medicine [5] also concludes that there is substantial evidence that early initiation of marijuana use, as well as increases in frequency of use during adolescence, are risk factors for the development of problem cannabis use later in life. Other earlier reviews of adolescent marijuana use have concluded that early and chronic use may have negative effects on several cognitive and mental health factors, such as executive functioning [7], depression [8], and use of other substances [9]. Thus, even though some benefits of medical marijuana have been found, as noted above, most of the research on medical marijuana to date has been conducted with adults. Overall, very little is known about medicinal benefits of marijuana for adolescents. Indeed, the available research on harms suggests that early initiation of marijuana, increased marijuana use during adolescence, and chronic marijuana use over time is linked to problems.

Concerning the use of medical marijuana by adolescents specifically, Boyd and colleagues [10] found that only 1% of the approximately 4400 12th graders in the 2012/2013 Monitoring the Future sample reported using medical

marijuana that they had obtained as part of their own recommendation from a provider that qualified them for participation in their state's medical marijuana program. (This is often called a marijuana "prescription" by those that obtain this recommendation; thus, hereafter we refer to this as a prescription.) Interestingly, 6% of the sample reported use of medical marijuana that was obtained from someone else's prescription (diverted marijuana use) [10]. Of the 12th graders that reported past-year marijuana use, 80% did *not* obtain it from a legal or medical source, 3% reported marijuana use from their own prescription, and 17% reported "diverted marijuana use." Findings indicated that those who obtained marijuana from their own prescription or from someone else's prescription were more at risk across a host of outcomes, including higher rates of frequent and daily marijuana use, greater likelihood of reporting "being hooked" on marijuana, and greater risk for using other prescription drugs non-medically and using other illicit drugs than those who obtained marijuana from a non-legal or non-medical source [10]. Thus, adolescents who obtain medical marijuana with a prescription, either their own or someone else's, represent a group that is at high risk for numerous problems.

Effects of Medical Marijuana Laws on Perceptions of Risk, Use, and Consequences

Given the increasingly widespread legalization of medical and recreational marijuana across the USA, there have been a number of recent high-quality epidemiological studies examining changes in overall marijuana use rates among adolescents before and after the passage of marijuana legalization laws attempting to answer the following important question: have marijuana use rates increased, decreased, or stayed the same following legalization? At this point, it is difficult to determine the "final answer." [11, 12] This is partly due to the heterogeneous nature of these studies. For example, some studies are national, some occur in single states with legalized medical marijuana, and still others take place in states where marijuana is legal for both medical and recreational possession, sale, and cultivation [13]. The story is further complicated by the nuances in policy in different states (e.g., registration requirements, home cultivation, dispensaries) and the timing of these policies [14]. For example, Pacula and colleagues [14] demonstrated the disadvantages of treating medical MMLs generically, showing that specific modes of regulation differentially influenced consumption, highlighting the importance of understanding the heterogeneity of these laws. Specifically, they found that access to dispensaries or home cultivation may increase marijuana consumption, including among adolescents, even though simple dichotomous indicators (e.g., yes MML versus no MML) were generally not associated with marijuana use. In addition, they found that marijuana dependence was higher in states that had more lenient access to medical marijuana, such as home cultivation and state acceptance of dispensaries [14].

Other studies have also failed to find a clear link between MMLs and increased use among adolescents [12, 15], including one recent large scale study of over one million adolescents surveyed between 1991 and 2014. Results showed that despite finding higher rates of marijuana prevalence in states that had passed an MML compared to those that did not, rates of marijuana use did not increase significantly within states from before to after the passage of MMLs [16•]. In addition, although according to NSDUH the rates of CUDs have been declining among youth over the past 12 years [2], rates of CUD among adults have increased in states with MMLs [17]. Pacula and Smart [18] note, however, that disparate findings across and within studies could also be attributed to the way that marijuana use is measured, such as whether the studies examining associations between MMLs and adolescent marijuana use utilized measures of past-month use, frequency of use, quantity of use, heavy use, or dependence.

With the rapidly changing landscape of marijuana policy across the USA, there has been increasing interest in assessing the effects of these policy changes on teens as the outcomes may not be clear for some time [11]. For example, Friese and Grube [19] examined the association between adolescent marijuana use and voter approval of medical marijuana and the number of medical marijuana cards issued in a sample of 17,482 adolescents age 13–19 across several counties in Montana. They found that youth reported greater lifetime and past 30-day use of marijuana when they lived in counties with a higher percentage of voters approving legalization of medical marijuana; however, the number of medical marijuana cards was not related to marijuana use [19]. This suggests that more positive perceptions of the drug may be affecting overall adolescent use.

Overall, there has been a trend towards more positive views of marijuana among both adults [20] and teens in recent years [21, 22]. More than 50% of 10th and 12th graders across the USA now endorse the belief that *smoking* marijuana regularly does not carry great risk (note that this question does not address other ways of using marijuana, such as vaping or edibles) [23]. In Washington state, which legalized medical and non-medical marijuana in 2012 (with stores commencing sale of recreational marijuana in 2014), one study found that the positive association between low perceived harm and marijuana use has grown stronger since 2000 [22]. A 2014 Monitoring the Future study cross-sectionally examined perceived harmfulness of marijuana use by grade, stratified by state MML status, and found that overall, adolescents living in states that had ever passed an MML were less likely to perceive marijuana as harmful [24].

Many of these positive beliefs for marijuana may come from social media and/or advertising, which has increased as

MMLs have passed. For example, among people ages 17 to 19 years, the popular pro-marijuana Twitter handle @stillblazingtho was in the top 10% of all Twitter handles followed [25]. Examinations of the more proximal effects of MML passage are critical: advertising, accessibility, and the growing prevalence of adults who use medical marijuana may drive adolescent perceptions of use. In a cohort of approximately 8000 youth with a mean age of 13, D'Amico and colleagues [26] found that sixth and eighth graders' exposure to advertising for medical marijuana was associated with both intentions to use marijuana and marijuana use 1 year later. This highlights the importance of beginning to think about regulations for marijuana advertising [26], similar to regulations that are in place for tobacco and alcohol [27].

Though billboards, magazines, and social media can increase young people's exposure to marijuana advertisements, the proliferation of medical marijuana and recreational marijuana dispensaries no doubt also increases adolescents' exposure to the drug. Specific methods to examine accessibility to dispensaries have been proposed to map dispensary locations given that these tend to fluctuate (e.g., a dispensary that is open today may not be open in 6 months) [28–30]. More work will be needed as policies rapidly change to get a better handle on effects of the actual dispensaries, including longitudinal studies that can address temporality. To date, only one study has examined how proximity to marijuana dispensaries affect adolescent marijuana use. This cross-sectional study used Monitoring the Future data and found that the availability of medical marijuana dispensaries within a 5-mile buffer zone was associated with a higher likelihood of recent marijuana use by eighth graders, and being within either a 5-mile or 25-mile buffer zone was associated with an increased likelihood of recent marijuana use for 10th graders [31]. Monitoring the Future data [1] indicate that 35% of eighth graders and the majority of 10th (64%) and 12th (81%) graders report that marijuana is "fairly easy" or "very easy" to get. More work is needed in this area to understand the pathways through which proximity to dispensaries may be related to subsequent marijuana use among adolescents.

In terms of adverse consequences related to MML passage, Plunk and colleagues examined the effects of exposure to MMLs on high school completion, college enrollment, and college completion [32]. They used data from the 2000 Census and 2001–2014 American Community Surveys. Exposure was defined as any exposure to policy of generic MMLs (i.e., irrespective of specific features of MML policy) while adolescents were of high school age (i.e., 14–18). They also assigned policy exposure based on the number of years that youth were exposed to the MML between the ages of 14 and 18 with possible values of 0–4 to reflect years of exposure during high school (i.e., exposure beginning at age 18 would be 1 year, age 17 was equal to 2 years, age 16 was equivalent to 3 years, and ages 14–15 equaled 4 years). They found that MML exposure was associated with a 0.40 increase in the probability of not earning a high school diploma (from 3.99% probability of not earning a HS diploma to 4.39%). In addition, exposure to MML during high school was associated with a higher probability of both college non-enrollment and degree non-completion (a 0.85 increase from 45.30% to 46.15%). Furthermore, MML exposure was associated with an increase in daily marijuana use among 12th graders (up from 1.25% to 2.11%) [32].

Other health risks may be related to changes in marijuana legalization. There is evidence that marijuana legalization is associated with the co-use of tobacco and marijuana. Data from the 2013 National Survey on Drug Use and Health (NSDUH) indicate that a higher proportion of past 30-day tobacco and marijuana co-users reside in states where medical marijuana is legal compared to states where it is illegal [33]. Although the reasons for marijuana and tobacco co-use are poorly understood and likely multifaceted [34, 35], there has been increasing public health concern that tobacco use may begin to increase among young people as a consequence of marijuana legalization. Cannabis and tobacco are often smoked on the same occasion, with some early research suggesting that these simultaneous users are at greater risk for CUDs [36]. Co-administration is another popular form of co-use; an example of this is blunt smoking, which involves replacing some or most of the tobacco in a cigar with marijuana [37].

Furthermore, marijuana-impaired driving has doubled in recent years for high school seniors across the USA, and teens report driving under the influence of marijuana at higher rates than driving under the influence of alcohol [38]. Nearly one in five teens reports driving under the influence of marijuana, 34% of whom believed their driving ability was improved after marijuana use [39], and younger drivers are especially likely to believe that driving under the influence of marijuana is socially acceptable and safe [40]. These data suggest that youth are not as concerned about driving under the influence of marijuana compared to alcohol, emphasizing that marijuana use and consequences may be viewed differently than alcohol use and consequences [41]. Overall, findings highlight the importance of addressing marijuana use and its potential consequences among this population.

The Challenge of Reducing Marijuana Use Among Adolescents

It is crucial that we begin to address marijuana use in this changing legal landscape. This requires a good understanding of how medical marijuana may be used and a focus on recreational use. The National Academies of Sciences, Engineering, and Medicine [5] report discusses identifying research gaps, improving data collection, and proposing

strategies to address barriers for marijuana research [5]. Furthermore, this report noted that marijuana potency has increased [42], and that different forms of marijuana have become popular, including edibles, vaping, and dabs [43•, 44]. In order to work with youth around this issue, providers must have a good understanding of the research, the reasons that youth may use marijuana (e.g., for a perceived health benefit versus recreationally), and the ways in which they may use marijuana.

Our prevention and intervention work with at risk teens [45] and emerging young adults age 18–25 [46] has shown that marijuana use may be more difficult to change than alcohol use, in part because youth view the consequences from marijuana use differently [41, 46]. Specifically, they tend to see fewer consequences occurring from their marijuana use because they view it as safer to use than alcohol, and they are also able to more clearly connect consequences to their drinking behavior than to their marijuana use [41]. Given this, and recent evidence of perceptions of marijuana harm decreasing [22, 25], intervention and prevention programs must better address the effects of marijuana, acknowledging that while there may be some benefits medically, marijuana use can affect functioning during adolescence [3, 4] when the brain is still developing [47].

Our work with at risk youth in a teen court setting [41, 48] and with urban Native American adolescents [49], for example, has emphasized the importance of discussing both the pros and cons of marijuana use with youth using a motivational interviewing (MI) approach [50]. In this MI approach, therapists discuss the nuances of research on the medical "benefits" of marijuana use versus recreational use, and also address how frequency and quantity of use and marijuana use over time can impact health, relationships, and attainment of educational and work goals. We have created a website at www.groupmiforteens.org that provides free online training for conducting MI in groups with teens and shows how to best discuss marijuana use, including addressing medical marijuana use. We also make our manuals available for free on this site, which provide different ways to talk to teens about marijuana use in a non-confrontational and collaborative manner.

Policy Implications and Conclusions

In sum, work has shown that specific components of MMLs (e.g., access to dispensaries or home cultivation) are associated with marijuana use and that these same components are associated with fatal car accidents and increased heavy drinking [14]. In addition, exposure to medical marijuana advertising [26] and perhaps proximity to dispensaries [31] are both associated with an increased likelihood of marijuana use among younger adolescents, although no longitudinal studies have yet been conducted on proximity to dispensaries. History from the tobacco and alcohol industries emphasizes the importance of having policies and regulations around advertising and outlet density. Pacula and colleagues [27] highlight specific areas that policymakers may want to address regarding marijuana legalization including: developing regulations that help reduce access, availability, and use by adolescents, driving under the influence, and concurrent use of marijuana and alcohol, particularly in public places. As other states move to legalize marijuana for both medical and recreational purposes, it will be crucial to address how marijuana should be regulated in order to decrease the chances of harm occurring.

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Compliance with Ethical Standards

Conflict of Interest Elizabeth J. D'Amico, Joan S. Tucker, Eric R. Pedersen, and Regina A. Shih declare they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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Exposure to Alcohol Advertisements and Teenage Alcohol-Related Problems

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ABBREVIATIONS
CI—confidence interval
OR—odds ratio

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WHAT'S KNOWN ON THIS SUBJECT: The influence of alcohol advertising on underage drinking has been demonstrated in both cross-sectional and prospective studies. What is not well known is whether this increase in drinking leads to more problems related to alcohol consumption.

WHAT THIS STUDY ADDS: Exposure to alcohol advertising and liking of those ads in grade 7 has a significant influence on the severity of alcohol-related problems in grade 10 and that influence is mediated by growth in alcohol use from grades 7 to 9.

abstract

NIH FREE

OBJECTIVE: This study used prospective data to test the hypothesis that exposure to alcohol advertising contributes to an increase in underage drinking and that an increase in underage drinking then leads to problems associated with drinking alcohol.

METHODS: A total of 3890 students were surveyed once per year across 4 years from the 7th through the 10th grades. Assessments included several measures of exposure to alcohol advertising, alcohol use, problems related to alcohol use, and a range of covariates, such as age, drinking by peers, drinking by close adults, playing sports, general TV watching, acculturation, parents' jobs, and parents' education.

RESULTS: Structural equation modeling of alcohol consumption showed that exposure to alcohol ads and/or liking of those ads in seventh grade were predictive of the latent growth factors for alcohol use (past 30 days and past 6 months) after controlling for covariates. In addition, there was a significant total effect for boys and a significant mediated effect for girls of exposure to alcohol ads and liking of those ads in 7th grade through latent growth factors for alcohol use on alcohol-related problems in 10th grade.

CONCLUSIONS: Younger adolescents appear to be susceptible to the persuasive messages contained in alcohol commercials broadcast on TV, which sometimes results in a positive affective reaction to the ads. Alcohol ad exposure and the affective reaction to those ads influence some youth to drink more and experience drinking-related problems later in adolescence. *Pediatrics* 2013;131:e369–e379

Alcohol use among adolescents and young adults is a major health concern in the United States. According to a Substance Abuse and Mental Health Services Administration report published in 2004,[1] ~10.9 million (29%) adolescents reported drinking alcohol in the past month, 16.6% reported problem behaviors related to alcohol use, and 6.2% met *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria for substance abuse or dependence.[2] Because of the risks involved, considerable attention has been given to the influence of alcohol advertising on underage drinking. Cross-sectional studies have consistently shown a small but significant association between exposure to alcohol ads and alcohol use.[3–6] More importantly, prospective studies have shown similar findings providing support for a temporal relationship between exposure to ads and alcohol use,[7–13] which has been confirmed in a systematic review of 13 longitudinal studies.[14] Few studies, however, have successfully used prospective data to demonstrate the temporal relationship among exposure to alcohol ads, alcohol consumption, and problem behaviors associated with alcohol use.

The current study examined the effects of alcohol ad exposure on consumption and problem behaviors across 4 years of data collection to test 2 hypotheses. First, the influence of exposure to alcohol ads on underage drinking was hypothesized to interact with an effect modifier (or moderator): an affective reaction to alcohol ads, self-reported as a liking of alcohol ads.[5,15] It was anticipated that adolescents who like alcohol advertisements will be more likely to elaborate on the content of the ads (eg, imagine themselves in the scene), and as a result, they will be more likely to be persuaded to try the product.[16,17] Studies on copy testing by advertisers have shown that liking of advertisements is predictive of sales for consumer products.[18] In addition, drinking among adolescents and young adults is associated with desirability and identification with characters in alcohol ads[5] and with liking of alcohol ads.[10,19] Second, it was hypothesized that the growth in alcohol use over the first 3 years of the study would significantly mediate the relationship between exposure to alcohol ads in year 1 and alcohol-related problems in year 4 (see paths a and b in Fig 1). That is, effects of Year 1 alcohol ads on the growth in alcohol consumption over time (path a) was expected to translate into later (Year 4) levels of alcohol problems (path b). Figure 1 depicts a conceptual model that incorporates both key hypotheses within a moderated-mediation model.

METHODS

Participants

The current data were collected as part of a prospective study on the influence of alcohol advertising on underage drinking.[12,13] Participants recruited from public schools were surveyed during regular school hours from the 7th through 10th grades. Of the 4186 students recruited to participate in the study, 3890 (93% of consented) students completed the survey in at least 1 wave: 2986 (77%) were surveyed in 7th grade, 2849 (73%) in the 8th grade, 2093 (54%) in the 9th grade, and 1609 (41%) in the 10th grade. Dropout in the 9th and 10th grades was largely because of failure of entire schools to remain in the study after initial agreements by the schools to participate. Thus, most dropouts were not because of subject self-selection factors that could confound results. Further, the data analysis (outlined below) thoroughly addresses missing data. A total of 23 public middle schools, randomly selected from all middle schools in Los Angeles County, agreed to participate in the study. The goal was to recruit a sample representative of students attending Los Angeles County high schools.

Procedures

All seventh grade students in each school at the time of the study were invited to participate. Data collectors visited classrooms to distribute consent and assent forms to students about 2 weeks before administering the surveys. Parents of the students either signed a consent form brought home from school by the student or gave verbal consent to data collectors via telephone if the consent forms were not returned. Students signed assent forms before completing the surveys. The surveys and all procedures were approved by the University of Southern California Institutional Review Board. Students completed paper-and-pencil questionnaires during regular classroom hours at their school.

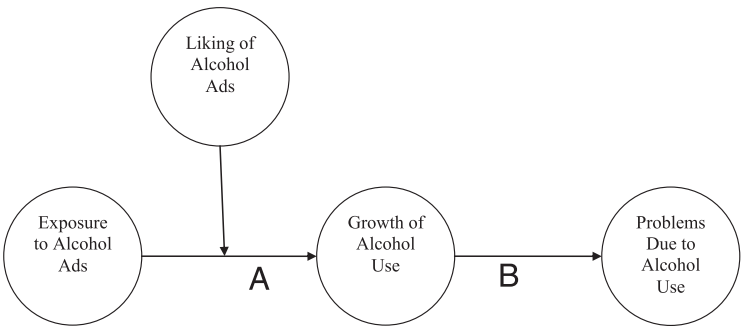

FIGURE 1
Conceptual model of primary hypothesized paths tested in the moderated-mediation models.

Outcome Measures

Current alcohol use was assessed with a total of 9 self-report items. Five items[20] assessed on how many days during the past 30 days the participant drank beer, wine, or liquor; drank 3 or more beers in a row; drank 3 or more glasses of wine or liquor; and drank enough to get drunk. An additional 4 items asked how often in the past 6 months participants drank beer, drank wine or wine coolers, drank liquor, or got drunk. An index was formed from all 9 items (coefficient α = 0.91). Problems due to alcohol use were assessed with 8 self-report items.[21] Participants indicated how often their alcohol use caused them problems, such as not being able to do their homework, getting into fights, neglecting responsibilities, or causing someone shame or embarrassment. An index score was formed from the 8 items (coefficient α = 0.93).

Independent Variables

Four measures of exposure to alcohol advertising were assessed: (1) Exposure to alcohol advertising on popular shows. Participants indicated how frequently they watched 20 popular TV shows during the past month on a 6-point scale ranging from 1 (never) to 6 (every day). The frequency of watching each show was multiplied by the average frequency of alcohol advertising broadcast on each show during the 10 months before the survey.[22] Data on televised alcohol advertising during the popular shows was purchased from Nielsen Media Research (New York, NY). The weighted items were summed to yield an index score for the number of alcohol ads each participant was exposed to during a typical day of watching popular shows (coefficient α = 0.79). This measure of exposure does not directly ask about exposure to alcohol ads, and it has been predictive of alcohol use in past studies.[13,22] (2) Exposure to alcohol advertising on sports programs. This measure was similar to the popular shows assessment except that it asked about the frequency of watching college and professional sports programs (coefficient α = 0.80), which often include a higher frequency of alcohol advertisements than other programming.[23] (3) Memory for alcohol ads: cued recall. Surveys included still pictures captured from TV advertisements including 2 example and 15 test ads.[24] The still pictures extracted from advertisements did not contain brand names or logos. An open-ended item asked participants to write down what product was being advertised. Independent judges coded the responses as being related to the advertisement or not (κ = 0.88). (4) Self-reported observation of alcohol advertising. Participants were asked 4 items[25] about how often they saw alcohol commercials on TV (coefficient α = 0.72).

The survey included 3 items assessing how much participants like alcohol ads on TV.[26] The items assessed whether participants thought that alcohol ads are funny or sexy, and whether they like the alcohol ads better than other ads (coefficient α = 0.78). These items measured an affective or emotional reaction to alcohol ads that has been useful in both the study of alcohol advertising[5,15,19] and by the advertising industry in general to estimate the potential effectiveness of advertising copy.[18] Additional covariates associated with adverting exposure, alcohol use, or alcohol-related problems included the amount of time watching television[27,28]; observing friends drinking[29]; observing well-known adults drinking[30]; participating in sports[31]; age, gender, ethnicity, language acculturation[32,33]; and parents' occupation and education (see Appendix for assessments).

Data Analyses

Construction of the structural equation models used to test the hypotheses involved 2 steps.[34] First, a measurement model established the simple structure of the model, measurement invariance across gender,[35] and acceptability of parcels as indicators.[36] The second step involved fitting of 4 latent growth-curve models, one for each measure of exposure to alcohol advertising. Goodness-of-fit statistics[37] included the χ^2 test, Comparative Fit Index, Tucker-Lewis Index, Root Mean Squared Error of Approximation, and the Standardized Root Mean Square Residual. The current analyses used full information maximum likelihood estimation[38] to adjust for uncertainty associated with missing data. Mediation effects (ie, specific and total indirect effects) were assessed using the multivariate δ method.[39] This method estimates significance for the product of 2 regression coefficients, the coefficient for the mediator regressed on the predictor and the coefficient for the outcome regressed on the mediator adjusted for the predictor and is consistent with criteria recommended by MacKinnon et al.[40] Mplus[41] was used to fit the measurement and the latent growth models. SEs were adjusted for clustering by school.[41]

RESULTS

Demographic characteristics for time 1 of the study, as shown in Table 1, indicated that the students in seventh grade were 12.51 (SD = 0.54) years old. Thirteen percent were non-Hispanic whites and 48% were Hispanic. Boys reported significantly more alcohol use than girls for past 30-day use of beer, lifetime binging with beer, and past 30 days binging with beer, and boys reported more negative consequences as a result of alcohol use. Participants more likely to have been lost to follow-up included those in wave 1 who knew peers (odds ratio [OR] = 1.30; 95% confidence interval [CI] = 1.16–1.44) or adults (OR = 1.13; 95% CI

= 1.05–1.21) who drank alcohol, were exposed to more alcohol commercials on popular shows (OR = 1.28; 95% CI = 1.01–1.61), or were Asian compared with whites (OR = 2.00; 95% CI = 1.30–3.08). There was no difference for those lost to follow-up based on gender, age acculturation, participation in sports, parents' education, lifetime or past 30-day alcohol use, alcohol-related problems, TV viewing, self-reported exposure to advertisements, or liking of alcohol advertisements.

Measurement Model

The measurement model examined the factor loading, simple structure, and measurement invariance of the latent variables proposed for the models. Indicators loaded well on their hypothesized latent variables in separate models for girls and boys. Examination of a priori hypothesized modification indices for cross-loadings among the alcohol use, alcohol-related problems, ad exposure, and liking of ads target latent factors provided support for a simple structure among the factors. The measurement model findings for the alcohol-related problems factor warranted the use of parcels of indicators in the structural model to provide more stable model estimation.[36,42] Tests for invariance of loadings and thresholds in a multigroup model by gender was adequate to compare structural models across gender.[43] Similar tests for invariance of loadings and thresholds in a multigroup model by grade provided evidence for invariance across time for items measuring alcohol use in the growth curves.

Latent Growth Models

The latent growth factors for alcohol use over times 1 through 3 and the latent factor for alcohol-related problems were regressed on each of the 4 alcohol ad exposure measures in 4 separate series of model evaluations.

TABLE 1 Demographic Information for Participants in Seventh Grade

Item	Total	Girls	Boys
Gender, *n* (%)	3890 (100)	1905 (50.14)	1894 (49.86)
Age, mean (SD)	12.51 (0.54)	12.51 (0.54)	12.51 (0.53)
Ethnicity, *n* (%)			
White/non-Hispanic	520 (13.37)	261 (13.78)	259 (13.60)
Hispanic	1862 (47.87)	937 (49.47)	923 (48.45)
Asian	662 (17.02)	324 (17.11)	338 (17.74)
Black/African American	120 (3.08)	56 (2.96)	64 (3.36)
Native Hawaiian or Pacific Islander	30 (0.77)	15 (0.79)	15 (0.79)
American Indian or American Native	37 (0.95)	17 (0.90)	20 (1.05)
Don't know	491 (12.62)	196 (10.35)	206 (10.81)
Mixed	168 (4.32)	88 (4.65)	80 (4.20)
Language acculturation, mean (SD)	4.22 (0.76)	4.14 (0.79)	4.28 (0.72)
At least 1 drink of beer in lifetime, *n* (%)			
0 d	1595 (56.94)	842 (59.21)	753 (54.60)
1 d	532 (18.99)	260 (18.28)	272 (19.72)
2 d	242 (8.64)	123 (8.65)	119 (8.63)
3 to 9 d	216 (7.71)	101 (7.10)	115 (8.34)
10 to 19 d	86 (3.07)	39 (2.74)	47 (3.41)
20 to 39 d	50 (1.79)	24 (1.69)	26 (1.89)
40 to 99 d	30 (1.07)	15 (1.05)	15 (1.09)
100 or more days	50 (1.79)	18 (1.27)	32 (2.32)
At least 1 drink of beer in past 30 days, *n* (%)[a]			
0 d	2414 (83.18)	1243 (84.44)	1171 (81.89)
1 d	281 (9.68)	140 (9.51)	141 (9.86)
2 d	90 (3.10)	40 (2.72)	50 (3.50)
3 to 5 d	55 (1.90)	20 (1.36)	35 (2.45)
6 to 9 d	27 (0.93)	16 (1.09)	11 (0.77)
10 to 19 d	9 (0.31)	6 (0.41)	3 (0.21)
20 to 29 d	6 (0.21)	3 (0.20)	3 (0.21)
All 30 d	20 (0.69)	4 (0.27)	16 (1.12)
At least 1 drink of wine or liquor in lifetime, *n* (%)			
0 d	1799 (64.67)	934 (66.15)	865 (63.14)
1 d	455 (16.36)	215 (15.23)	240 (17.52)
2 d	210 (7.55)	113 (8.00)	97 (7.08)
3 to 9 d	153 (5.50)	78 (5.52)	75 (5.47)
10 to 19 d	69 (2.48)	33 (2.34)	36 (2.63)
20 to 39 d	40 (1.44)	17 (1.20)	23 (1.68)
40 to 99 d	23 (0.83)	0 (0.64)	14 (1.02)
100 or more days	33 (1.19)	13 (0.92)	20 (1.46)
At least 1 drink of wine or liquor in past 30 days, *n* (%)			
0 d	2422 (83.81)	1246 (85.05)	1176 (82.53)
1 d	272 (9.41)	124 (8.46)	148 (10.39)
2 d	105 (3.63)	54 (3.69)	51 (3.58)
3 to 5 d	34 (1.18)	17 (1.16)	17 (1.19)
6 to 9 d	23 (0.80)	14 (0.96)	9 (0.63)
10 to 19 d	10 (0.35)	5 (0.34)	5 (0.35)
20 to 29 d	6 (0.21)	2 (0.14)	4 (0.28)
All 30 d	18 (0.62)	3 (0.20)	15 (1.05)
3 or more drinks of beer in a row in lifetime, *n* (%)[a]			
0 d	2432 (88.12)	1258 (89.92)	1174 (86.26)
1 d	134 (4.86)	61 (4.36)	73 (5.36)
2 d	70 (2.54)	33 (2.36)	37 (2.74)
3 to 9 d	45 (1.63)	13 (0.93)	32 (2.35)
10 to 19 d	26 (0.94)	13 (0.93)	13 (0.96)
20 to 39 d	25 (0.91)	14 (1.00)	11 (0.81)
40 to 99 d	8 (0.29)	2 (0.14)	6 (0.44)
100 or more days	20 (0.72)	5 (0.36)	15 (1.10)
3 or more drinks of beer in a row in past 30 days, *n* (%)[a]			
0 d	2688 (92.91)	1383 (94.40)	1305 (91.39)
1 d	105 (3.63)	47 (3.21)	58 (4.06)
2 d	34 (1.18)	14 (0.96)	20 (1.40)
3 to 5 d	25 (0.86)	9 (0.61)	16 (1.12)

TABLE 1 Continued

Item	Total	Girls	Boys
6 to 9 d	11 (0.38)	5 (0.34)	6 (0.42)
10 to 19 d	7 (0.24)	3 (0.20)	4 (0.28)
20 to 29 d	6 (0.21)	2 (0.14)	4 (0.28)
All 30 d	17 (0.59)	2 (0.14)	15 (1.05)
3 or more drinks of wine or liquor in lifetime, *n* (%)			
0 d	2448 (89.15)	1263 (90.67)	1185 (87.58)
1 d	135 (4.92)	55 (3.95)	80 (5.91)
2 d	58 (2.11)	31 (2.23)	27 (2.00)
3 to 9 d	43 (1.57)	20 (1.44)	23 (1.70)
10 to 19 d	20 (0.73)	9 (0.65)	11 (0.81)
20 to 39 d	17 (0.62)	7 (0.50)	10 (0.74)
40 to 99 d	6 (0.22)	2 (0.14)	4 (0.30)
100 or more days	19 (0.69)	6 (0.43)	13 (0.96)
3 or more drinks of wine or liquor in past 30 days, *n* (%)			
0 d	2707 (93.73)	1384 (94.60)	1323 (92.84)
1 d	92 (3.19)	43 (2.94)	49 (3.44)
2 d	30 (1.04)	16 (1.09)	14 (0.98)
3 to 5 d	18 (0.62)	10 (0.68)	8 (0.56)
6 to 9 d	13 (0.45)	4 (0.27)	9 (0.63)
10 to 19 d	7 (0.24)	2 (0.14)	5 (0.35)
20 to 29 d	6 (0.21)	2 (0.14)	4 (0.28)
All 30 d	15 (0.52)	2 (0.14)	13 (0.91)
Consequences of alcohol use, mean (SD)[b]	0.09 (0.41)	0.08 (0.38)	0.11 (0.44)

[a] Alcohol use by student gender was significant for past 30-days use of beer, lifetime binging with beer, and past 30- days binging with beer (all $\chi^2(7) > 14.07$, $P < .05$), but all other comparisons of alcohol use by student gender were nonsignificant (all $P > .05$).

[b] Consequences of alcohol use differed by gender ($t[2648] = -2.15$, $P < .05$); *P* = proportion.

The hypothesized moderator, liking of alcohol ads, was included in each of the 4 models. In addition, the growth factors were simultaneously regressed on covariates measured at time 1, including age, observing peers drink, observing adults drink, playing sports, general TV watching, language acculturation, and socioeconomic status (occupation and education of each participant's parents). All structural growth models differed by gender, so only those results for multigroup models by gender are presented here.

As shown in Table 2 and Fig 2, the coefficient for the intercept regressed on the interaction term was significant for boys and for girls. Figure 3 depicts this interaction illustrating that the level of exposure to ads was more predictive of alcohol use in seventh grade for those students who reported a greater liking of alcohol ads. There was no interaction in the prediction of the slope for the latent growth for alcohol use.

Significant mediation effects or indirect effects were observed among girls for the path from exposure to ads on popular shows at time 1 through the growth curve slopes to problems at time 4 (δ method indirect effect: ab = 0.091, P = .02) and for the path from liking of ads at time 1 through the growth curve intercepts to problems at time 4 (ab = 0.105, P = .03). Among boys, there was a significant total effect of the interaction term for popular shows and liking of ads at time 1 on problems at time 4, which included the direct effect on time 4 problems and indirect effects through the intercept and slope (δ method total effect: b = 0.164, P = .02). These effects among girls and boys were significant even after adjustment for time 1 problems, age, friends drinking, adults drinking, playing sports, general TV watching, acculturation, parents' jobs, parents' education, and clustering by school.

The covariates, alcohol-related problems at time 1 and friends and close adult drinking at time 1, were significant predictors of the intercept for girls. The same covariates plus language acculturation and parent jobs were significant predictors of the intercept for boys. For boys, drinking by friends and language acculturation were significant predictors of the slope, and the sign of the coefficients for these predictors changed between the intercept and the slope, suggesting that those higher in alcohol use at time 1 might have had lower growth rates than those lower in use at time 1. None of the time 1 variables were significant direct-effect (unmediated) predictors of alcohol-related problems at time 4 for boys or girls.

Mediation models for the other 3 exposure measures (frequency of watching sports show, cued recall of ads, and self-reported frequency of seeing alcohol ads) fit the data very well (results not shown). In all 3 models for girls, the intercept for the growth of alcohol use mediated the influence of liking of alcohol ads at time 1 on alcohol-related problems at time 4. No other indirect effects were significant for girls or boys. In these 3 mediation models for girls, both the intercept and slope for the growth of alcohol use were positive predictors of the level of alcohol-related problems at time 4, whereas this was not the case for boys.

DISCUSSION

This study provides evidence supporting the hypothesis that exposure to alcohol advertising and affective reactions to those advertisements on television influence underage drinking and the development of alcohol-related problems. The growth of alcohol use from the seventh through the ninth grades is predicted by the frequency of watching popular shows and self-reports on the liking of alcohol ads. In partial support of hypothesis 1, there

is a significant interaction between exposure to ads and liking of ads in the prediction of the intercept (but not the slope) for a growth curve modeled across these grade levels for both male and female students. The interaction shows that the level of exposure to ads is more predictive of a higher level of alcohol use in seventh grade for those students who report a greater liking of alcohol ads. In addition to this interaction observed at time 1, the frequency of watching popular shows at time 1 predicts the slope for the growth of alcohol use for girls, and the liking of alcohol ads at time 1 predicts the slope for boys.

In support of hypothesis 2, the mediation model shows that the influence of alcohol ads at time 1 on the occurrence of alcohol-related problems at time 4 is mediated by the growth of alcohol use. Among girls, there was a significant indirect effect of exposure to ads on popular shows in time 1 on problems in time 4 through the growth of alcohol use, and among boys, there was a significant total effect from the shows and liking interaction term in time 1 to problems in time 4. These relationships are significant even after adjusting for a range of other covariates measured at time 1 that are known to be associated with alcohol use. The other 3 measures of exposure to alcohol advertising show similar findings, although these measures are somewhat less predictive of the growth in alcohol use and alcohol-related problems.

Although causality cannot be verified in 1 observational study, the relevant theories and empirical evidence from the current prospective study and previous research are consistent with possible causal effects linking alcohol advertising to underage alcohol use and alcohol-related problems. In the current study, measures of exposure at time 1 are associated with the increasing use of alcohol over time and the

TABLE 2 Standardized Parameter Estimates for the Mediation Model

	Girls		Boys	
	Parameter Estimate	SE	Parameter Estimate	SE
Intercept on				
T1 alcohol use	0.759***	0.046	0.821***	0.038
T2 alcohol use	0.590***	0.060	0.643***	0.047
T3 alcohol use	0.466***	0.056	0.506***	0.030
Slope on				
T1 alcohol use	0.000	0.000	0.000	0.000
T2 alcohol use	0.404***	0.036	0.349***	0.057
T3 alcohol use	0.640***	0.056	0.549***	0.101
T4 alcohol-related problems on				
T4 problems 1	0.707***	0.029	0.720***	0.035
T4 problems 2	0.692***	0.039	0.721***	0.056
T4 problems 3	0.705***	0.038	0.736***	0.048
T4 problems 4	0.734***	0.050	0.780***	0.037
Intercept on T1 predictors				
Popular shows	−0.052	0.034	−0.027	0.031
Liking of ads	0.267***	0.047	0.171***	0.028
Shows x Liking	0.091*	0.042	0.093*	0.046
T1 problems	0.297*	0.123	0.264**	0.084
Age	0.030	0.031	0.040	0.030
Peer drinking	0.426***	0.060	0.539***	0.052
Playing sports	0.006	0.043	−0.009	0.024
Adult drinking	0.155***	0.036	0.138**	0.053
General TV viewing	0.012	0.034	0.012	0.037
Language acculturation	0.050	0.042	−0.098*	0.040
Parents' jobs	0.000	0.041	0.112*	0.046
Parents' education	−0.041	0.045	−0.002	0.030
Slope on T1 predictors				
Popular shows	0.190**	0.058	0.113	0.063
Liking of ads	−0.021	0.078	0.129*	0.060
Shows x Liking	−0.083	0.068	−0.112	0.081
T1 problems	−0.125	0.135	0.076	0.156
Age	0.031	0.039	−0.075	0.068
Peer drinking	0.057	0.075	−0.483***	0.128
Playing sports	−0.137	0.073	−0.015	0.074
Adult drinking	−0.029	0.067	−0.103	0.119
General TV viewing	−0.021	0.064	−0.059	0.062
Language acculturation	0.029	0.073	0.227*	0.097
Parents' jobs	0.130	0.075	−0.135	0.109
Parents' education	−0.085	0.064	0.009	0.090
T4 alcohol-related problems on				
Intercept	0.393*	0.166	0.177	0.303
Slope	0.478***	0.106	0.179	0.214
Popular shows	−0.054	0.065	−0.007	0.058
Liking of ads	−0.102	0.064	−0.095	0.062
Shows x Liking	0.040	0.072	0.167	0.094
T1 problems	0.050	0.070	0.014	0.090
Age	0.036	0.049	−0.004	0.034
Peer drinking	−0.022	0.085	0.234	0.214
Playing sports	0.050	0.059	0.027	0.044
Adult drinking	−0.027	0.041	0.021	0.074
General TV viewing	0.022	0.062	−0.021	0.063
Language acculturation	0.013	0.063	−0.048	0.086
Parents' jobs	−0.003	0.103	0.061	0.092
Parents' education	0.006	0.064	−0.018	0.100
Intercepts for latent factors				
Problems with alcohol at T4	0.000	0.000	0.232	0.184
Growth curve intercept	0.526***	0.032	0.496***	0.032
Growth curve slope	0.495***	0.059	0.441***	0.104
Residual variances				
T4 problems 1	0.500***	0.041	0.482***	0.050

TABLE 2 Continued

	Girls		Boys	
	Parameter Estimate	SE	Parameter Estimate	SE
T4 problems 2	0.522***	0.054	0.481***	0.080
T4 problems 3	0.502***	0.054	0.458***	0.071
T4 problems 4	0.462***	0.074	0.392***	0.058
T1 alcohol use	.0.424***	0.070	0.326***	0.063
T2 alcohol use	0.513***	0.049	0.631***	0.046
T3 alcohol use	0.404***	0.075	0.648***	0.067
Intercept	0.386***	0.096	.0.253**	0.077
Slope	0.921***	0.055	0.686***	0.087
T4 alcohol-related problems	0.661***	0.061	0.849***	0.054
Effects from Shows to Problems				
Total	0.017	0.051	0.008	0.046
Total indirect	0.070	0.042	0.015	0.028
Indirect Shows – I – Problems	–0.021	0.018	–0.005	0.009
Indirect Shows – S – Problems	0.091*	0.040	0.02	0.028
Direct Shows – Problems	–0.054	0.065	–0.007	0.058
Effects from Liking to Problems				
Total	–0.007	0.063	–0.042	0.041
Total indirect	0.095	0.057	0.053	0.058
Indirect Liking – I – Problems	0.105*	0.048	0.030	0.052
Indirect Liking – S – Problems	–0.010	0.038	0.023	0.030
Direct Liking – Problems	–0.102	0.064	–0.095	0.062
Effects from Interaction SxL to Problems				
Total	0.036	0.066	0.164*	0.069
Total indirect	–0.004	0.040	–0.004	0.045
Indirect from SxL – I – Problems	0.036	0.026	0.016	0.032
Indirect from SxL – S – Problems	–0.039	0.031	–0.020	0.029
Direct from SxL – Problems	0.040	0.072	0.167	0.094

I, intercept factor for growth curve; na, not available, slope variance fixed at 0; S, slope factor for growth curve; SxL, interaction term for popular shows and liking of alcohol ads; T1, time 1; T2, time 2; T3, time 3.

* $P < .05$.

** $P < .01$.

*** $< .001$.

development of alcohol-related problems at time 4, demonstrating a temporal ordering of predictors and outcomes. In addition, the models for this study control for a range of potentially confounding variables, including strong predictors, such as previous alcohol-related problems and peer influences. In previous studies, the indirect measure of exposure to alcohol ads on popular shows is predictive of alcohol use[22,26] and measures for liking of alcohol ads are predictive of alcohol use.[5,6,10,15]

The findings here are also consistent with well-established theories on vicarious learning, such as Social Learning Theory,[44] theories on persuasive messages in the media, such as the Elaboration Likelihood Model,[16] and with the more recent Message Interpretation Process model by Austin and colleagues.[5] Austin and colleagues[5] provide evidence for the influence of alcohol advertising on alcohol use through a number of affective mediators, including liking of advertisements.[5,45] Liking or desirability of alcohol advertisements predicts identification with

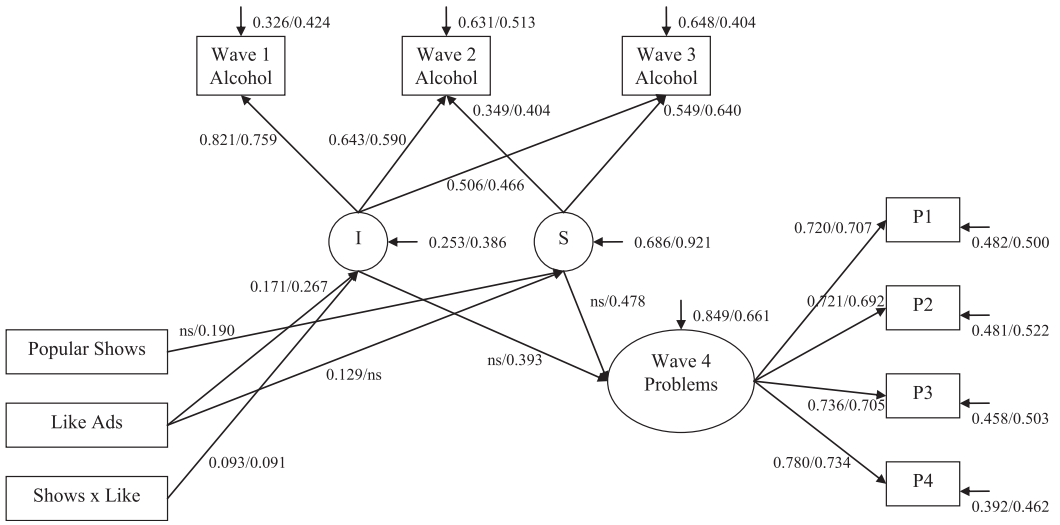

FIGURE 2

Mediation model for alcohol-related problems. Alcohol use = past 30 days + past 6 months. I, growth curve intercepts; S, growth curve slopes. Standardized parameter estimates: boys/girls ($P < .05$). Paths that were nonsignificant for both boys and girls are not included in the figure for clarity (eg, the direct effect of popular shows on wave 4 problems was not significant and is not shown). Adjusted for wave 1 problems, age, drinking peers, drinking adults, playing sports, general TV watching, acculturation, parents' jobs, parents' education, and clustering by school. Fit indices: $\chi^2(130) = 182.66$, $P = .002$; Comparative Fit Index = 0.98; Tucker-Lewis Index = 0.97; Root Mean Squared Error of Approximation = .015; Standardized Root Mean Square Residual = .026. ns = non-significant.

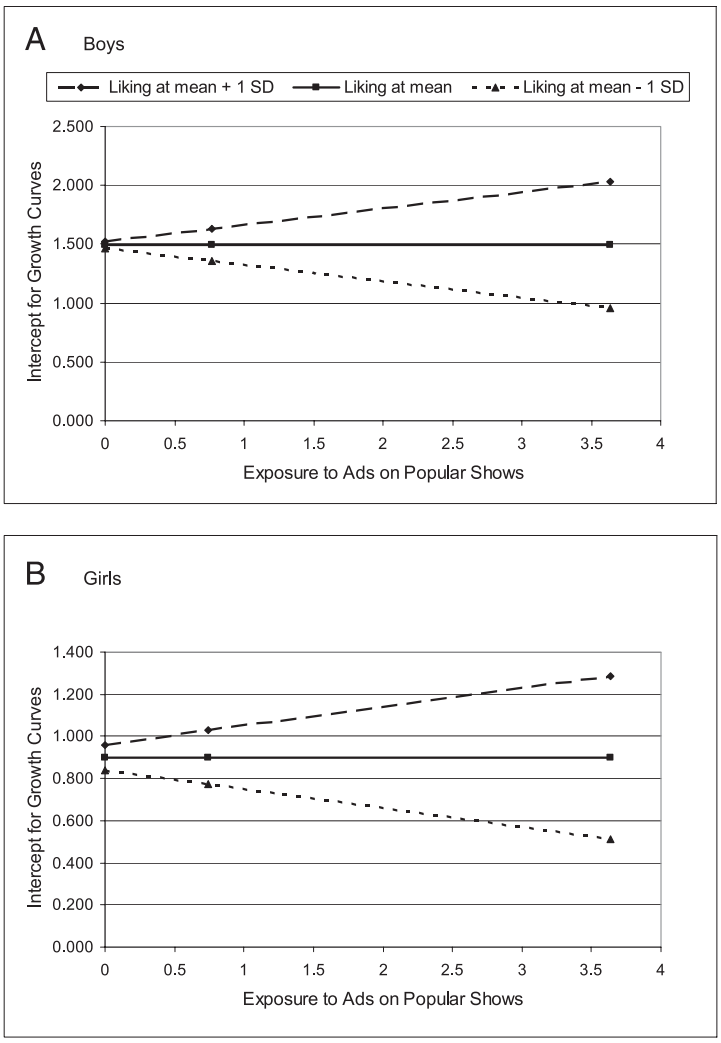

FIGURE 3
Interaction of exposure to ads with liking of ads. Liking of ads plotted at the mean, the mean plus 1 SD, and the mean minus 1 SD.

portrayals of alcohol use in advertisements, which, in turn, predicts liking of brands of beer and positive expectancies for alcohol use. The overall influence of liking of advertisements on alcohol use might be somewhat larger in the current model if these mediating pathways were taken into account. In another study of advertising, Austin et al[46] found that a media-literacy intervention increased skepticism (reduced liking) for advertising, as expected, but also increased recall of advertisement. This is consistent with the current study where memory and liking of advertisements interact. That is, a greater memory for alcohol advertisement does not necessarily mean an increase in alcohol use; it also depends on liking of the advertisements. This combination of theory and empirical evidence across research teams provides reasonably good support for the influence of exposure to alcohol advertisements on alcohol use and alcohol-related problems among adolescents.

A few limitations warrant discussion. First, the current results may be generalized only to public school students in the Los Angeles area. Second, alcohol use measures among young adolescents are often skewed toward 0, and this is true in the current sample. Seventh graders were actually recruited because of their low levels of alcohol use to examine the early development of alcohol use, but, unfortunately, these skewed measures may have contributed, in part, to some of the null findings in this study. Finally, not all results converge across multiple measures of exposure to advertising, but there is little literature available that indicates which exposure measures are optimal. However, it may not be surprising that cued recall of advertisements was not predictive of alcohol use. In the communication theory of Lang,[47] cued recall is thought to be a less effective measure of retrieval/accessibility of information than it is a measure of encoding/availability of information.[47] In encoding specificity[48] and transfer-appropriate processing[49] views, cued recall would reflect good accessibility and predictability at the time of drinking decisions only if the retrieval cues at test overlap well with retrieval cues during these later decisions; such overlap is unlikely, as the test cues were still pictures of commercials. However, the use of the indirect measure of exposure on popular shows and liking of ads are used successfully across a range of studies, and, in particular, liking of ads, although not strictly a measure of exposure, is used across product categories to predict the success of individual ads or ad campaigns.[18]

CONCLUSIONS

The accumulation of evidence for the influence of televised alcohol advertisements on underage drinking has important implications for prevention. First, children can be taught about the design of persuasive messages in the media early to help them avoid undue

influence by the media on their behaviors.[45,50] Second, it is important to have a comprehensive policy to limit the exposure of children to alcohol ads on television and on other media, such as the Internet, print media, and display ads. Although there are other influences on underage drinking, including those of peers and adults, prevention strategies should address the influence of alcohol ads as part of an overall strategy to prevent early initiation of alcohol use and the development of problems related to consumption.

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APPENDIX Assessments

Assessment	Items	α	Example Item	Response Option Anchors
Current frequency and quantity of alcohol use[20]	9	0.91	During the last 30 d, on how many days did you…have at least 1 drink of beer?	0 = 0 d 7 = all 30 d
Problems associated with alcohol use[21]	8	0.93	How many times have you ever…gone to school drunk?	1 = never 4 = more than 10 times
Exposure to alcohol advertising[a] on popular shows[22]	20	0.79	How frequently do you watch MTV?	1 = never 6 = every day
Exposure to alcohol advertising[a] on sports shows[22,23]	6	0.80	How often to you watch professional football?	1 = never 6 = every day
Cued recall memory for alcohol advertisements[24]	15	0.74	What product is being advertised in the photo?	Open-ended
Self-reported observation of alcohol advertisements[25]	4	0.72	In the past week, how many commercials have you seen for alcohol drinks like beer, wine, or liquor?	0 = none 6 = 6 or more
Liking of alcohol advertisements[26]	3	0.78	Of all the commercials you see on TV, how much do you like the TV commercials for alcohol?	1 = I like alcohol commercials the most 4 = I like the alcohol commercials the least
Propensity to watch TV[27,28]	7	0.79	On a typical weekday, how many hours a day do you watch TV…after school before dinner?	1 = I do not watch TV 5 = 5 h or more
Observed drinking by peers and friends[29]	4	0.86	About how often did you do the following things in the last 6 mo…saw someone your age drink beer or other alcohol?	0 = never 6 = every day
Observed drinking by known adults[30]	3	0.84	About how often did you do the following things in the last 6 mo…saw an adult you know well drink alcohol?	0 = never 6 = every day
Participation in sports[31]	5	0.73	About how often did you do the following things in the last 6 mo… played soccer?	0 = never 6 = every day
Language acculturation[32,33]	3	0.67	What language(s) do you usually speak at home?	1 = only English 5 = only another language
Socioeconomic status[51]	2	na	What is the highest grade completed by your mother?	1 = not completed elementary school 6 = Completed graduate school
Socioeconomic status[51]	2	na	What type of work does your father do?	Open-ended (coded)

na, not applicable.

[a] The frequency of watching popular shows or sports programs was weighted by the frequency of alcohol advertisements broadcast on those shows in the previous 10 mo, as reported by Nielsen Media Research (see text).

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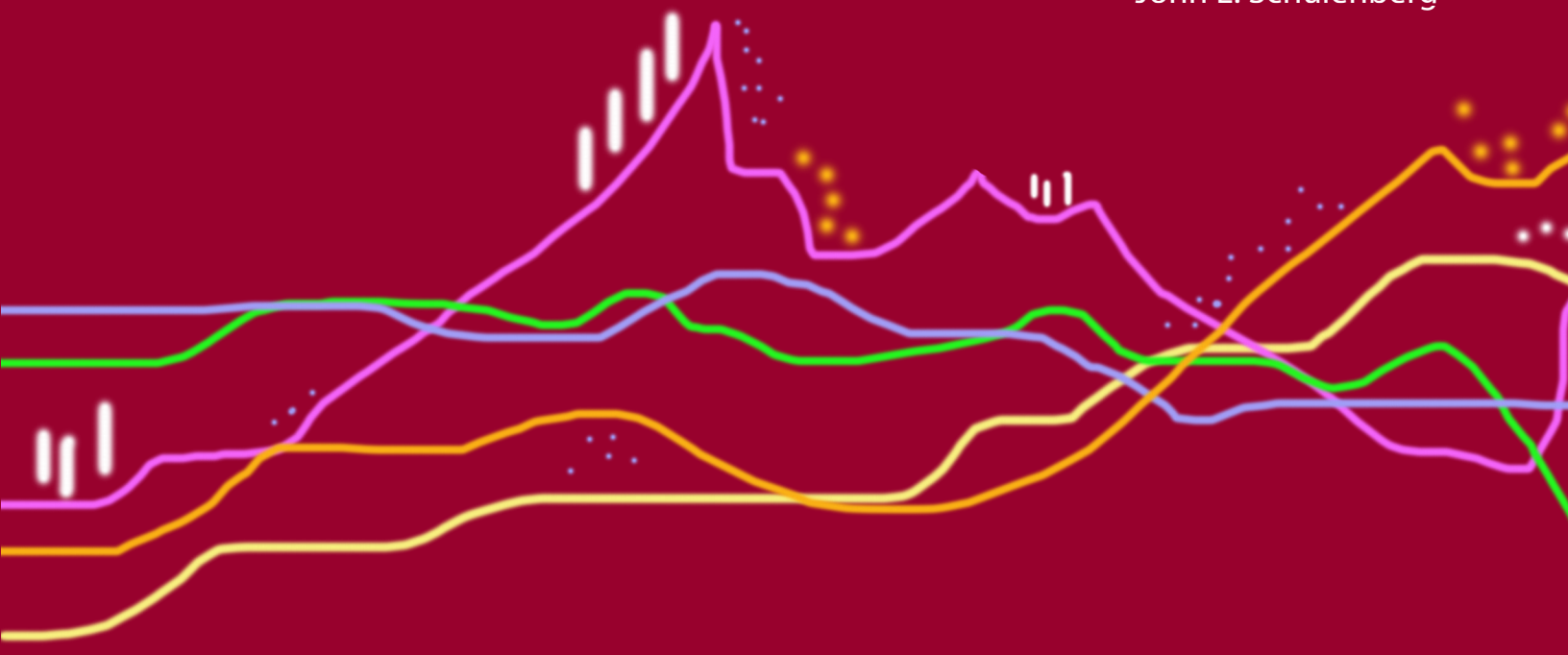

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by

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The University of Michigan
Institute for Social Research

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Institute for Social Research
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Contents

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Introduction

Monitoring the Future (MTF) is a long-term study of American adolescents, college students, and adult high school graduates through age 55. It has been conducted annually by the University of Michigan's Institute for Social Research since its inception in 1975 and is supported under a series of investigator-initiated, competitive research grants from the National Institute on Drug Abuse.

The need for a study such as MTF is clear. Substance use by American young people has proven to be a rapidly changing phenomenon, requiring frequent assessments and reassessments. Since the mid-1960s, when it burgeoned in the general youth population, illicit drug use has remained a major concern for the nation. Smoking, drinking, and illicit drug use are leading causes of morbidity and mortality during adolescence as well as later in life. How vigorously the nation responds to teenage substance use, how accurately it identifies the emerging substance abuse problems, and how well it comes to understand the effectiveness of policy and intervention efforts largely depend on the ongoing collection of valid and reliable data. MTF is uniquely designed to generate such data in order to provide an accurate picture of what is happening in this domain and why, and the study has served that function well for the past 42 years. Policy discussions in the scientific literature and media, in government, education, public health institutions, and elsewhere have been informed by the ready availability of extensive and consistently accurate information from the study relating to a large and ever-growing number of substances. Similarly, the work of organizations and agencies providing prevention and treatment services is informed by MTF.

The 2016 MTF survey involved about 45,500 students in 8th-, 10th-, and 12th grades enrolled in 372 secondary schools nationwide. The first published results based on the 2016 survey are presented in this report. Recent trends in the use of licit and illicit drugs are emphasized, as well as trends in the levels of perceived risk and personal disapproval associated with each drug. This project has shown these beliefs and attitudes to be particularly important in explaining trends in use. In addition, trends in the perceived availability of each drug are presented, which at times have proven important to explaining changes in usage levels for some drugs.

A synopsis of the design and methods used in the study and an overview of the key results from the 2016 survey follow this introductory section. We then provide a separate section for each individual drug class, including figures that show trends in the overall proportions of students at each grade level (a) using the drug, (b) seeing a "great risk" associated with its use (perceived risk), (c) disapproving of its use (disapproval), and (d) saying that it would be "fairly easy" or "very easy" to get if they wanted to (perceived availability). For 12th graders, annual data are available since 1975 and for 8th and 10th graders since 1991, the first year they were included in the study.

The tables at the end of this report provide the statistics underlying the figures; in addition, they present data on lifetime, annual, 30-day, and (for selected drugs) daily prevalence.[1] For the sake of brevity, we present these prevalence statistics here in tabular form only for the 1991–2016 interval, but statistics on 12th graders going back to 1975 are available in other MTF publications. For each prevalence period, the tables indicate which one-year changes from 2015 to 2016 are statistically significant. (In the text below, 's' indicates $p \leq .05$, 'ss' indicates $p \leq .01$, 'sss' indicates $p \leq .001$, and 'ns' indicates not statistically significant). The graphic depictions of multiyear trends often reveal gradual change that may not reach significance in a given one-year interval but nevertheless may be shown to be real over a longer time frame.

An extensive analysis of the study's findings on secondary school students may be found in *Volume I*, the second publication in this series, published at the end of May each year.[2] *Volume I* contains a more detailed description of the study's methodology, as well as chapters on grade of initiation, attitudes toward drugs, the social milieu, and a summary of other publications from the study that year (mostly journal articles). *Volume I* also contains an appendix

[1] Prevalence refers to the proportion or percentage of the sample reporting use of the given substance on one or more occasions in a given time interval—e.g., lifetime, past 12 months, or past 30 days. For most drugs, the prevalence of daily use refers to reported use on 20 or more occasions in the past 30 days, except for cigarettes and smokeless tobacco, for which actual daily use is measured, and for binge drinking, defined as having 5+ drinks on at least one occasion in the prior two weeks. E-cigarettes and some tobacco products are measured on number of days used in past 30 days.

[2] The most recent publication of *Volume I* is Miech, R. A., Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2016). *Monitoring the Future national survey results on drug use, 1975–2015: Volume I, Secondary school students*. Ann Arbor: Institute for Social Research, The University of Michigan, 636 pp. Available at: http://monitoringthefuture.org/pubs/monographs/mtf-vol1_2015.pdf

report because the follow-up data from those populations become available later in the year. Those findings will be covered in *Volume II*, the third monograph in this annual series, published at the end of July each year.[3]

Two annual MTF Occasional Papers are published each year in conjunction with *Volumes I* and *II*, providing trends in use for various demographic subgroups.[4]

A fourth monograph, *HIV/AIDS Risk and Protective Behaviors Among Young Adults*, dealing with national trends in HIV/AIDS-related risk and protective behaviors among young adults 21 to 40 years old, was added to the series beginning in 2010.[5] It is published in October of each year. From 2005 to 2009, these findings were reported as part of *Volume II*.

For the publication years prior to 2010, the volumes in these annual series are available from the NIDA Drug Publications Research Dissemination Center (877-NIDA-NIH, drugpubs.drugabuse.gov) and can also be found on the MTF website. Beginning with the 2010 publication date, the volumes are available at the MTF website immediately upon publication. Further information on the study, including its latest press releases, a listing of all publications, and freely accessible reports may also be found at www.monitoringthefuture.org.

[3]The most recent publication of *Volume II* is Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E. , and Miech, R. A. (2016). *Monitoring the Future national survey results on drug use, 1975–2015: Volume II, College students & adults ages 19–55.* Ann Arbor: Institute for Social Research, The University of Michigan, 427 pp. Available at: http://www.monitoringthefuture.org/pubs/monographs/mtf-vol2_2015.pdf

[4]Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Miech, R. A. (2016). *Demographic subgroup trends among adolescents in the use of various licit and illicit drugs 1975-2015* (Monitoring the Future Occasional Paper No. 86). Ann Arbor, MI: Institute for Social Research, University of Michigan, 552 pp. Available at: http://monitoringthefuture.org/pubs/occpapers/mtf-occ86.pdf

Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Miech, R. A. (2016). *Demographic subgroup trends among young adults in the use of various licit and illicit drugs 1989-2015* (Monitoring the Future Occasional Paper No. 87). Ann Arbor, MI: Institute for Social Research, University of Michigan, 109 pp. Available at: http://monitoringthefuture.org/pubs/occpapers/mtf-occ87.pdf

[5]The most recent publication in the *HIV/AIDS monograp series* is Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., Patrick, M. E., & Miech, R. A. (2016). *HIV/AIDS: Risk and protective behaviors among adults ages 21-40 in the U.S., 2004–2015.* Ann Arbor: Institute for Social Research, The University of Michigan, 123 pp. Available at: http://monitoringthefuture.org/pubs/monographs/mtf-hiv-aids_2015.pdf

Study Design and Methods

Monitoring the Future's main data collection involves a series of large, annual surveys of nationally representative samples of public and private secondary school students throughout the coterminous United States. Every year since 1975, such samples of 12th graders have been surveyed. In 1991, the study was expanded to include comparable, independent national samples of 8th and 10th graders. The year 2016 marked the 42nd survey of 12th graders and the 26th survey of 8th and 10th graders.

Sample Sizes

In 2016 about 45,500 students in 372 secondary schools participated in the study, with sample sizes in 8th, 10th, and 12th grades of about 17,600, 15,200, and 12,600, respectively. The number of cases upon which a particular statistic is based may be less than the total sample size. Multiple questionnaire forms are distributed randomly at each grade level to increase coverage of attitudinal and behavioral domains relevant to substance use. To reduce burden on the respondents, not all questions are contained in all forms. The tables here contain notes on the number of forms used for each statistic if less than the total sample is used.

Field Procedures

University of Michigan staff members administer the questionnaires to students, usually in the student classroom during a regular class period. Participation is voluntary. Parents are notified well in advance of the survey administration and are provided the opportunity to decline their child's participation. Questionnaires are self-completed and are formatted for optical scanning. Procedures are kept consistent over time.

In 8th and 10th grades the questionnaires are completely anonymous, and in 12th grade they are confidential (name and address information is gathered separately from the 12th grade questionnaire to permit the longitudinal follow-up surveys of random subsamples of participants after high school). Extensive procedures are followed to protect the confidentiality of the participants and their data. All procedures are reviewed and approved on an annual basis by the University of Michigan's Institutional Review Board (IRB) for compliance with federal guidelines for the treatment of human subjects.

Measures

A standard set of three questions is used to determine usage levels for most of the drugs. For example, we ask, "On how many occasions (if any) have you used marijuana… (a)…in your lifetime? (b)…during the last 12 months? (c)…during the last 30 days?" Each of the three questions is answered on the same answer scale: 0, 1–2, 3–5, 6–9, 10–19, 20–39, and 40 or more occasions.

For the psychotherapeutic drugs (amphetamines, sedatives [barbiturates], tranquilizers, and narcotics other than heroin), respondents are instructed to include only use "…on your own—that is, without a doctor telling you to take them." A similar qualification is used in the question on use of anabolic steroids, OxyContin, Vicodin, and several other drugs.

For cigarettes, respondents are asked two questions about use. First, they are asked, "Have you ever smoked cigarettes?" The answer categories are "never," "once or twice," "occasionally but not regularly," "regularly in the past," and "regularly now." The second question asks, "How frequently have you smoked cigarettes during the past 30 days?" The answer categories are "not at all," "less than one cigarette per day," "one to five cigarettes per day," and about one-half, one, one and one half, and two packs or more per day.

Smokeless tobacco questions parallel those for cigarettes. There are also questions recently added about electronic vaporizers, e-cigarettes, small cigars, and a number of other tobacco products. In general, their use is asked on a prevalence/frequency scale for either the last 12 months or the last 30 days.

Alcohol use is measured using the three questions illustrated above for marijuana. A parallel set of three questions asks about the frequency of being drunk. Binge drinking is assessed with the question, "How many times (if any) have you had five or more drinks in a row" over the past two weeks? Extreme binge, now also called high-intensity, drinking among 12th graders is assessed with similar questions about consuming ten or more and fifteen or more drinks in a row.

In general, we try to keep measures consistent across time. When a change is warranted, we usually splice the older and newer measures for at least one year to permit an assessment of the effect of the change.

Perceived risk is measured by the question, "How much do you think people risk harming themselves (physically or in other ways), if they…" try or use a drug—for example, "…try marijuana once or twice." The answer categories are "no risk," "slight risk," "moderate risk," "great risk," and "can't say, drug unfamiliar." Parallel questions refer to using marijuana "occasionally" and "regularly."

Disapproval is measured by the question "Do YOU disapprove of people doing each of the following?" followed by "trying marijuana once or twice," for example. Answer categories are "don't disapprove," "disapprove," and "strongly disapprove." In the 8th- and 10th-grade questionnaires, a fourth category—"can't say, drug unfamiliar"—is provided and included in the calculation of percentages.

Perceived availability is measured by the question "How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?" Answer categories are "probably impossible," "very difficult," "fairly difficult," "fairly easy," and "very easy." For 8th and 10th graders, an additional answer category—"can't say, drug unfamiliar"—is provided and included in the calculation of percentages.

Summary of Key Findings

Before delving into the 2016 findings, a note about three kinds of trends we reference: Monitoring the Future (MTF) is designed to detect age effects, secular trends (sometimes referred to as period effects), and cohort effects in substance use and related attitudes and beliefs. Age effects (similar changes at similar ages seen across multiple class cohorts) are common during adolescence, and we typically find that use, as well as positive attitudes and beliefs about use, increase across 8th, 10th, and 12th grades. When changes over time in substance use and related attitudes and beliefs are parallel across the three grades, they reflect secular trends, which are also common.

Cohort effects pertain to differences in substance use and related attitudes and behaviors among those born at different times that are maintained as the birth cohorts age (or in this case, as class-in-school cohorts, which are strongly correlated with age). Such cohort effects sometimes drive changes in substance use prevalence at the population level. For example, much of the decline in the prevalence of U.S. cigarette smoking has its roots in youth cohorts that did not take up smoking and then continued to abstain from smoking as they aged into adulthood. As subsequent youth cohorts continued to avoid smoking and then grew older, these cohorts contributed to a decline in the overall population prevalence of smoking. Cohort effects can also act in the opposite direction, with newer cohorts taking up a substance and continuing to use it as they get older. One important contribution of the MTF study has been the specification of cohort effects that emerged starting in the early 1990s, when an increase in youth substance use occurred for many drugs.

MTF allows detection of cohort effects at an early age through comparison of substance use prevalence of 8th, 10th, and 12th graders relative to each other. Often 8th grade substance use is a bellwether, and year-to-year changes that are unique to 8th grade can signify an emerging increase or decrease in substance use at later grade levels with some time lag.

The analyses and associated tables that follow present substance use trends for all three grades separately, as well as trends in key attitudes, beliefs, and perceived availability. In a number of cases we provide insight into the age and cohort effects and secular trends that underlie trends in use and in key attitudes and beliefs.

An additional set of tables provides an overview of drug use trends for the three grades combined (Tables 1–4). This information gives a summary of the general nature of secular trends over the last several years, though it obscures any cohort effects that may be occurring. Also, for simultaneous trends that are in the same direction and magnitude across all three grades, these combined analyses provide greater statistical power to detect secular trends that are statistically significant.

Declines in Use of a Number of Drugs in 2016

Perhaps the most striking finding in 2016 is that across the broad spectrum of drugs (more than 50 classes and subclasses) most decreased and hardly any exhibited a statistically significant increase.[6]

In many cases these decreases in use were continuing the declines seen in 2014 and 2015. ***Cigarettes*** and ***alcohol*** continued to show significant declines, reaching their lowest levels in the history of the study. With regard to illicit drugs, annual prevalence declined in the three grades combined for the use of ***any illicit drug***, ***any illicit drug other than marijuana***, ***synthetic marijuana***, ***MDMA***(ecstasy, Molly), ***cocaine***, ***crack***, ***amphetamines***, ***Adderall*** specifically, ***methamphetamine***, ***heroin***, ***Rohypnol***, some psychotherapeutic drugs used without medical supervision (***Vicodin***, ***tranquilizers***), and ***steroids***.

The decline in annual prevalence of using ***any illicit drug*** is largely due to the fact that the annual prevalence of ***marijuana***, which tends to drive the overall index, showed a decline in the two lower grades in 2016. (The 2.4 percentage point decline to 9.4% in 8th grade was highly significant; the 1.5 percentage point decline in 10th grade to 23.9% was not.). Among 12th graders, however, the annual prevalence of marijuana has held quite steady for several years, increasing by a non-significant 0.7% to 35.6% in 2016. For the three grades combined, annual prevalence of marijuana showed a significant decline of 1.1 percentage points in 2016.

Although use of marijuana declined (or in the case of the 12th graders held steady) in 2016 marijuana attitudes among students continued to move toward greater acceptance. This fact is contradictory to the association that has existed between perceived risk and actual use for many years, in which they usually move in opposite directions with a one-year lag between a change in perceived risk and a change in annual prevalence. (This is a topic we will address in future publications.) *Perceived risk* of smoking marijuana regularly declined only slightly

[6] The few exceptions were annual use of bath salts among 8th graders only, annual use of over-the-counter cough and cold medicines to get high among 8th graders, and 30-day use of heroin with a needle among 10th graders; and none of those changes were large or part of a pattern of continuing increase.

further in 2016 in two of the grades, following a sharp decline in all three grades in recent years. In all three grades, the percentage seeing great risk of smoking marijuana regularly is at or near the lowest point ever recorded in the study—58%, 44%, and 31% in grades 8, 10, and 12, respectively. *Disapproval* of smoking marijuana regularly was unchanged in 8th grade (at 82%) and 10th grade (at 74%) in 2016, but declined non-significantly in 12th grade (to 69%). Although the 2016 levels are at or near historic lows, they still indicate relatively high levels of disapproval of smoking marijuana regularly. Indeed the decline in disapproval or regular marijuana use since about 2008 has been considerably less than the decline in perceived risk. Reported *availability* of marijuana continued a longer-term decline among 8th and 10th graders in 2016.

Use of ***any illicit drug other than marijuana*** declined slightly in all three grades, significantly so in 8th grade. Annual prevalence in 2016 is 5%, 10%, and 14% in 8th, 10th, and 12th grades, respectively—the lowest levels since all three grades were included in the study in 1991.

Additional drugs with declining annual prevalence include ***synthetic marijuana*** (which in 2011 was the second most widely used drug after marijuana), ***MDMA*** (ecstasy, Molly), ***inhalants***, ***heroin***, ***cocaine***, ***crack***, ***amphetamines***, and ***steroids***. ***Methamphetamine*** use declined significantly at 10th grade but remained unchanged in the other two grades.

The ***psychotherapeutic drugs*** warrant special attention, given that they now make up a significantly larger part of the overall U.S. drug problem than was true 10–15 years ago. This is in part because of increases in nonmedical use of many prescription drugs over that period, and in part because use of a number of street drugs has declined substantially since the mid- to late-1990s. It seems likely that young people are less concerned about the dangers of using these prescription drugs outside of medical regimen because they are widely used for legitimate purposes. (Indeed, the low levels of perceived risk for sedatives and amphetamines observed among 12th graders illustrate this point.) Also, prescription psychotherapeutic drugs are now being advertised directly to the consumer, which implies that they are both widely used and safe.

Fortunately, the use of most of these drugs has either leveled or begun to decline in the past few years. The proportion of 12th graders misusing any of these prescription drugs (i.e., amphetamines, sedatives, tranquilizers, or narcotics other than heroin) in the prior year continued to decline in 2016 (-1.0%, not significant) to 12%, down from a high of 17% in 2005. ***Amphetamine*** use without a doctor's orders—which generally has been the second most widely used class of illicit drugs after marijuana—continued a gradual decline in 2016 in all grades, though the one-year declines did not reach statistical significance. Use of ***narcotics*** other than heroin without a doctor's orders (reported only for 12th grade) also continued a gradual decline begun after 2009, when annual prevalence was 9.2%; it was 4.8% after a non-significant decline of 0.6 percentage points in 2016. Given the epidemic of narcotics use in older populations along with concurrent rise in medical emergencies and deaths, it is particularly good news that young people are moving away from the use of these drugs.

Illicit Drugs Holding Steady in 2016

The use of a number of drugs showed little or no change from 2015 to 2016. These include ***hallucinogens***, ***LSD*** specifically, ***hallucinogens other than LSD***, ***salvia***, ***tranquilizers***, ***heroin*** use without a needle, ***crystal methamphetamine***, and the club drugs ***GHB***, ***rohypnol***, and ***ketamine***.

Illicit Drugs Showing Any Increase in 2016

The use of so-called ***"bath salts"*** (synthetic stimulant cathinones) rose significantly (but just by 0.5% to 0.9%) among 8th graders in 2016 but remained unchanged in the upper grades. Similarly, ***cough and cold medicines used to get high*** (which usually contain dextromethorphan) rose significantly among 8th graders to an annual prevalence of 2.6%, but not among the upper grades.

Tobacco and Alcohol Use

As in 2015, ***cigarette smoking*** and ***alcohol*** use have continued their long declines and are now at the lowest levels in the history of the survey. *Thirty-day* prevalence of cigarette use reached a peak in 1996 at grades 8 and 10, capping a rapid climb from the 1991 levels (when data were first gathered on these grades). Between 1996 and 2016, current smoking fell dramatically in these grades, by 87% and 84%, respectively. For 12th graders, peak 30-day prevalence occurred in 1997 at 37% and has shown a more modest decline since then. It is at 11% in 2016—a seven-tenths decline since the peak—with a continuing decline in smoking prevalence in 2016. A similar decline is statistically significant at 8th and 10th grades. Because of the strong cohort effect that we have consistently observed for cigarette smoking, we have predicted use at 12th grade to continue to show declines, as the lighter-using cohorts of 8th and 10th graders become 12th graders.

Initiation of ***cigarette*** use also continues its long-term and extremely important decline. *Lifetime* prevalence declined between 2015 and 2016 in all three grades: to 10% in 8th grade (-3.5, sss), to 18% in 10th grade (-2.4, s), and to 29% in 12th grade (-2.8, s). The fact that fewer young people now initiate cigarette smoking is an important reason for the large declines in their current use. The proportion of students who have *ever tried* cigarettes

has fallen from peak levels reached in 1996 or 1997 by roughly three quarters, two thirds, and one half in the three grades, respectively.

Overall increases in perceived risk and disapproval appear to have contributed to the downturn in cigarette use. Perceived risk of smoking one or more packs of cigarettes per day increased substantially and steadily in all grades from 1995 through 2004, with 62%, 68%, and 74% of 8th, 10th, and 12th graders seeing great risk in 2004. Since then, changes have been small and uneven, and the corresponding figures in 2016 are only slightly changed, at 61%, 72%, and 77%. Disapproval of smoking one or more packs of cigarettes per day has increased somewhat steadily in all three grades since 1996 and has reached very high levels. In 2016 disapproval stands at 88%, 89%, and 85% in grades 8, 10, and 12, respectively.

It seems likely that some of the attitudinal change surrounding cigarettes is attributable to the considerable adverse publicity aimed at the tobacco industry in the 1990s, as well as a reduction in cigarette advertising and an increase in antismoking campaigns reaching youth.

Various other attitudes toward smoking became more unfavorable during that interval as well, though most have since leveled off. For example, among 8th graders, the proportions saying that they "prefer to date people who don't smoke" rose from 71% in 1996 to 81% by 2004, where it remained through 2016. Similar changes occurred in 10th and 12th grades. Thus, at the present time, smoking is likely to make an adolescent less attractive to the great majority of potential romantic age-mates. Likewise, most of the other negative connotations of smoking and smokers have leveled off in the past few years after rising previously. In addition to changes in attitudes and beliefs about smoking, price almost surely also played an important role in the decline in use. Cigarette prices rose appreciably in the late 1990s and early 2000s as cigarette companies tried to cover the costs of the 1998 Master Settlement Agreement, and as many states increased excise taxes on cigarettes. A significant increase in the federal tobacco tax passed in 2009 may have contributed to the continuation of the decline in use since then.

Cigarillos. One consequence of the rise in cigarette prices is that it may have shifted some adolescents to less expensive alternatives, like cigarillos (little or small cigars), which are taxed at a lower rate than cigarettes. Taking into account this form of smoking of tobacco raises the 30-day prevalence of students smoking tobacco—by about three-fourths among 8th and 10th graders and by more than half among 12th graders—over what it would be if just cigarette smoking were counted. It does appear, however, that the prevalence of using small cigars is also in decline, with 16% of 12th graders in 2016 reporting any *past-year* use, down substantially from 23% in 2010. Of note is the fact that the majority of users of small cigars in each grade smoke flavored ones.

Annual prevalence of smoking tobacco using a ***Hookah*** (water pipe) had been increasing steadily until 2014 among 12th graders (8th and 10th graders are not asked about this practice), reaching 23% in 2014; but use declined non-significantly by three percentage points to 20% in 2015 and declined significantly (by 6.9 percentage points) to reach 13% in 2016.

Smokeless tobacco. From the mid-1990s to the early 2000s, smokeless tobacco use declined substantially, but a rebound in use developed from the mid-2000s through 2010. Since 2010, prevalence levels have declined modestly in all three grades. Perceived risk and disapproval appear to have played important roles in the earlier decline in smokeless tobacco use. In all three grades, perceived risk and disapproval rose fairly steadily from 1995 through 2004, accompanying the declines in use. However, there was not much change between 2004 and 2010, suggesting that other factors may have led to the increases in smokeless tobacco use during that time interval. : perhaps including increased promotion of these products, a proliferation of types of smokeless tobacco products available, and increased restrictions on places where cigarette smoking is permitted. The decline in smokeless tobacco use since 2010 (including a significant decline among 12th graders in 2015 and 10th graders in 2016) may be attributable, at least in part, to the 2009 increase in federal taxes on tobacco. Perceived risk has not changed appreciably since 2010 at any grade level.

Alcohol remains the substance most widely used by today's teenagers. Despite recent declines, six out of every ten students (61%) have consumed alcohol (more than just a few sips) by the end of high school, and about a quarter (23%) have done so by 8th grade. In fact, nearly half (46%) of 12th graders and one in eleven (9%) 8th graders in 2016 reported having been drunk at least once in their life.

Alcohol use began a substantial decline in the 1980s. To some degree, alcohol trends have tended to parallel the trends in illicit drug use. These include a modest increase in binge drinking (defined as having five or more drinks in a row at least once in the past two weeks) in the early to mid-1990s, though it was a proportionally smaller increase than was seen for cigarettes and most of the illicit drugs. Fortunately, binge drinking rates leveled off in the early 2000s, just about when the illicit drug rates began to turn around, and in 2002, a drop in ***drinking*** and ***drunkenness*** resumed in all grades. Gradual declines continued into 2016, which marked the lowest levels for

alcohol use and drunkenness ever recorded by the survey in the three grades combined. All three grades showed further decline in 2016. The declines in the percentage reporting having been drunk at least once are quite substantial, down from the peak year since 1991 by about 70%, 50%, and 30% for grades 8, 10, and 12.

Vaping

Vaping involves the inhalation of vapors (sometimes including nicotine) using devices such as e-cigarettes, "mods," and e-pens. Thirty-day prevalence of vaping fell significantly in each grade in 2016. It declined by 1.8 percentage points in 8th grade, by 3.3 percentage points in 10th grade, and by 3.8 percentage points in 12th grade, to levels of 6%, 11%, and 13% in the respective grades.

This marks the first reversal of vaping prevalence, which grew rapidly from near zero prevalence in 2011 to one of the most common forms of adolescent substance use. Despite the decline in 2016 the prevalence of vaping remains substantially higher than the use of any other tobacco product, including cigarettes. Whether teen vaping has peaked or only paused is an issue that MTF will be able to determine in the coming years.

The percentage of students who associated vaping with "great risk" increased slightly as vaping prevalence declined. ***E-cigarettes*** are the most commonly used vaping device, and from 2015 to 2016 the percentage of adolescents who believe that regular e-cigarette use poses a great risk of harm increased from 16% to 18% in 12th grade, from 17% to 19% in 10th grade, and from 19% to 21% in 8th grade. Even after these increases, e-cigarettes have some of the lowest levels of perceived risk of any substance.

One reason for low levels of perceived risk may be that the majority of users say that they vape only flavoring not nicotine, on their most recent occasion of use. This is consistent with the fact that only a very few of them (from 5% to 10% of users) say they are using e-cigarettes to help them quit regular cigarette use. The most common reason given for use is "to see what it's like," while the second most common reason given is "because it tastes good."

Any Illicit Drug

MTF routinely reports three different indexes of illicit drug use—any illicit drug,[7] any illicit drug other than marijuana, and any illicit drug including inhalants. In this section we discuss only the first two; the statistics for all three may be found in Tables 5–7.

In order to make direct comparisons over time, we have kept the definitions and measurement of these indexes constant. The levels of prevalence of each of the indexes could be somewhat affected by the inclusion of newer substances. Typically, the effects would be minimal, primarily because most individuals using newer ones are also using the more prevalent drugs included in the indexes. The major exception has been inhalants, the use of which is quite prevalent in the lower grades, so in 1991 a special index that includes inhalants was added.

Trends in Use

In the late 20th century, U.S. adolescents reached extraordinarily high levels of illicit drug use by U.S. as well as international standards. The trends in *lifetime* use of ***any illicit drug*** are shown in the first (upper left) panel on the facing page.[8] In 1975, when MTF began, the majority of young people (55%) had used an illicit drug by the time they left high school. This figure rose to two thirds (66%) in 1981 before a long and gradual decline to 41% by 1992—the low point. After 1992—in what we have called the "relapse phase" in the drug epidemic—the proportion rose considerably to a recent high point of 55% in 1999; it then declined gradually to 47% in 2009, and has remained between 48% and 50% since 2011.

Trends for *annual*, as opposed to lifetime, prevalence are shown in the second (upper right) panel. They are quite parallel to those for lifetime prevalence, but at a lower level. Among 8th graders, a gradual and continuing falloff occurred after 1996. Peak rates since 1991 were reached in 1997 in the two upper grades and declined little for several years. Between 2001 and 2007 all three grades showed declines, but the annual use rates in all three grades rose some through 2012. In 2016, 8th and 10th grades showed some decline,while annual prevalence among 12th grader showed essentially no change.

Because marijuana is much more prevalent than any other illicit drug, trends in its use tend to drive the index of any illicit drug use. Thus we also report an index that excludes marijuana and shows the proportions of students who use any of the other illicit drugs. The proportions who have used ***any illicit drug other than marijuana*** in their *lifetimes* are shown in the third panel (lower left). In 1975 over one third (36%) of 12th graders had tried some illicit drug other than marijuana. This figure rose to 43% by 1981, then declined for over a decade to a low of 25% in 1992. An increase followed in the 1990s as the use of a number of drugs rose steadily, and it reached 30% by 1997. (In 2001 it was 31%, but this apparent upward shift in the estimate was an artifact due to a change in the question wording for "other hallucinogens" and tranquilizers.[9]) Lifetime prevalence among 12th graders then fell slightly to 24% by 2009, before dropping to 21% by 2016. The fourth (lower right) panel presents the *annual* prevalence data for any illicit drug other than marijuana, which shows a pattern of change over the past few years similar to the index of any illicit drug use, but with much less pronounced change since 1991. It dropped fairly steadily and gradually in all three grades in recent years but leveled in 2013 before dropping to 14%.among 12th graders by 2016. In fact, prevalence declined in all three grades in 2016—significantly so in 8th grade.

Overall, these data reveal that while use of individual drugs (other than marijuana) may fluctuate widely, the proportion using *any* of them is much more stable. In other words, the proportion of students prone to using such drugs and willing to cross the normative barriers to such use changes more gradually. The usage rate for each individual drug, on the other hand, reflects many more rapidly changing determinants specific to that drug, such as how widely its psychoactive potential is recognized, how favorable the reports of its supposed benefits are, how risky its use is seen to be, how acceptable it is in the peer group, how accessible it is, and so on.

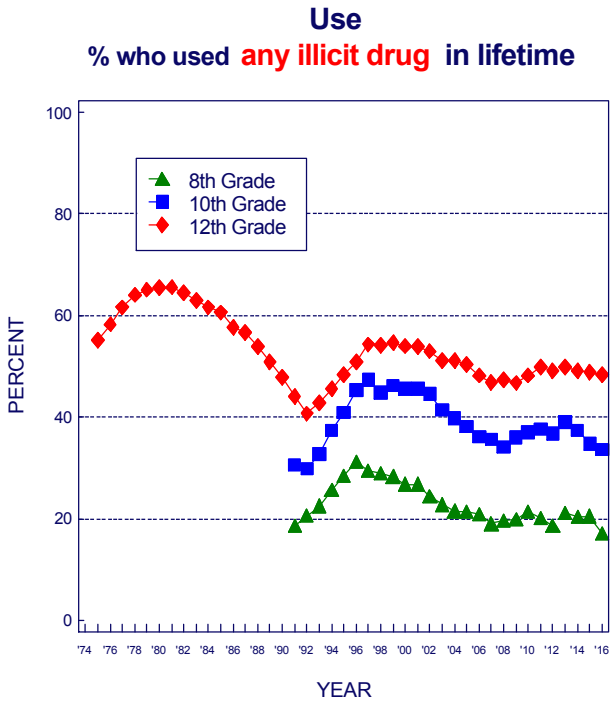
[7]Footnote 'a' to Tables 5 through 8 provides the exact definition of any illicit drug.

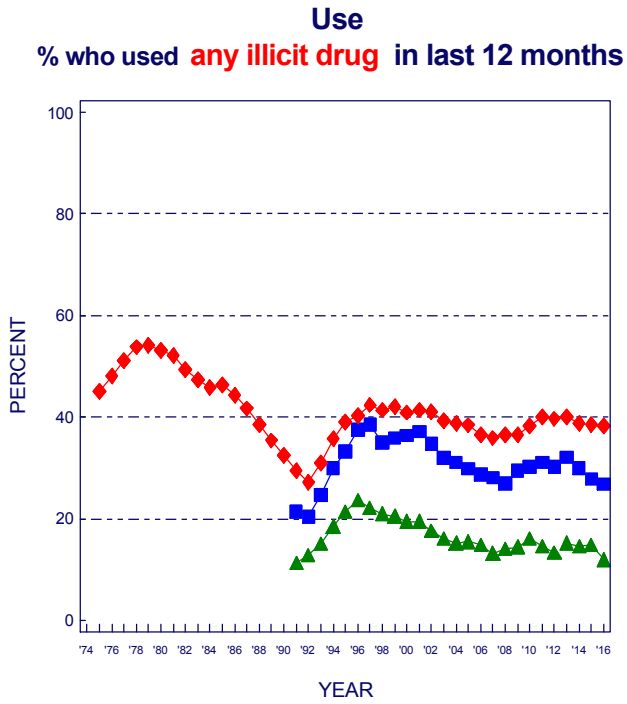
[8]This is the only set of figures in this *Overview* presenting lifetime use statistics. Lifetime statistics for all drugs may be found in Table 5.

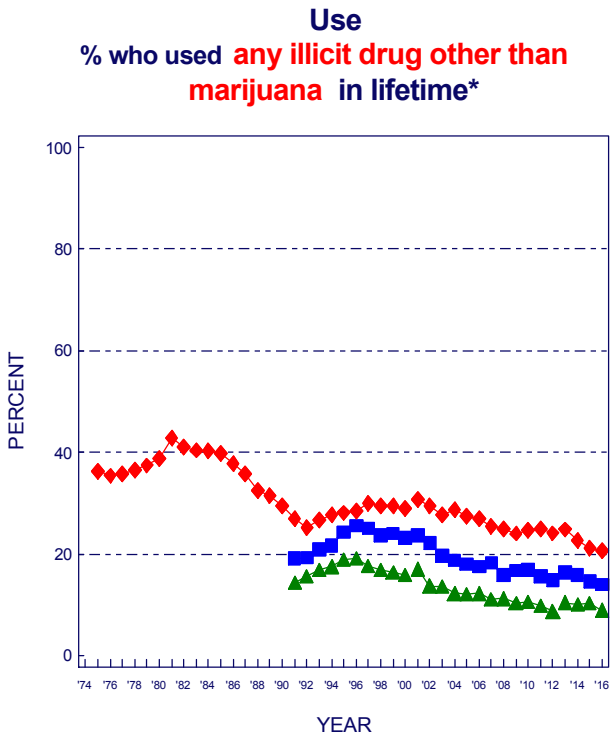
[9]The term psychedelics was replaced with hallucinogens, and shrooms was added to the list of examples, resulting in somewhat more respondents indicating use of this class of drugs. For tranquilizers, Xanax was added to the list of examples given, slightly raising the reported prevalence of use.

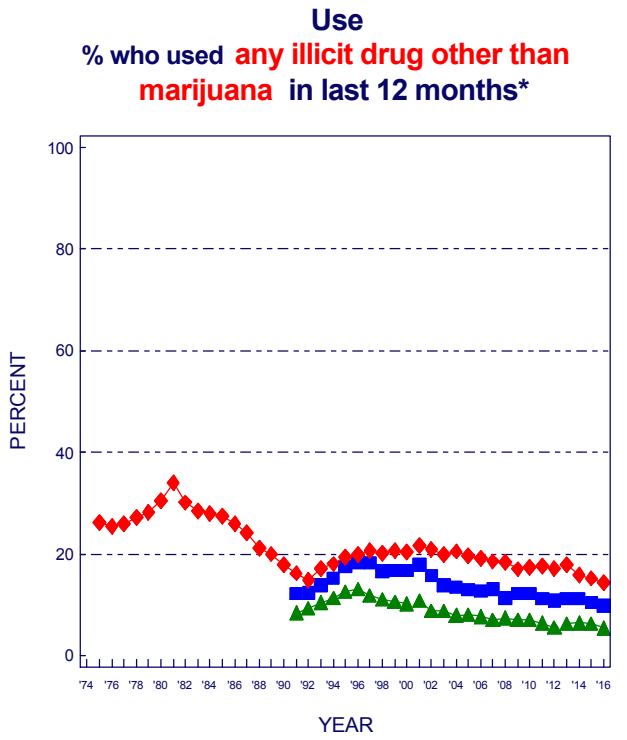
Any Illicit Drug and Any Illicit Drug Other than Marijuana: Trends in Lifetime and Annual Use

Grades 8, 10, 12









Source. The Monitoring the Future study, the University of Michigan.

*In 2001, a revised set of questions on other hallucinogen use and tranquilizer use were introduced. In 2013, a revised set of questions on amphetamine use was introduced. Data for any illicit drug other than marijuana were affected by these changes.

Marijuana

Marijuana has been the most widely used illicit drug throughout MTF's 42-year history. It can be taken orally, mixed with food or drink, and smoked, including in a concentrated form as hashish—the use of which is much more common in Europe.[10] The great majority of recreational use in the U.S. involves smoking it in rolled cigarettes ("joints"), in pipes or water pipes ("bongs"), in hollowed-out cigars ("blunts"), or more recently in a vaporizer. Newer methods also include smoking or eating different forms of resin extracts like hash oil, honey oil, or shatter—a solid form.

Trends in Use

Annual marijuana prevalence peaked among 12th graders in 1979 at 51%, following a rise that began during the 1960s. Then use declined fairly steadily for 13 years, bottoming at 22% in 1992—a decline of more than half. The 1990s, however, saw a resurgence of use. After a considerable increase (one that actually began among 8th graders a year earlier than among 10th and 12th graders), annual prevalence rates peaked in 1996 at 8th grade and in 1997 at 10th and 12th grades. After these peak years, use declined among all three grades through 2007 or 2008. After these declines, an upturn occurred in use in all three grades, lasting for three years in the lower grades and longer in grade 12. Annual marijuana prevalence among 8th graders increased in use from 2007 to 2010, decreased slightly from 2010 to 2012, and then declined significantly in 2016. Among 10th graders, use increased somewhat from 2008 to 2013 and then declined after that. Among 12th graders, use increased from 2006 to 2011 and then held level through 2016. As shown in Table 8, *daily* use increased in all three grades after 2007, reaching peaks in 2011 (at 1.3% in 8th), 2013 (at 4.0% in 10th), and 2011 (at 6.6% in 12th), before declining slightly since. Daily prevalence rates in 2016 were 0.7%, 2.5%, and 6.0%, respectively, with one in seventeen 12th graders smoking daily.

Perceived Risk

The proportion of students seeing great risk from smoking marijuana regularly fell during the rise in use in the 1970s and again during the subsequent rise in use in the 1990s. Indeed, for 10th and 12th grades, perceived risk declined a year before use rose in the upturn of the 1990s, making perceived risk a leading indicator of change in use. (The same may have happened for 8th grade as well, but we lack data starting early enough to know.) The decline in perceived risk halted in 1996 in 8th and 10th grades; the increases in use in 10th and 12th grades ended a year or two later, again making perceived risk a leading indicator of trends in use. From 1996 to 2000, perceived risk held fairly steady, and the decline in use in the upper grades stalled. After some decline prior to 2002, perceived risk increased a bit in all grades through 2004 as use decreased. Since 2004 in 8th grade, 2005 in 12th grade, and 2008 in 10th grade, perceived risk has fallen substantially, presaging some resurgence in marijuana use lasting three to five years; but no increase in perceived risk preceded the recent leveling of use. Rather, perceived risk has continued a steep decline since the mid-2000s without a concomitant further rise in overall use. Disapproval and availability may be constraining factors offsetting the effects of risk. Recent, sharp declines in the use of "gateway drugs"—in particular cigarette smoking, with which marijuana use has been highly correlated—may also be playing a role

Disapproval

Personal disapproval of trying marijuana has declined some since 2007 or 2008 in all three grades, but still remains quite high with 82%, 74%, and 69% in 8th, 10th, and 12th grades still saying that they disapprove of regular use. Disapproval fell considerably among 8th graders between 1991 and 1996 and among 10th and 12th graders between 1992 and 1997—by 17, 21, and 19 percentage points, respectively, over those intervals of increasing use and declining perceived risk. As is often the case, perceived risk fell before disapproval. Since 2008 there has been some decline in disapproval.

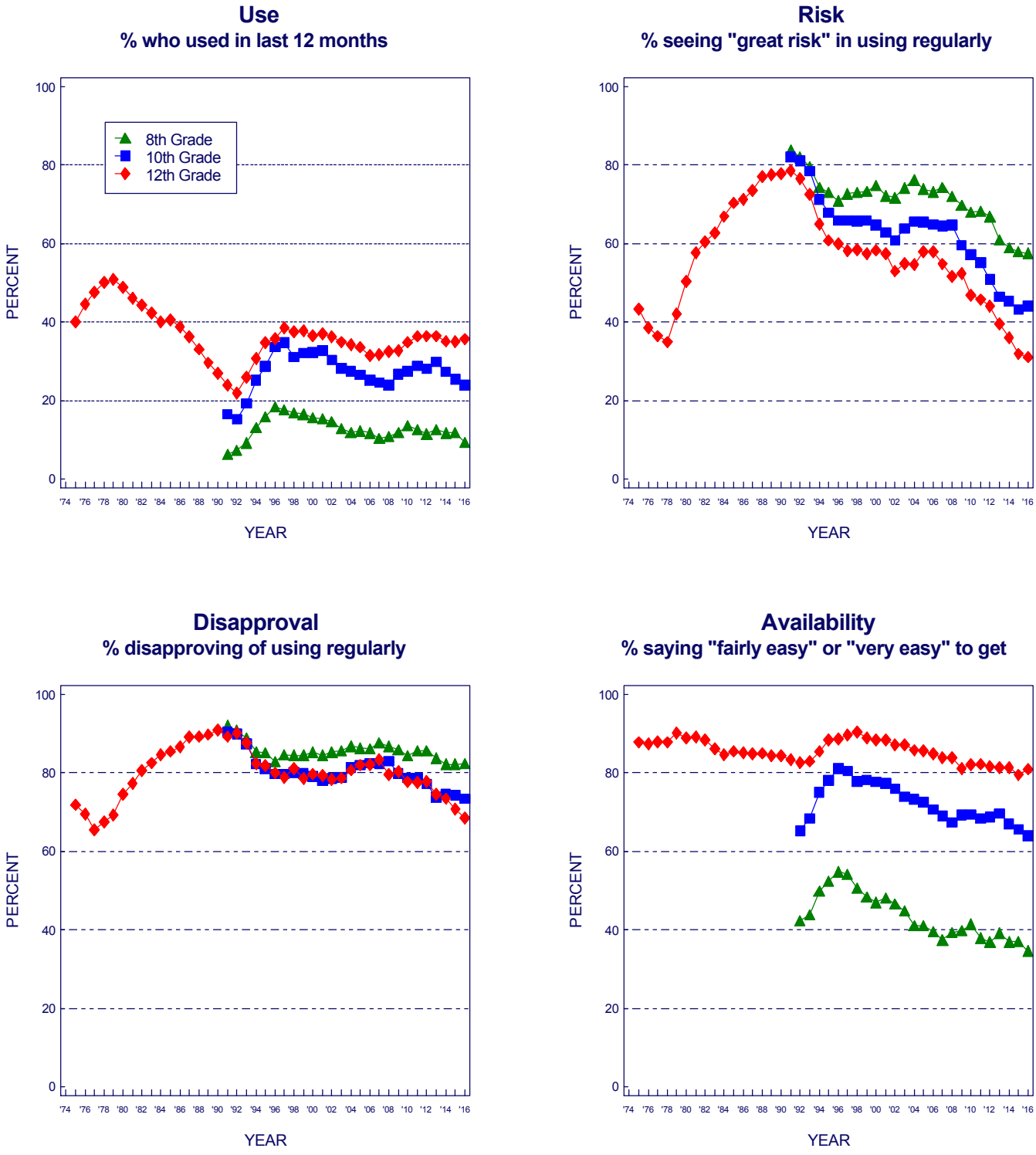
Availability

Since the MTF study began in 1975, between 80% and 90% of 12th graders each year have said that they could get marijuana fairly easily or very easily if they wanted some, with that figure standing at 81% in 2016. Marijuana has been considerably less readily available to 8th graders, with 35% in 2016 reporting it to be fairly or very easy to get. Availability is intermediate for the 10th graders, with 64% reporting easy access in 2016. Availability has declined appreciably, especially among the younger adolescents, but marijuana remains readily available to most 12th graders.

[10]Compared with Europe, American teens have high rates of illicit drug use http://monitoringthefuture.org/pressreleases/16ESPADpr.pdf

Marijuana: Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12



Source. The Monitoring the Future study, the University of Michigan.

Synthetic Marijuana

Synthetic marijuana has generally been sold over the counter under such labels as Spice and K-2. It usually contains some herbal materials that have been sprayed with one or more of the designer chemicals that fall into the cannabinoid family. Until March 2011, these drugs were not scheduled by the Drug Enforcement Administration (DEA), so they were readily and legally available on the Internet and in convenience stores, head shops, gas stations, etc. However, the DEA scheduled some of the most widely used chemicals beginning March 1, 2011, making their possession and sale no longer legal; subsequent laws have expanded the list of banned chemicals, but producers keep tweaking the chemical formula to avoid legal control. These drugs can be dangerous both because the active ingredients keep changing and because those ingredients have never undergone testing to determine their effects on humans.

Trends in Use

MTF first addressed the use of synthetic marijuana in its 2011 survey by asking 12th graders about their use in the prior 12 months (which would have covered a considerable period of time prior to the drugs being scheduled). Annual prevalence was found to be 11.4%, making synthetic marijuana the second most widely used class of illicit drug after marijuana itself among 12th graders at that time. Despite the DEA's intervention, use among 12th graders remained unchanged in 2012 at 11.3%, which suggests either that compliance with the new scheduling had been limited or that producers of these products succeeded in continuing to change their chemical formulas to avoid using the ingredients that had been scheduled. In 2012, for the first time, 8th and 10th graders were asked about their use of synthetic marijuana; their annual prevalence rates were 4.4% and 8.8%, respectively. Use in all 3 grades dropped in 2013, and the decline was sharp and significant among 12th graders, while the declines were significant for both 10th and 12th graders in 2014 and continued through 2016, with significant declines in both 10th and 12th grades. Annual prevalence in 2016 was down to 2.7%, 3.3%, and 3.5% for the three grades, reflecting a dramatic drop in use.

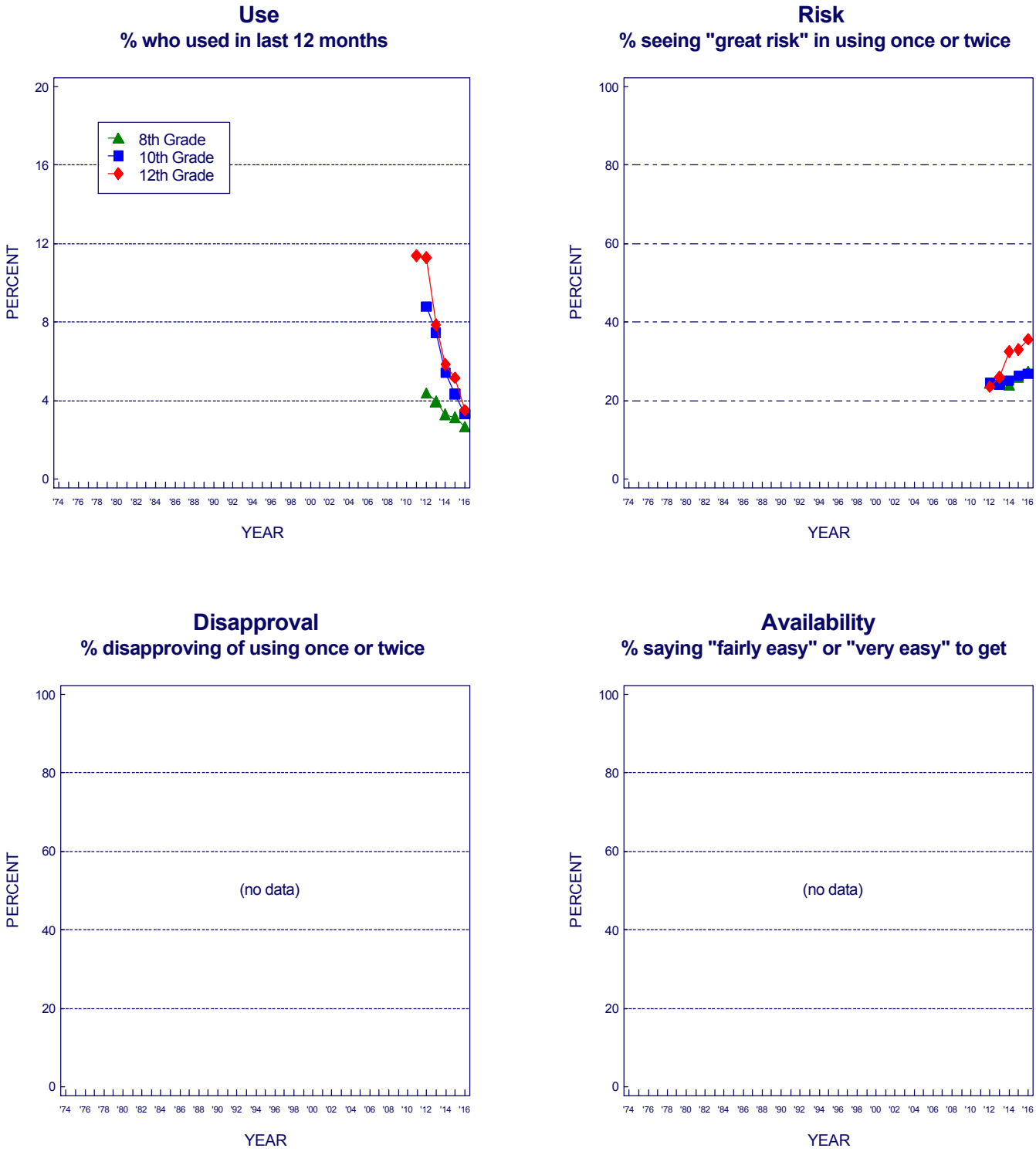
Perceived Risk

All three grades were asked whether they associated great risk with trying synthetic marijuana once or twice. As can be seen on the facing page, the level of perceived risk for experimental use was quite low in 2012 (between 24% and 25%) but has risen some, particularly among 12th graders, to 36% in 2016. (Likely the pecent would be higher if those answering "Can't say, Drug unfamiliar" were excluded.) The availability of these drugs over the counter probably has had the effect of communicating to teens that they must be safe, though they are not.

Disapproval and Availability have not been measured for this class of drugs.

Synthetic Marijuana: Trends in Annual Use and Risk

Grades 8, 10, 12



Source. The Monitoring the Future study, the University of Michigan.

Inhalants

Inhalants are any gases or fumes that can be inhaled for the purpose of getting high. These include many household products—the sale and possession of which is legal—including glue, nail polish remover, gasoline, solvents, butane, and propellants used in certain commercial products such as whipped cream dispensers. Unlike nearly all other classes of drugs, their use is most common among younger adolescents and tends to decline as youth grow older. The use of inhalants at an early age may reflect the fact that many inhalants are cheap, readily available (often in the home), and legal to buy and possess. The decline in use with age likely reflects their coming to be seen as "kids' drugs," in addition to the fact that a number of other drugs become available to older adolescents, who are also more able to afford them.

Trends in Use

Inhalant use (excluding the use of nitrite inhalants) by 12th graders rose gradually from 1976 to 1987, which was somewhat unusual because most other forms of illicit drug use were in decline during the 1980s. Use of inhalants rose among 8th and 10th graders from 1991, when those grades were first included in the study, through 1995; it rose among 12th graders from 1992 to 1995. All grades then exhibited a fairly steady and substantial decline in use through 2001 or 2002. After 2001 the grades diverged somewhat in their trends: 8th graders showed a significant increase in use for two years, followed by a decline from 2004 to 2013, and a leveling in 2014, before resuming the decline in 2015 and 2016; 10th graders showed an increase after 2003 but a considerable decline since 2007; and 12th graders showed a brief increase from 2003 to 2005 but also a considerable decline since then. For the three grades combined, annual use declined significantly in both 2012 and 2013, held steady in 2014 and then declined further in 2015 and 2016.

Perceived Risk

Only 8th and 10th graders have been asked questions about the degree of risk they associate with inhalant use. Relatively low proportions think that there is a "great risk" in using an inhalant once or twice. However, significant increases in this belief were observed between 1995 and 1996 in both 8th and 10th grades, probably due to an anti-inhalant advertising initiative launched by The Partnership for a Drug-Free America. That increase in perceived risk marked the beginning of a long and important decline in inhalant use, when no other drugs showed a turnaround in use. However, the degree of risk associated with inhalant use declined steadily between 2001 and 2008 among both 8th and 10th graders, perhaps explaining the increase in use in 2003 among 8th graders and in 2004 in the upper grades. The hazards of inhalant use were communicated during the mid-1990s, but generational forgetting of those hazards has likely taken place as replacement cohorts who were too young to get that earlier message now comprise the nation's adolescents. The decline in perceived risk is worrisome, though perceived risk has not changed much since about 2008. In this case, the decline in perceived risk (between 2001 and 2008) did not translate into a large surge in use, but it may leave future class cohorts at risk for a resurgence of inhalant use.

Disapproval

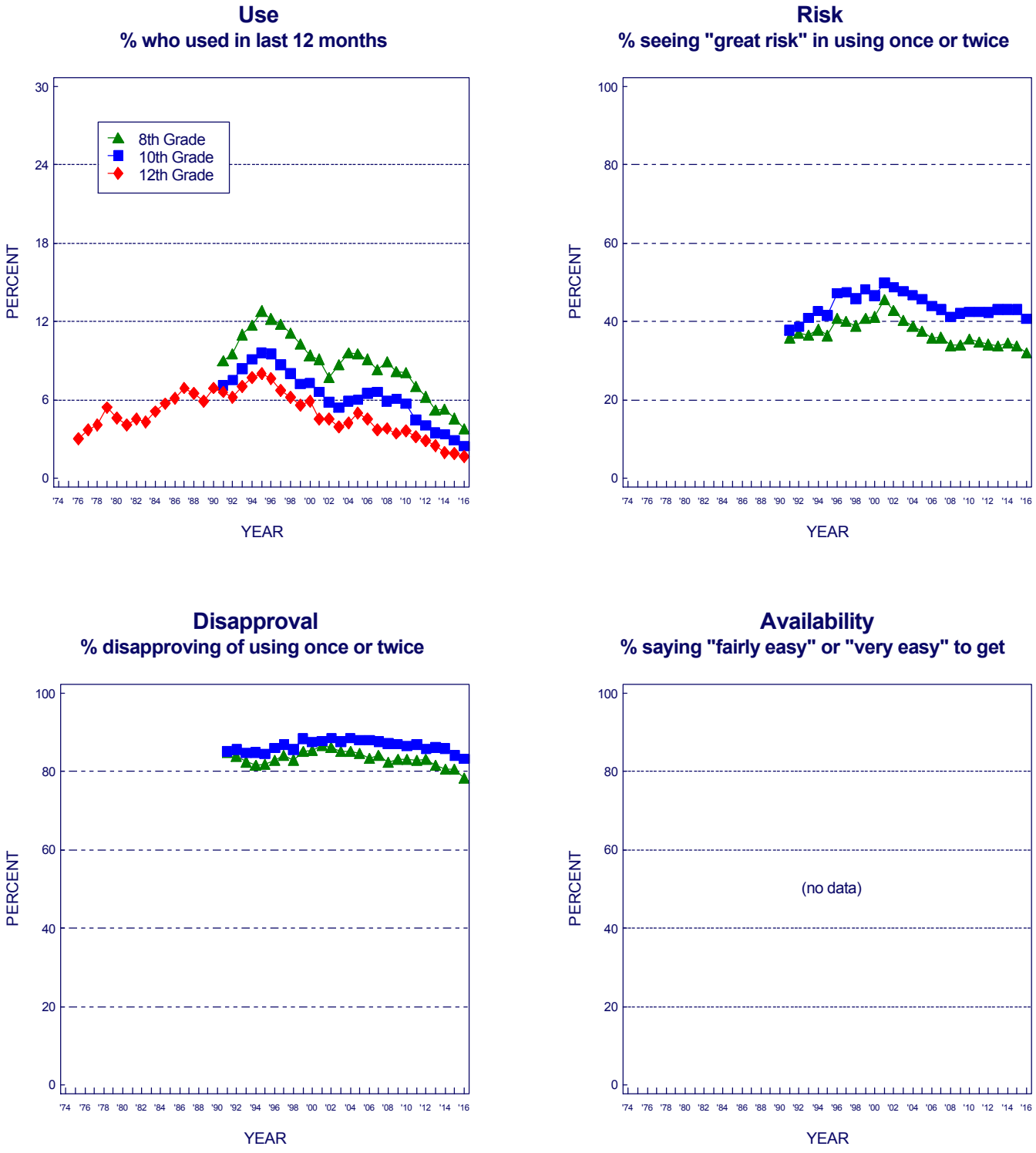
Over 80% of 8th and 10th grade students say that they would disapprove of even trying an inhalant. (The question was not asked of 12th graders.) There was a very gradual upward drift in this attitude among 8th and 10th graders from 1995 through about 2001, with a gradual falloff since then in both grades. For 8th graders there has been some decline in disapproval of trying inhalants since 2012. Since 2013 it has dropped among 10th graders as well, including significant declines in 2015 and a continuing decline in 2016.

Availability

Respondents have not been asked about the availability of inhalants, because we assume that these products are universally available to young people in these age ranges.

Inhalants: Trends in Annual Use, Risk, and Disapproval

Grades 8, 10, 12



Source. The Monitoring the Future study, the University of Michigan.

LSD

For some years, LSD was the most widely used drug within the larger class of hallucinogens. This was no longer true for some following years, due to sharp decreases in its use combined with an increasing use of psilocybin. (Statistics on overall hallucinogen use and on use of hallucinogens other than LSD are shown in the tables at the end of this report.) Now overall hallucinogen use and use of hallucinogens other than LSD are about equivalent due to a drop in the use of the other hallucinogens.

Trends in Use

Annual prevalence of LSD use among 12th graders has been below 10% since MTF began. Use declined some for the first 10 years among 12th graders, likely continuing a decline that had begun before 1975. Use was fairly level in the latter half of the 1980s but, as was true for a number of other drugs, rose in all three grades between 1991 and 1996. Between 1996 and 2006 or so, use declined in all three grades, with particularly sharp declines between 2001 and 2003. Since then use has remained at very low levels although there has been a slight increase in the upper grades since 2013.

Perceived Risk

We think it likely that perceived risk for LSD use increased during the early 1970s, before MTF began, as concerns grew about possible neurological and genetic effects (most of which were never scientifically confirmed) as well as "bad trips" and "flashbacks." However, there was some decline in perceived risk in the late 1970s, after which it remained fairly level among 12th graders through most of the 1980s. A substantial decline occurred in all grades in the early 1990s as use rose. Since about 2000, perceived risk declined steadily and substantially among 8th graders until 2007, when it leveled; it declined considerably among 10th graders before leveling around 2002, dropping through 2007, and then leveling after that. Among 12th graders, perceived risk has held fairly steady after 2002, at least until 2014 when some decline began. The decline in the lower grades suggests that younger teens may be less knowledgeable about this drug's effects than their predecessors—through what we have called "generational forgetting"—making them vulnerable to a resurgence in use. (The percentages who respond "can't say, drug unfamiliar" to questions about LSD have risen in recent years, consistent with the notion of "generational forgetting.")

The decline of LSD use in recent years, despite a fall in perceived risk, suggests that some factors other than a change in underlying attitudes and beliefs were contributing to the downturn—prior to 2001 some displacement by ecstasy may have been a factor, while more recently a decline in availability (discussed below) likely is a factor.

Disapproval

Disapproval of LSD use was quite high among 12th graders through most of the 1980s but began to decline after 1991 along with perceived risk. All three grades exhibited a decline in disapproval through 1996, with disapproval of experimentation dropping 11 percentage points between 1991 and 1996 among 12th graders. After 1996 a slight increase in disapproval emerged among 12th graders, accompanied by a leveling among 10th graders and some further decline among 8th graders. Since 2001, disapproval of LSD use has diverged among the three grades, declining considerably among 8th graders, declining less among 10th graders, and increasing significantly among 12th graders. Note, however, that the percentages of 8th and 10th graders who respond with "can't say, drug unfamiliar" increased through 2008; thus the base for disapproval has shrunk, suggesting that the real decline of disapproval among the younger students is less than it appears here. There has been rather little change in disapproval over the past eight years (or more years in the case of 12th graders.)

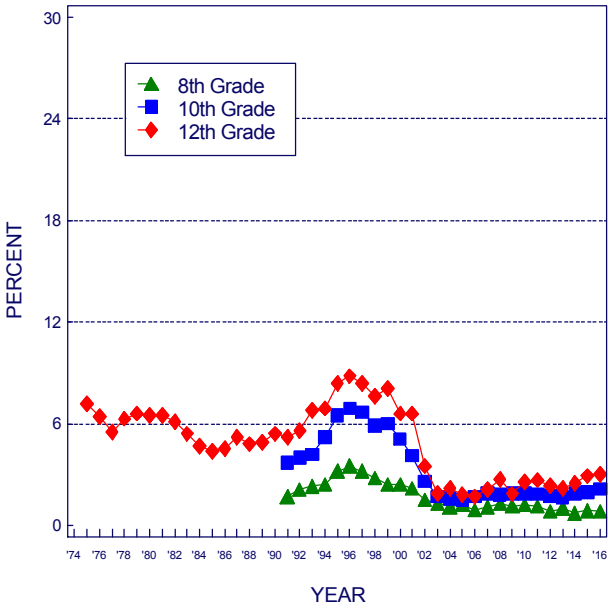
Availability

Reported availability of LSD by 12th graders fell considerably from 1975 to 1979, declined a bit further until 1986, and then began a substantial rise, reaching a peak in 1995. LSD availability also rose somewhat among 8th and 10th graders in the early 1990s, reaching a peak in 1995 or 1996. Since those peak years, there has been considerable falloff in availability in all three grades, quite possibly in part because fewer students have LSD-using friends from whom they could gain access. There was also very likely a decrease in supply due to the closing of a major LSD-producing lab by the Drug Enforcement Administration in 2000. It is clear that attitudinal changes cannot explain the recent declines in use.

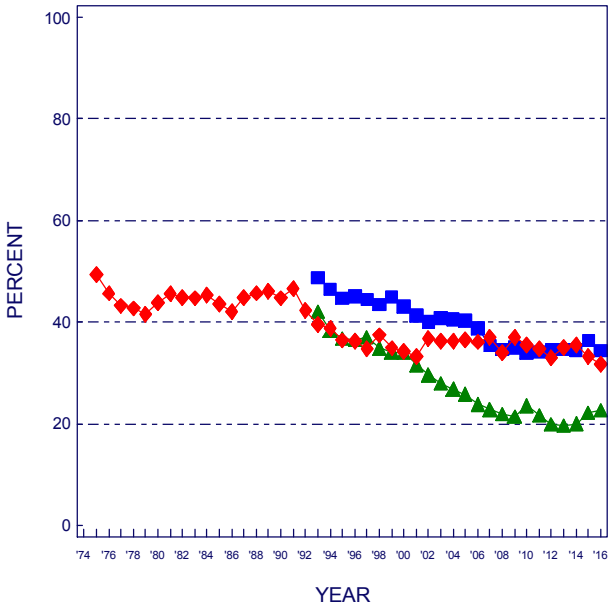
LSD: Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12

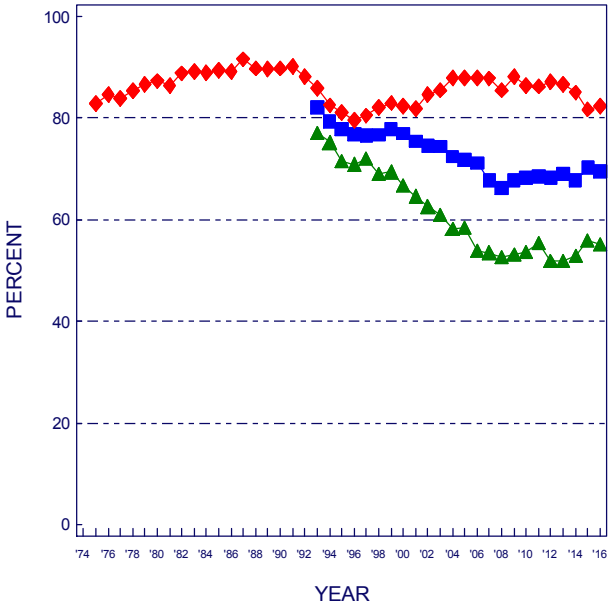
Use
% who used in last 12 months



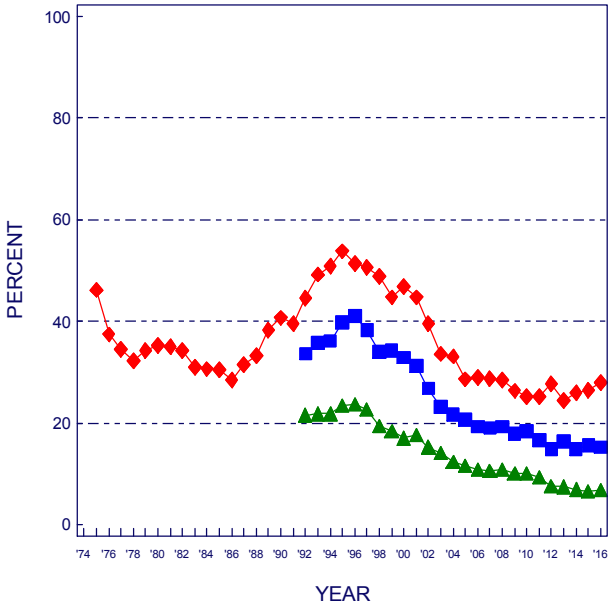
Risk
% seeing "great risk" in using once or twice



Disapproval
% disapproving of using once or twice



Availability
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.

Cocaine

Cocaine was used almost exclusively in powder form for some years, though "freebasing" emerged for a while. The early 1980s brought the advent of crack cocaine. Our original questions did not distinguish among different forms of cocaine or modes of administration. Since 1987, though, we have asked separate questions about the use of crack and "cocaine other than crack," which has consisted almost entirely of powder cocaine use. Data on cocaine use in general (i. e., all forms of cocaine) are presented in the figures in this section, and results for crack alone are presented in the next section.

Trends in Use

There have been some important changes in the levels of overall cocaine use over the life of MTF. Use among 12th graders originally burgeoned in the late 1970s and remained fairly stable through the first half of the 1980s before starting a precipitous decline after 1986. Annual prevalence among 12th graders dropped by about three quarters between 1986 and 1992. Between 1992 and 1999, use reversed course again during the relapse phase of the overall drug epidemic and doubled before declining by 2000. Use also rose among 8th and 10th graders after 1992 before reaching peak levels in 1998 and 1999. Over the last sixteen years, use has declined in all three grades; annual 12th-grade use stands at a historic low of just 2.3% in 2016, with use by 8th and 10th graders still lower, at 0.8% and 1.3%.

Perceived Risk

Questions about the dangers of cocaine in general (without specifying any particular form of cocaine) have been asked only of 12th graders. The results tell a fascinating story. They show that perceived risk for experimental use fell in the latter half of the 1970s (when use was rising), stayed level in the first half of the 1980s (when use was level), and then jumped very sharply in a single year (by 14 percentage points between 1986 and 1987), just when the substantial decline in use began. The year 1986 was marked by a national media frenzy over crack cocaine and also by the widely publicized cocaine-related death of Len Bias, a National Basketball Association first-round draft pick. Bias' death was originally reported as resulting from his first experience with cocaine. Though that was later proven to be incorrect, the message had already "taken." We believe that this event helped to persuade many young people that use of cocaine at any level is dangerous, no matter how healthy the individual.[11] Perceived risk continued to rise through 1991 as the fall in use continued. Perceived risk declined modestly from 1991 to 2000, and use rose from 1992–2000. Perceived risk has leveled in recent years at far higher levels than existed prior to 1987, and there was a gradual upward drift for about six years in grades 8 and 10, before leveling. For the 12th graders perceived risk also increased for about six years before leveling after 2013. There is as yet little evidence of generational forgetting of cocaine's risks. For 12th graders, survey questions on both risk and disapproval referred to cocaine in general, until 1986. After that they referred to cocaine powder and crack separately, as did the questions asked of 8th and 10th graders. The question change seemed to matter rather little in the results.

Disapproval

Disapproval of cocaine use by 12th graders followed a cross-time pattern similar to that for perceived risk, although its seven-percentage-point jump in 1987 was not quite as pronounced. Some decline from 1991 to 1997 was followed by a period of stability. Subsequent years showed a gradual increase in disapproval in all three grades. This upward drift ended in recent years, but disapproval of even trying cocaine remains very high and is above 85% in all grades in 2016.

Availability

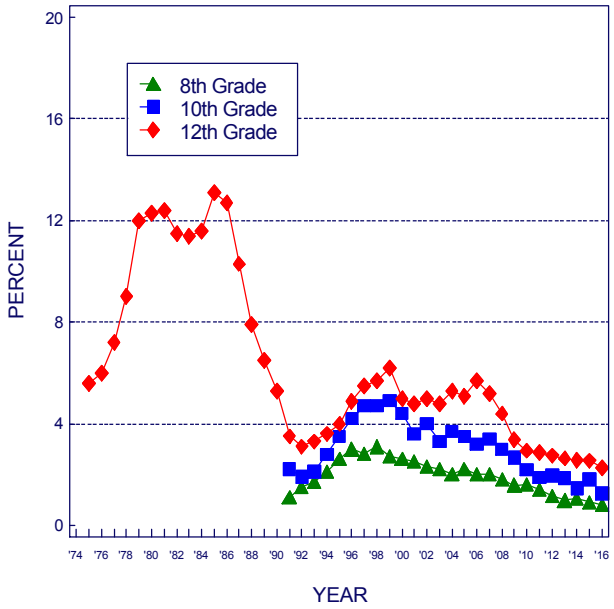
The proportion of 12th graders saying that it would be "fairly easy" or "very easy" for them to get cocaine if they wanted some was 33% in 1977, rose to 48% by 1980 as use rose, and held fairly level through 1982; it increased steadily to 59% by 1989 (in a period of rapidly declining use). Perceived availability then fell back to about 47% by 1994. Since around 1997, perceived availability of cocaine has fallen considerably in all three grades. Among 12th graders it stood at 29% in 2016—about half of its peak level in 1989. Note that the pattern of change does not map well onto the pattern of actual use, suggesting that changes in overall availability have not been a major determinant of use—particularly during the sharp decline in use in the late 1980s.

[11] Among 12th graders trends in perceived risk in Table 8 show a particularly sharp rise from 34% in 1986 to 48% in 1987 for trying cocaine once or twice.

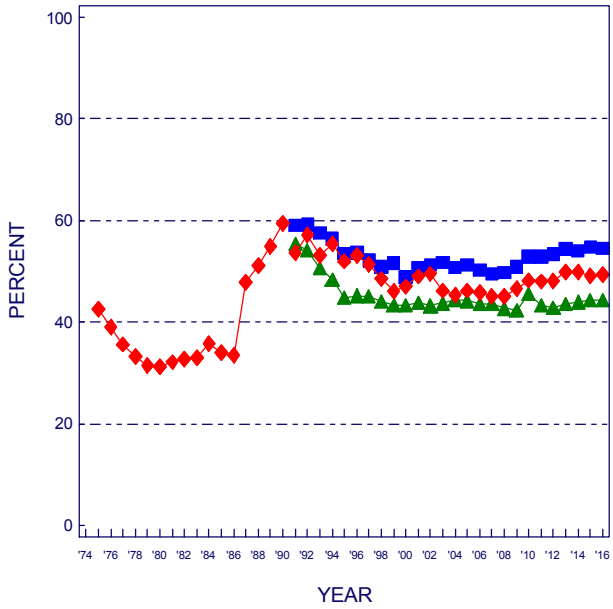
Cocaine (including Crack): Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12

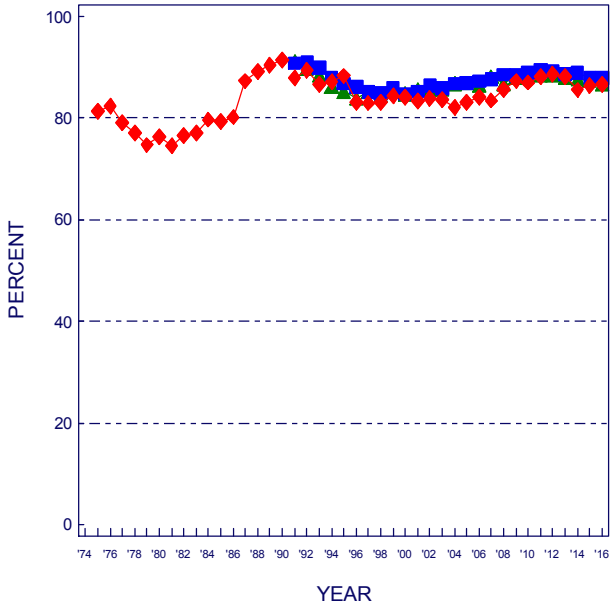
Use
% who used in last 12 months



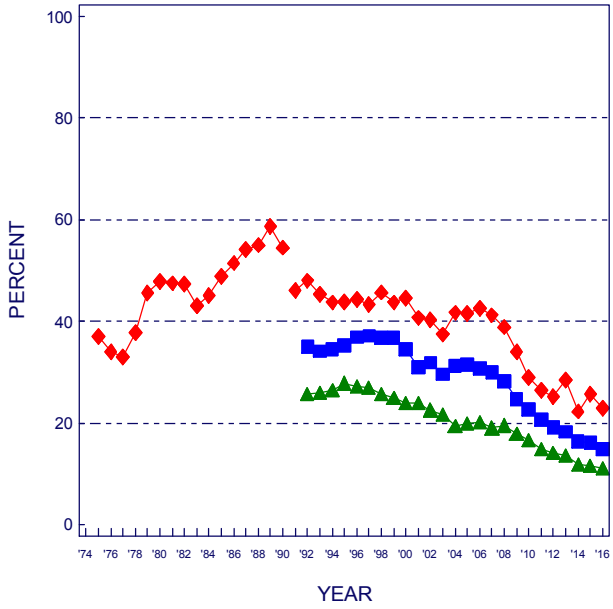
Risk*
% seeing "great risk" in using once or twice



Disapproval*
% disapproving of using once or twice



Availability*
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.
*Prior to 1991, data reported here is based on questions on use of cocaine in general. Starting in 1991, data based on questions on use of cocaine powder specifically.

Crack

Several indirect indicators suggest that crack use grew rapidly in the period 1983–1986, beginning before we had direct measures of its use. In 1986 a single usage question was included in one of the five 12th-grade questionnaire forms, asking those who indicated any cocaine use in the prior 12 months if they had used crack. The results from that question represent the first data point in the first panel on the facing page. After that, three questions about crack use covering the usual three prevalence periods were introduced into several questionnaire forms.

Trends in Use

Clearly crack use rose rapidly in the early 1980s, judging by the 4% annual prevalence reached in 1986; but after 1986 there was a precipitous drop in crack use among 12th graders; the drop continued through 1991. After 1991 for 8th and 10th graders (when data were first available) and after 1993 for 12th graders, all three grades showed a slow, steady increase in use through 1998 during the relapse phase of the overall drug epidemic. Since 1999, annual prevalence dropped by about 75% in 8th grade, 82% in 10th grade, and 70% in 12th grade. Today use of crack is at historic lows in all three grades. As with many drugs, the decline at 12th grade lagged behind those in the lower grades due to a cohort effect.

Perceived Risk

By the time we added questions about the perceived risk of using crack in 1987, crack was already seen by 12th graders as one of the most dangerous illicit drugs: 57% saw a great risk in even trying it. This compared to 54% for heroin, for example. Perceived risk for crack rose still higher through 1990, reaching 64% of 12th graders who said they thought there was a great risk in taking crack once or twice. (Use was dropping during that interval.) After 1990 some falloff in perceived risk began, well before crack use began to increase in 1994, making perceived risk again a leading indicator. Between 1991 and 1998 there was a considerable falloff in this belief in grades 8 and 10, as use rose steadily. Perceived risk leveled in 2000 in grades 8 and 12 and a year later in grade 10. We think that the declines in perceived risk for crack and cocaine during the 1990s may well reflect an example of generational forgetting wherein the class cohorts that were in adolescence when the adverse consequences were most obvious (i.e., in the mid-1980s) were replaced by cohorts who were less knowledgeable about the dangers. By 2016 perceived risk for crack had leveled in all three grades.

Disapproval

Disapproval of crack use was not assessed until 1990, when it was at a very high level, with 92% of 12th graders saying that they disapproved of even trying it. Disapproval of crack use declined slightly but steadily in all three grades from 1991 through about 1997. After 1997, disapproval in all three grades rose back to high levels by 2012 before beginning a slight decline.

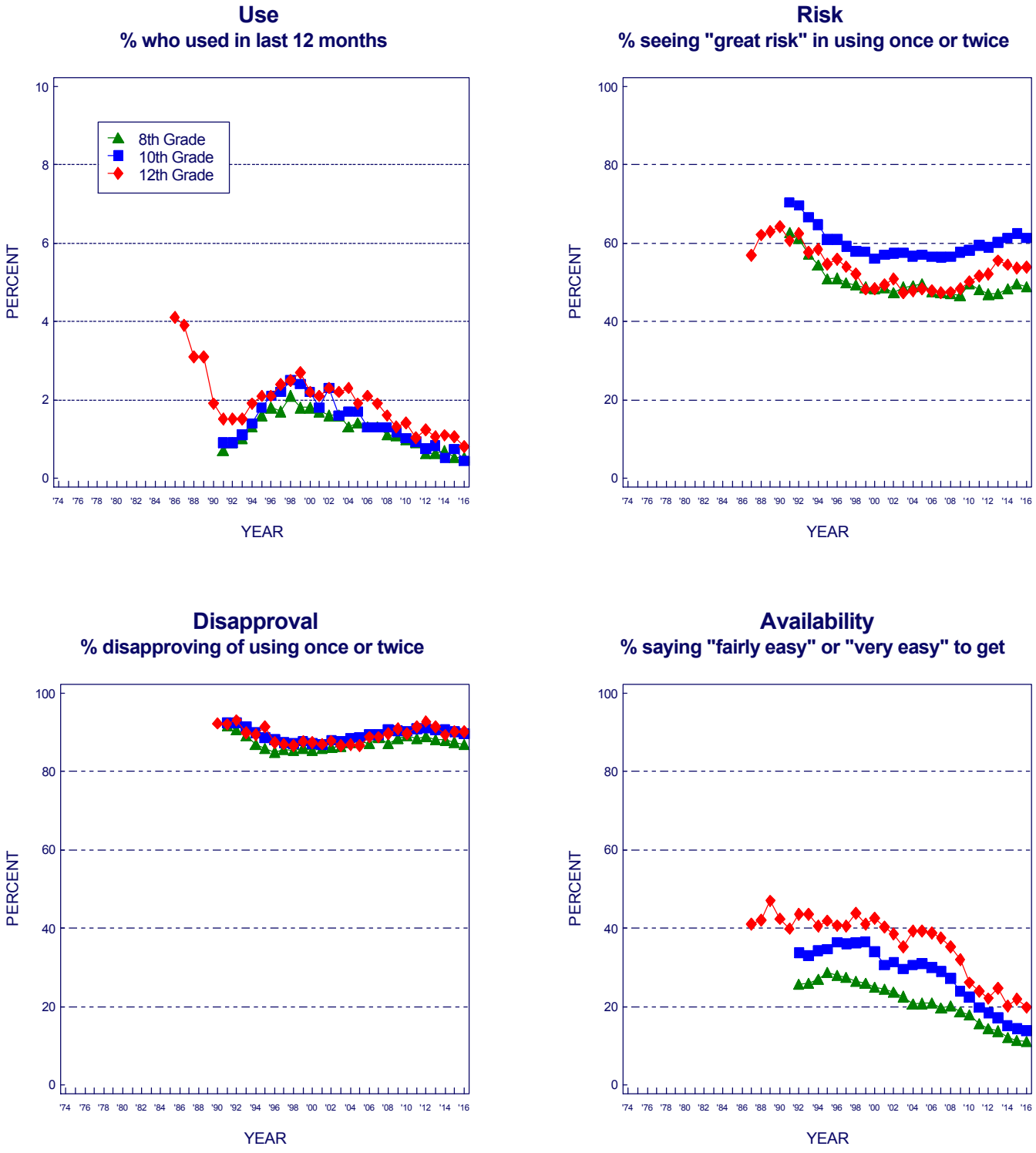
Availability

Crack availability did not change dramatically in the early years for which data are available. It began a sustained decline after 1995 among 8th graders, after 1999 among 10th graders, and after 2000 among 12th graders. Since 2000, availability has declined considerably, particularly in the upper grades.

NOTE: The distinction between crack cocaine and other forms of cocaine (mostly powder) was made several years after the study's inception. The figures on the facing page begin their trend lines when these distinctions were introduced. Figures are not presented here for the "other forms of cocaine" measures, simply because the trend curves look extremely similar to those for crack. (All statistics are contained in the tables presented later.) Although the trends are very similar, the absolute levels of use, risk, etc., are somewhat different. Usage levels tend to be higher for cocaine powder compared to crack, and the levels of perceived risk a bit lower, while disapproval has been close for the two different forms of cocaine and relative availability has varied (Tables 15 through 17).

Crack: Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12



Source. The Monitoring the Future study, the University of Michigan.

Amphetamines and Other Stimulant Drugs

Amphetamines, a class of psychotherapeutic stimulants, had a relatively high prevalence of use in the youth population for many years. The behavior reported here excludes any use under medical supervision. Amphetamines are controlled substances—they are not legally bought or sold without a doctor's prescription—but some are diverted from legitimate channels, and some are manufactured and/or imported illegally. There are other controlled stimulants that are also included, like Ritalin which is used to treat ADHD, as is Adderall, the most prevalent of the amphetamines.

Trends in Use

The use of these stimulants rose in the last half of the 1970s, reaching a peak in annual prevalence of 26% in 1981 (likely exaggerated due to commonly used "look-alikes")—two years after marijuana use peaked. From 1981 to 1992, 12th graders reported a steady and very substantial decline in their use, reaching 7%.

As with many other illicit drugs, these stimulants made a comeback in the 1990s. Use peaked in the lower two grades by 1996. Since then, use declined steadily in 8th grade and sporadically in 10th grade. Only after 2002 did it begin to decline in 12th grade. The decline paused in 2008 for 8th graders and 2009/2010 for 12th graders, and then resumed. The 12th-grade decline began in 2003 but reversed from 2009 to 2013. In 2013 the amphetamines/stimulants prevalence question text was changed in half of the questionnaire forms. The 2013 report used data from the changed forms only, to be comparable to the 2014 measure. In 2014 the remaining forms were changed; the 2014 and subsequent data presented here are for all the forms. From 2009 to 2013 use rose in the upper grades, likely due to use intended to assist with academic performance. Since 2013 there has been a downward drift in annual prevalence but a steeper decline in 30-day prevalence (significant in the upper grades).

See Table 6 for the trends in annual use of two specific amphetamines—Ritalin and Adderall. Since it was first measured in 2001, Ritalin use has declined by 70% to 80% in all three grades. Adderall use declined in the lower grades since it was first measured in 2009; but annual prevalence increased significantly in 12th grade between 2009 (5.4%) and 2013 (7.4%) where it remained in 2015 before falling to 6.2% in 2016.

Perceived Risk

Only 12th graders are asked about the amount of risk they associate with amphetamine/stimulant use. For a few years, changes in perceived risk were not correlated with changes in usage levels (at the aggregate level). Specifically, in the interval 1981–1986, risk was quite stable even though use fell considerably, likely as a result of some displacement by increasing cocaine use. There was, however, a decrease in risk during the period 1975–1981 (when use was rising), some increase in perceived risk in 1986–1991 (when use was falling), and some decline in perceived risk from 1991 to 1995 (in advance of use rising again). Perceived risk has generally been rising in recent years, very likely contributing to the decline in use that occurred among 12th graders after 2002; it appears to have leveled after 2007. In 2011 the examples of specific amphetamines provided in the text of the questions on perceived risk, disapproval, and availability were updated with the inclusion of Adderall and Ritalin. This led to some discontinuities in the trend lines in 2011. (Levels of perceived risk and disapproval lowered as a result.) Based on the revised question, some decline has occurred since 2013.

Disapproval

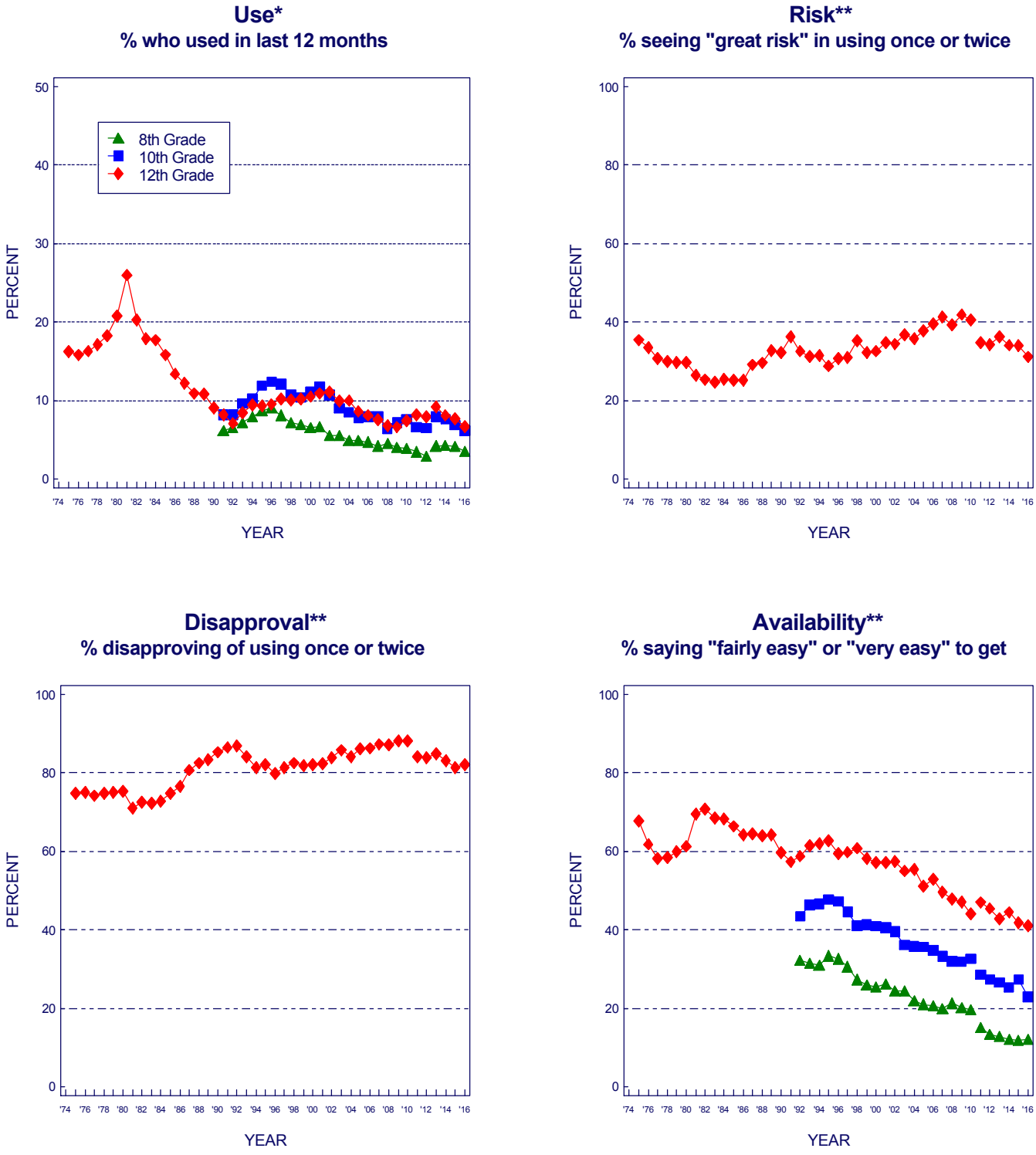
Disapproval of amphetamine/stimulant use is asked in 12th grade only. Relatively high proportions of 12th graders have disapproved of even trying amphetamines/stimulants throughout the life of the study. Disapproval did not change in the late 1970s despite an increase in use. From 1981 to 1992, disapproval rose gradually and substantially from 71% to 87% as perceived risk rose and use declined. In the mid-1990s disapproval declined along with perceived risk, but it increased fairly steadily from 1996 through 2009 before leveling. There has been a slight falloff since 2013.

Availability

In 1975, amphetamines/stimulants had a high level of reported availability. The level fell by about 10 percentage points by 1977, drifted up a bit through 1980, jumped sharply in 1981, and then began a long, gradual decline through 1991. There was a modest increase in availability at all three grade levels in the early 1990s as use rose, followed by a long-term decline which continued through 2016.

Amphetamines: Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12



Source. The Monitoring the Future study, the University of Michigan.

*In 2013 the question text was changed on two of the questionnaire forms for 8th and 10th graders and four of the questionnaire forms for 12th graders, and changed on the remaining forms in 2014. Beginning in 2013, data presented here include only the changed forms.

**In 2011 the list of examples was changed from uppers, pep pills, bennies, speed to uppers, speed, Adderall, Ritalin, etc. These changes likely explain the discontinuity in the 2011 results.

Methamphetamine and Crystal Methamphetamine (Ice)

One subclass of amphetamines is called methamphetamine ("speed"). This subclass has been around for a long time and gave rise to the phrase "speed kills" in the 1960s. Probably because of the reputation it got at that time as a particularly dangerous drug, it was not popular for some years, so we did not include a full set of questions about its use in MTF's early questionnaires. One form of methamphetamine, crystal methamphetamine or "ice," grew in popularity in the 1980s. It comes in crystallized form, as the name implies, and the chunks can be heated and the fumes inhaled, much like crack cocaine.

Trends in Use

For most of the life of the study, the only question about ***methamphetamine*** use has been contained in one of the six 12th-grade questionnaire forms. Respondents who indicated using any type of amphetamines in the prior 12 months were asked in a sequel question to indicate on a pre-specified list the types they had used during that period. Methamphetamine was one type on the list, and data exist on its use since 1976. (The rates are not graphed here until 1990.) In 1976, annual prevalence using this measure was 1.9%; it then roughly doubled to 3.7% by 1981 (the peak year), before declining for over a decade all the way down to 0.4% by 1992. Use then rose again in the mid-1990s, as did use of a number of drugs, reaching 1.3% by 1998. In other words, it has followed a cross-time trajectory fairly similar to that for amphetamines as a whole. No questions have yet been added to the study on perceived risk, disapproval, or availability with regard to overall methamphetamine use.

In 1990, in the 12th-grade questionnaires only, we introduced our usual set of three questions for ***crystal methamphetamine***, measuring lifetime, annual, and 30-day use. Among 12th graders in 1990, 1.3% indicated any use in the prior year; use climbed to 3.0% by 1998, and has generally been declining since then, reaching an all-time low of 0.5% in 2015 and then 0.8% in 2016. This variable is charted on the first panel of the facing page.

Responding to the growing concern about methamphetamine use in general—not just crystal methamphetamine use—we added a full set of three questions about the use of any methamphetamine to the 1999 questionnaires for all three grade levels. These questions yield a somewhat higher annual prevalence for 12th graders: 4.3% in 2000, compared to the sum of the methamphetamine and crystal methamphetamine answers in the other, branching question format, which totaled 2.8%. It would appear, then, that the long-term method we had been using for tracking methamphetamine use probably yielded an understatement of the absolute prevalence level, perhaps because some proportion of methamphetamine users did not correctly categorize themselves initially as amphetamine users (even though methamphetamine was given as one of the examples of amphetamines). We think it likely that the shape of the trend curve was not distorted, however.

The newer questions for ***methamphetamine*** (not graphed here) show annual prevalence rates in 2016 of 0.4% for both 8th and 10th graders, and 0.6% for 12th graders. In every grade, 2016 prevalence is at the lowest level ever recorded by the survey. The 2016 levels for all three grades are down considerably from the first measurement taken in 1999, when they were 3.2%, 4.6%, and 4.7% (see Table 6). So, despite growing public concern about the methamphetamine problem in the United States, use actually has shown a fairly steady and substantial decline since 1999, at least among secondary school students. (A similar decline in methamphetamine use did not begin to appear among college students and young adults generally until after 2004, likely reflecting a cohort effect. See *Volume II* in this series for data on adults through age 55.)

Other Measures

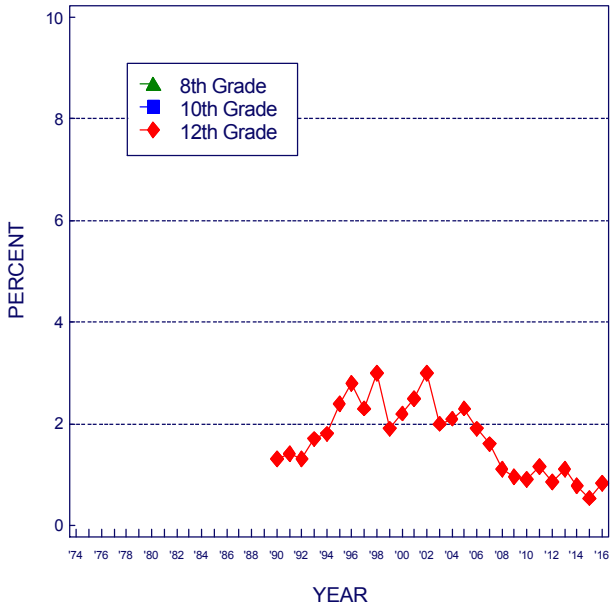
Data on perceived risk and availability for crystal methamphetamine, specifically, may be found on the facing page.

Clearly, the perceived risk of crystal methamphetamine use has risen considerably since 2003, very likely explaining much of the decline in use since then. Perceived risk then leveled after 2013. Perceived availability generally has been falling in all three grades since 2006, perhaps in part because there are many fewer crystal methamphetamine users from whom to gain access.

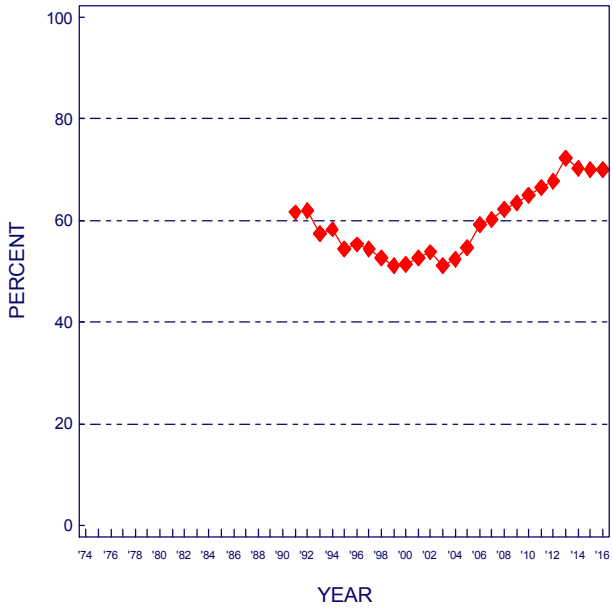
Crystal Methamphetamine (Ice): Trends in Annual Use, Risk, and Availability

Grades 8, 10, 12

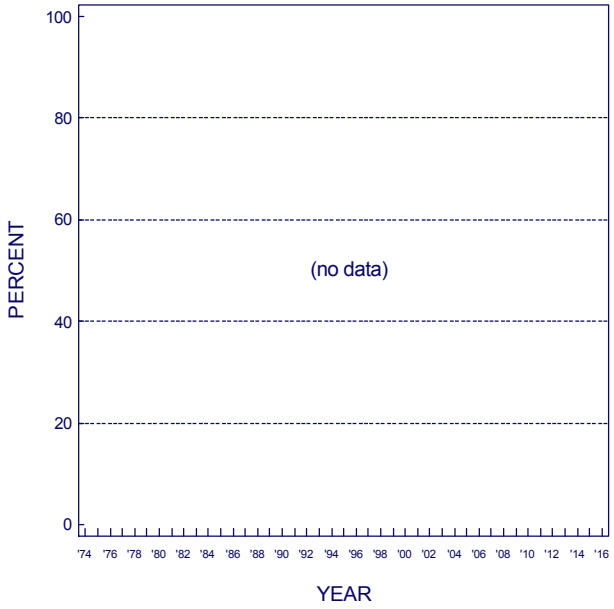
Use
% who used in last 12 months



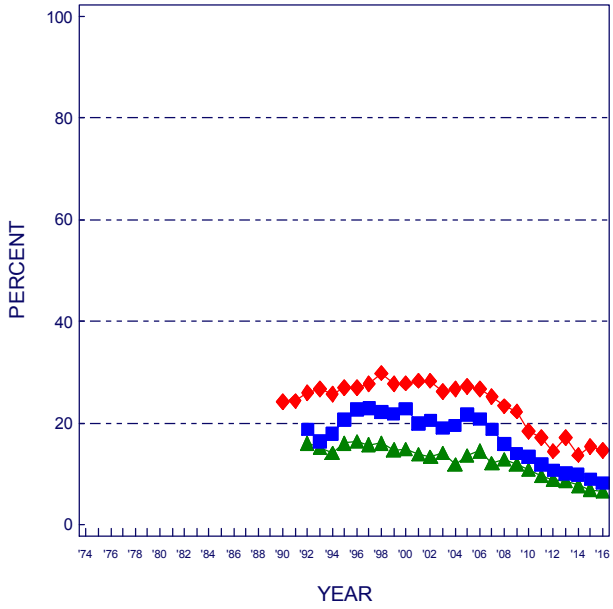
Risk
% seeing "great risk" in using once or twice



Disapproval
% disapproving of using once or twice



Availability
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.

Heroin

For many decades, heroin—a derivative of opium—was administered primarily by injection into a vein. However, in the 1990s the purity of available heroin reached very high levels, making other modes of administration (e.g., snorting, smoking) practical alternatives. Thus, in 1995 we introduced questions that asked separately about using heroin with and without a needle to determine whether non-injection use explained the upsurge in heroin use we observed. The usage statistics presented on the facing page are based on heroin use by any method, but data on the two specific types of administration are provided in the tables at the end of this report.

Trends in Use

The annual prevalence of heroin use among 12th graders fell by half between 1975 and 1979, from 1.0% to 0.5%. The rate then held amazingly steady until 1994. Use rose in the mid- and late-1990s, along with the use of most drugs; it reached peak levels in 1996 among 8th graders (1.6%), in 1997 among 10th graders (1.4%), and in 2000 among 12th graders (1.5%), suggesting a cohort effect. Following those peak levels, use declined, with annual prevalence in all three grades fluctuating between 0.7% and 0.9% from 2005 through 2010. Since then, annual prevalence in the three grades combined has declined, from 0.8% to 0.3% in 2016. In 2016, use reached its lowest levels since 1991 in all three grades (0.3% in each).

Because the questions about use with and without a needle were not introduced until the 1995 survey, they did not encompass much of the period of increasing heroin use. Responses to the new questions showed that, by then, about equal proportions of all 8th-grade users were taking heroin by each method of ingestion and some—nearly a third of users—were using both means. At 10th grade, a somewhat higher proportion of all users took heroin without a needle, and at 12th grade, the proportion was higher still. Much of the increase in overall heroin use after 1995 occurred in the proportions using it without injecting, which we strongly suspect was true in the immediately preceding period of increase as well. Likewise, much of the decrease since the recent peak levels has been due to decreasing use of heroin without a needle. In 2012, there were significant decreases in use of heroin without a needle for 8th and 12th graders, and very slight declines since then in 8th and 10th grades.

Use with a needle has fallen considerably in all three grades since the mid-1990s; annual prevalence in 2016 stood at 0.2%, 0.3%, and 0.3%, respectively, including significant declines in 8th and 10th grades from the 2014 to 2015 prevalence levels, but no further change in 2016. The proportional declines were greatest in the lower grades. While a heroin epidemic continues among adults, our data—as well as those from NSDUH—suggest that use has grown primarily among young adults and not among adolescents.

Perceived Risk

Students have long seen heroin to be one of the most dangerous drugs, which helps to account for both the consistently high level of personal disapproval of use (see below) and the quite low prevalence of use. Nevertheless, perceived risk levels have changed some over the years. Between 1975 and 1986, perceived risk gradually declined, even though use dropped and then stabilized in that interval. Then there was a big spike in 1987 (when perceived risk for cocaine also jumped dramatically), where it held for four years. In 1992, perceived risk dropped to a lower plateau again, presaging an increase in use a year or two later. Perceived risk rose in the latter half of the 1990s, and use leveled off and then declined. Risk at 12th grade is still rising, but has been level for some time at 8th and 10th grades. Perceived risk of use without a needle rose in 8th and 10th grades between 1995 and 1997, foretelling an end to the increase in that form of use. Note that perceived risk has served as a leading indicator of use for this drug as well as a number of others. During the 2000s, perceived risk was relatively stable.

Disapproval

There has been little fluctuation in the very high levels of disapproval of heroin use over the years, though it did rise gradually between 2000 and 2010. The small changes that have occurred have been generally consistent with changes in perceived risk and use.

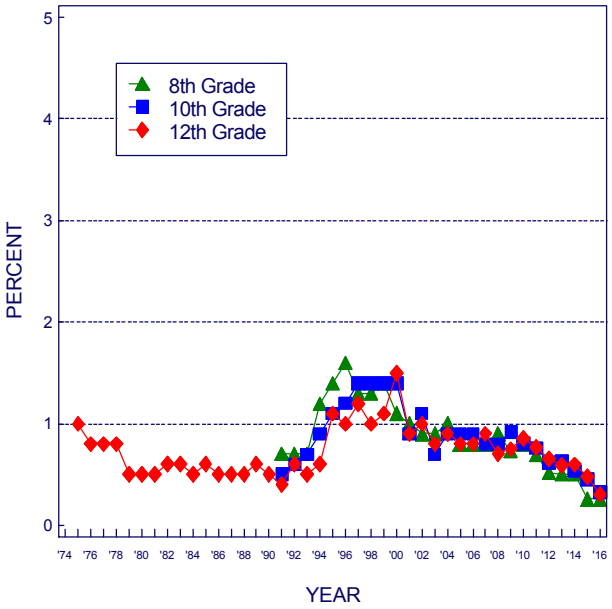
Availability

The proportion of 12th-grade students saying they could get heroin fairly easily if they wanted some remained around 20% through the mid-1980s. It then increased considerably from 1986 to 1992 before stabilizing at about 35% from 1992 through 1998. From the mid- to late-1990s through 2014, perceived availability of heroin declined gradually but substantially in all three grades before leveling in 2014 or 2015.

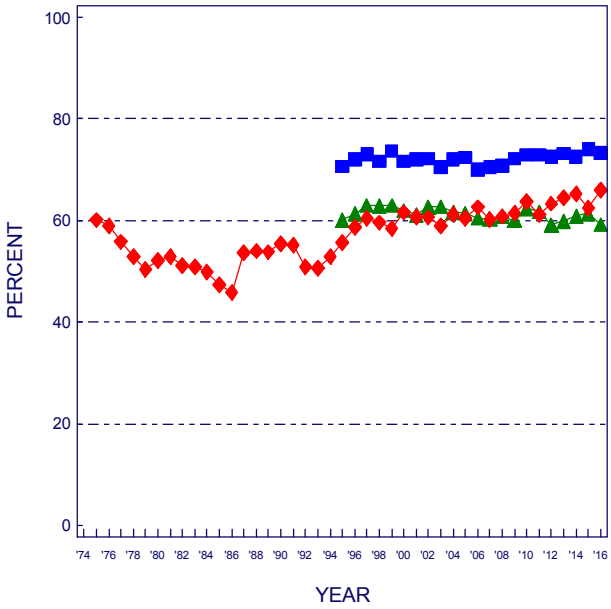
Heroin: Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12

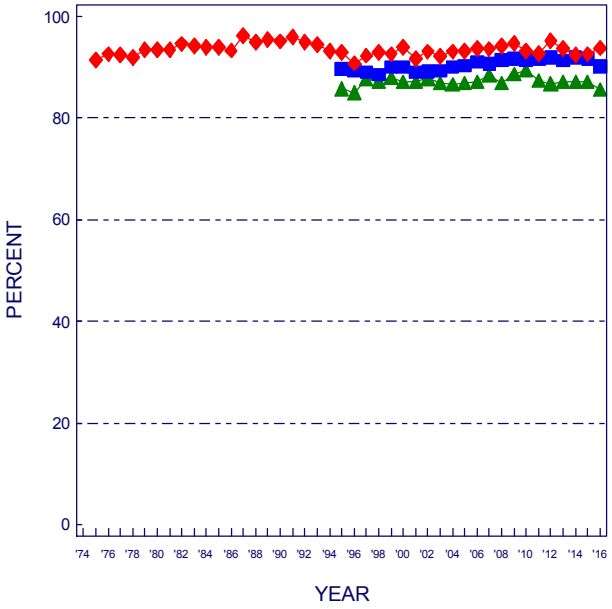
Use
% who used in last 12 months



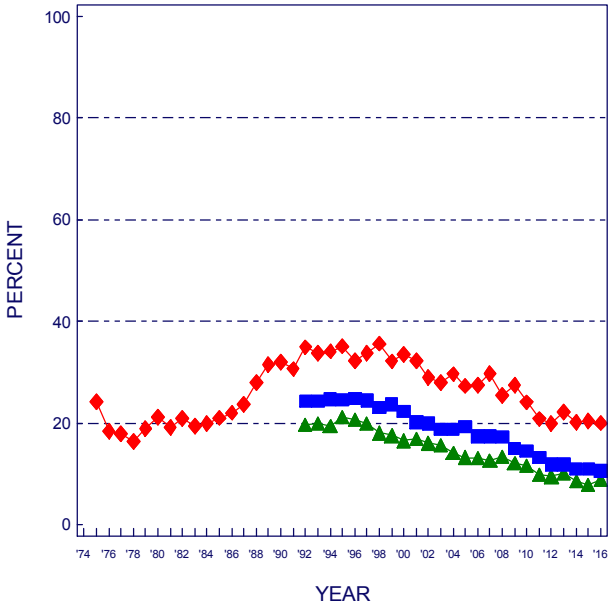
Risk*
% seeing "great risk" in using once or twice



Disapproval*
% disapproving of using once or twice



Availability
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.

*Prior to 1995, the questions asked about heroin use in general. Since 1995, the questions have asked about heroin use without a needle.

Other Narcotic Drugs, Including OxyContin and Vicodin

There are a number of narcotic drugs other than heroin—all controlled substances. Many are analgesics that can be prescribed by physicians and dentists for pain. Like heroin, many are derived from opium, but there are also a number of synthetic analogues in use today, with OxyContin and Vicodin being two of the major ones.

Throughout the life of the MTF study, we have asked about the use of any narcotic drug other than heroin without specifying which one. Examples of drugs in the class are provided in the question stem. In one of the six 12th-grade questionnaire forms, however, respondents indicating that they had used any narcotic in the past 12 months were then asked to check which of a fairly long list of such drugs they used. Table E-4 in Appendix E of *Volume I* of this annual monograph series provides trends in their annual prevalence data. In the late 1970s, opium and codeine were among the narcotics most widely used. In recent years Vicodin, codeine, Percocet, OxyContin, and hydrocodone have been the most prevalent.

Trends in Use

Use is reported for 12th graders only, because we considered the data from 8th and 10th graders to be of questionable validity. As shown in the first panel of the facing page, 12th graders' use of narcotics other than heroin generally trended down from about 1977 through 1992, dropping considerably. After 1992 use rose rather steeply as all forms of substance use were increasing, with annual prevalence nearly tripling from 3.3% in 1992 to 9.5% in 2004, before leveling through about 2009. Since then, use has been declining, particularly since 2009.

In 2002, the question was revised to add Vicodin, OxyContin, and Percocet to the examples given, which clearly had the effect of increasing reported prevalence, as may be seen in the first panel on the facing page. So the extent of the increase over the full time span likely is exaggerated, although probably not by much, because these drugs came onto the scene later, during the rise. They simply were not being fully reported until the late 1990s. Narcotics had become one of the most widely used classes of illicit drugs by 2004, when annual prevalence reached 9.5%.

Use rates for two narcotics of recent interest—OxyContin and Vicodin—are presented in the second and third panels on the facing page, in a departure from the usual arrangement. There are no data for disapproval and only limited data on perceived risk (since 2012) for the two drugs, showing low and stable risk levels.

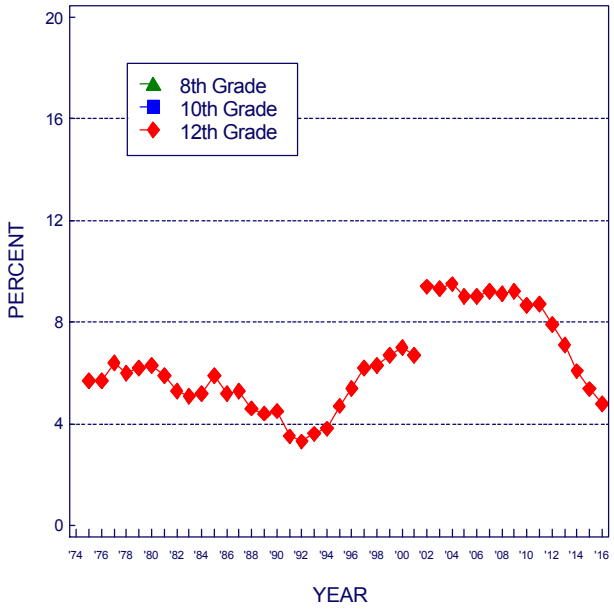
OxyContin use increased some in all grades from 2002 (when it was first measured) through roughly 2009, though the trend lines have been irregular. Since 2009 or 2010, the prevalence rate has dropped in all grades. Annual prevalence in 2016 was 0.9%, 2.1%, and 3.4% in grades 8, 10, and 12, respectively. Use of ***Vicodin***, on the other hand, remained fairly steady at somewhat higher levels from 2002—the first year it was measured—until 2009, after which it declined substantially in all grades. In 2016, annual prevalence rates continued to decline and were 0.8%, 1.7%, and 2.9% for 8th, 10th and 12th graders respectively.

Availability

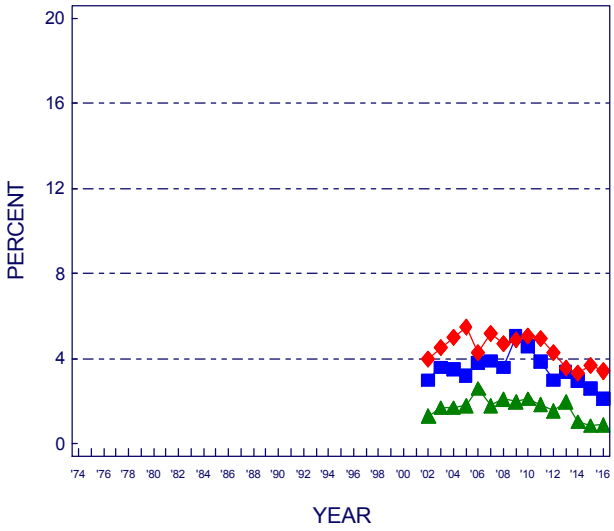
Questions were asked about the availability of narcotics other than heroin, taken as a class. Perceived availability increased gradually among 12th graders for more than a decade (from 1978 through 1989), even as reported use was dropping. Perceived availability then rose further for another decade (from 1991 through 2001) as use rose quite sharply before leveling by about 2000 and then declining after 2006. In contrast, perceived availability had declined among 8th and 10th graders since the late 1990s. (In all three grades, a change in question wording in 2010 to include OxyContin and Vicodin as examples presumably accounts for the jump in reported availability that year.) Availability has declined further in all three grades since 2010.

Narcotics other than Heroin and OxyContin and Vicodin Specifically:
Trends in Annual Use and Availability
Grades 8, 10, 12

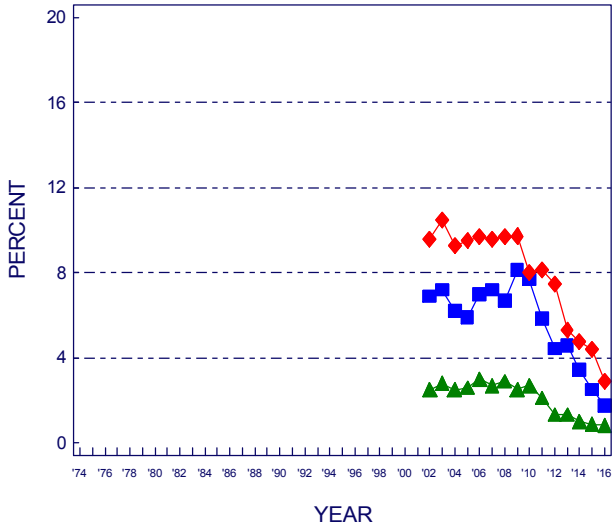
Use of Narcotics other than Heroin
% who used any narcotics other than heroin in last 12 months*



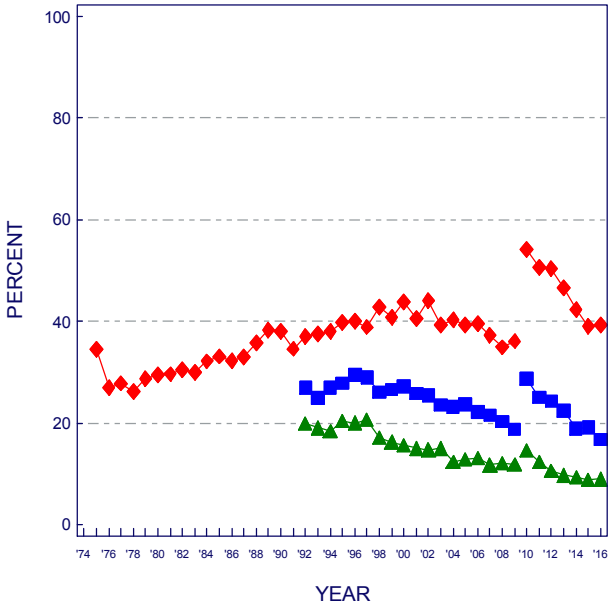
OxyContin Use
% who used OxyContin in last 12 months



Vicodin Use
% who used Vicodin in last 12 months



Availability of Narcotics other than Heroin**
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.
*Beginning in 2002, a revised set of questions on other narcotics use was introduced in which Talwin, laudanum, and paregoric were replaced as examples given with Vicodin, OxyContin, and Percocet.
**In 2010 the list of examples was changed from methadone, opium to Vicodin, OxyContin, Percocet, etc.

Tranquilizers

Tranquilizers are psychotherapeutic drugs that are legally sold only by prescription. They are central nervous depressants and, for the most part, comprise benzodiazepines (minor tranquilizers), although some non-benzodiazepines have been introduced. Respondents are instructed to exclude any medically prescribed use from their answers. At present, ***Xanax*** is the tranquilizer most commonly used by 12th graders (only 12th graders are asked to indicate which specific tranquilizers they used). (See Table E-3 in appendix E of *Volume I* in this series for details.) Valium, Klonopin, and Ativan are other tranquilizers, used at somewhat lower levels. In 2001, the examples given in the tranquilizer question were modified to reflect changes in the drugs in common use—Miltown was dropped and Xanax was added. As the first panel on the facing page shows, this caused a modest increase in the reported level of tranquilizer use in the upper grades, so we have broken the trend line to reflect the point of redefinition.

Trends in Use

During the late 1970s and all of the 1980s, tranquilizers fell steadily and substantially from popularity, with 12th graders' use declining by three fourths over the 15-year interval between 1977 and 1992. Their use then increased, as happened with many other drugs during the 1990s. Annual prevalence more than doubled among 12th graders, rising steadily through 2002, before leveling. Use also rose steadily among 10th graders, but began to decline some in 2002. Use peaked much earlier among 8th graders in 1996 and then declined slightly for two years. Tranquilizer use remained relatively stable among 8th graders through 2010 at considerably lower levels than the upper two grades. Use in 8th grade showed declines in 2011 and 2012 before stabilizing again. From 2002 to 2005, there was some decline among 10th graders, followed by a leveling, then a resumption of the decline through 2014 before drifting up again. Among 12th graders, there was a very gradual decline from 2002 through 2007, before leveling and then decreasing in 2010 and again in 2013. This staggered pattern of change suggests that a cohort effect has been at work. There has been little further change since 2013. In 2016, the prevalence of use of these prescription-type drugs was somewhat lower than their recent peak levels, with annual prevalence rates of 1.7%, 4.1%, and 4.9% in grades 8, 10, and 12, respectively.

Perceived Risk and Disapproval

Data have not been collected on perceived risk and disapproval for tranquilizers, primarily due to questionnaire space limitations.

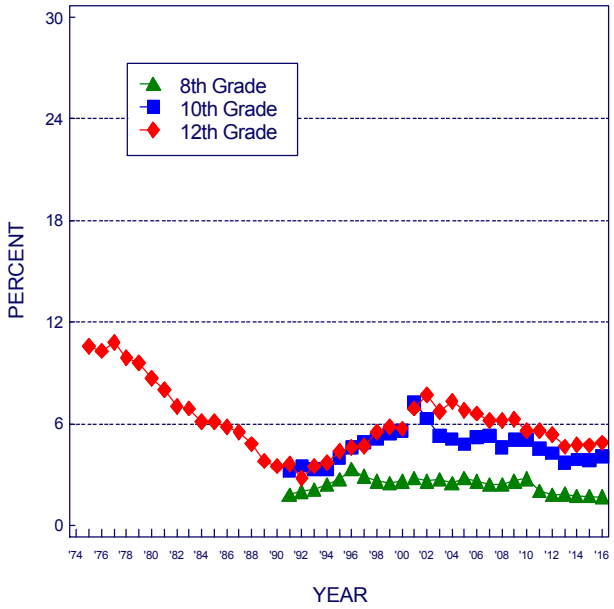
Availability

As the number of 12th graders reporting non-medically prescribed tranquilizer use fell dramatically during the 1970s and 1980s, so did the proportion saying that tranquilizers would be fairly or very easy to get. Whether declining use caused the decline in availability or vice versa is unclear. However, 12th graders' perceived availability has continued to fall since then, even as use rebounded in the 1990s; it is now down by eight tenths over the life of the study—from 72% in 1975 to 15% by 2016 saying that tranquilizers would be fairly or very easy to get if they wanted some. Availability has fallen fairly continuously since 1991 in the lower grades as well, though not as sharply. In 2016 all three grades showed a slight upward movement in availability (significantly so in 8th grade).

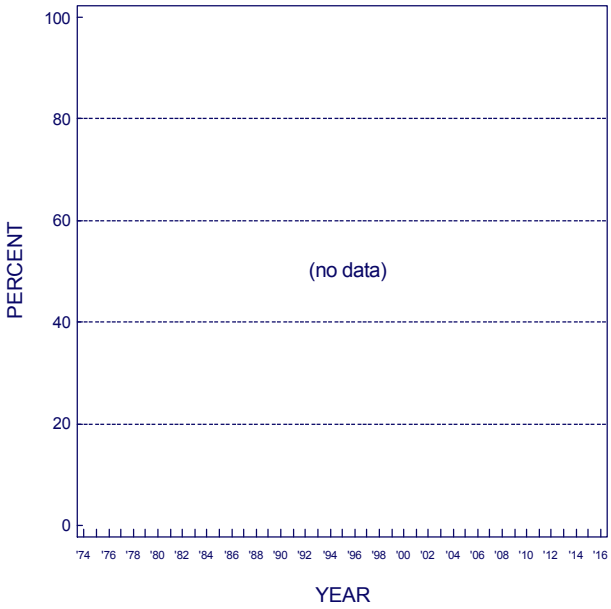
Tranquilizers: Trends in Annual Use and Availability

Grades 8, 10, 12

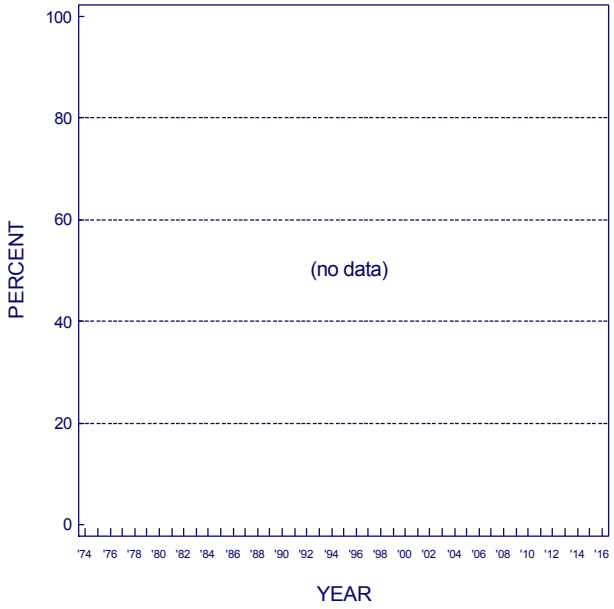
Use*
% who used in last 12 months



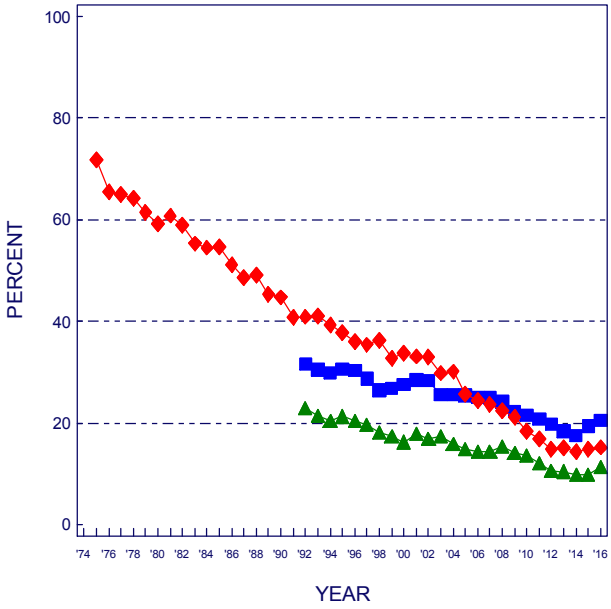
Risk
% seeing "great risk" in using once or twice



Disapproval
% disapproving of using once or twice



Availability
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.
*Beginning in 2001, a revised set of questions on tranquilizer use was introduced in which Xanax replaced Miltown in the list of examples.

Sedatives (Barbiturates)

Like tranquilizers, sedatives are prescription-controlled psychotherapeutic drugs that act as central nervous system depressants. They are used to assist sleep and relieve anxiety.

Though for many years respondents have been asked specifically about their use of barbiturate sedatives, they likely have been including other classes of sedatives in their answers. In 2004, the question on use was revised to say "sedatives/barbiturates"—a change that appeared to have no impact on reported levels of use. Respondents are told for what purposes sedatives are prescribed and are instructed to exclude from their answers any use under medical supervision. Usage data are reported only for 12th graders because we believe that 8th- and 10th-grade students tend to over-report use, perhaps including in their answers their use of nonprescription sleep aids or other over-the-counter drugs.

Trends in Use

As with tranquilizers, the use of sedatives (barbiturates) fell steadily among 12th graders from the mid-1970s through the early 1990s. From 1975 to 1992, annual prevalence fell by three fourths, from 10.7% to 2.8%. As with many other drugs, a gradual, long-term resurgence in sedative use occurred after 1992, but unlike the case with most illegal drugs, sedative (barbiturate) use continued to rise steadily through 2005, well beyond the point at which the use of most illegal drugs began falling. (Recall that tranquilizer use also continued to rise into the early 2000s.) Use has declined some since 2005, and by 2016, the annual prevalence rate was down by about six-tenths from its recent peak, falling to 3.0%. The sedative methaqualone (known as Quaaludes) was included in the MTF study from the very beginning, and was never as popular as barbiturates; use rates have generally been declining since 1975, reaching an annual prevalence of just 0.5% in 2007, about where it remained through 2012, after which the question was dropped.

Perceived Risk

Trying sedatives (barbiturates) was never seen by most students as very dangerous; and it is clear from the upper right panel on the facing page that changes in perceived risk cannot explain the trends in use that occurred from 1975 through 1986, when perceived risk was actually declining along with use. But then perceived risk shifted up some through 1991 while use was still falling. It dropped back some through 1995, as use was increasing, and then remained relatively stable for a few years. Perceived risk has generally been at quite low levels, which may help to explain why the use of this class of psychotherapeutic drugs (and likely others) continued to grow in the first half of the decade of the 2000s. However, perceived risk began to rise a bit after 2000, foretelling the decline in use that began after 2005. When the term "sedatives" was changed to "sedatives/barbiturates" in 2004, the trend line shifted down slightly, but perceived risk continued to climb gradually through 2013, before turning down. Prior to that point use declined as perceived risk rose.

Disapproval

Like many illicit drugs other than marijuana, sedative (barbiturate) use has received the disapproval of most high school seniors since 1975, with some variation in disapproval rates that have moved consistently with usage patterns. The change in question wording in 2004 appeared to lessen disapproval slightly. There has been a modest increase in disapproval since 2000, although that appears to have stopped in 2014 and was followed by a slight decrease afterwards.

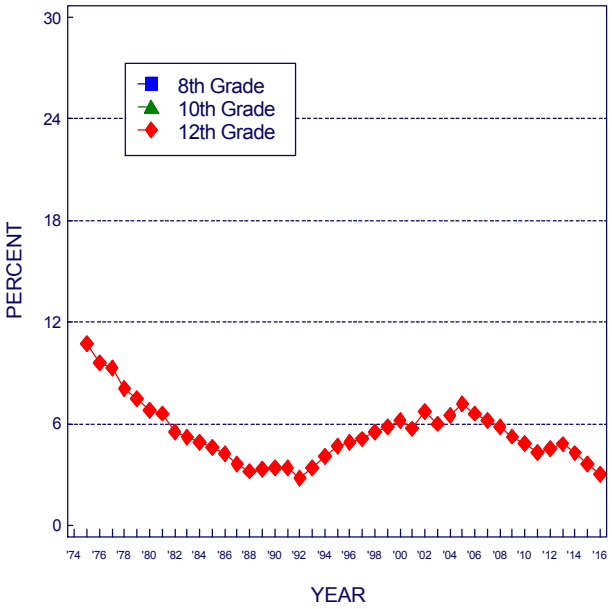
Availability

As the fourth panel on the facing page shows, the perceived availability of sedatives (barbiturates) has generally been declining during most of the life of the study, except for one upward shift that occurred in 1981—a year in which look-alike drugs became more widespread. (The change in question text in 2004 appears to have had the effect of increasing reported availability among 12th graders but not among students in the lower grades.) Perceived availability for sedatives (barbiturates) continued its long-term decline into 2015; in 2016, it declined significantly among 10th graders, with no significant change among 8th and 12th graders.

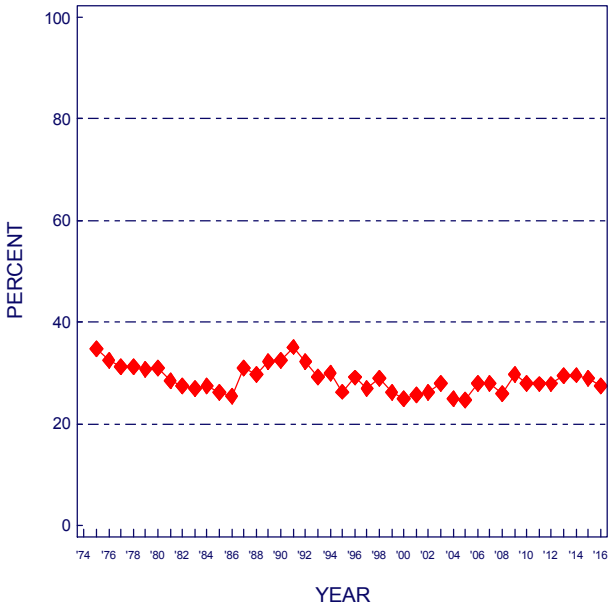
Sedatives (Barbiturates): Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12

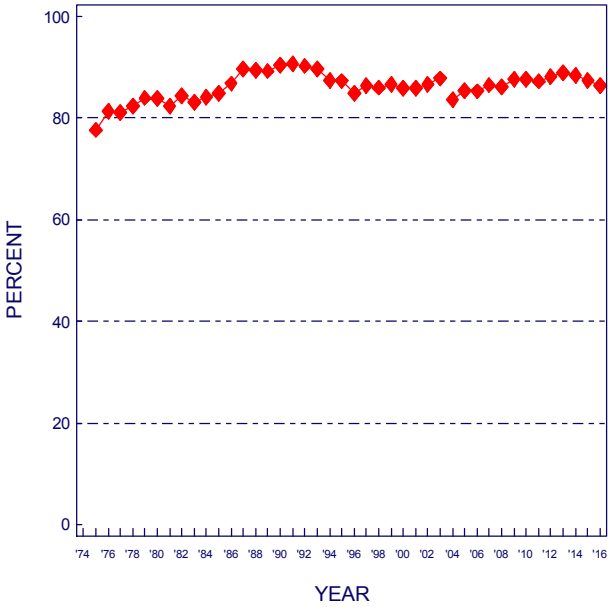
Use*
% who used in last 12 months



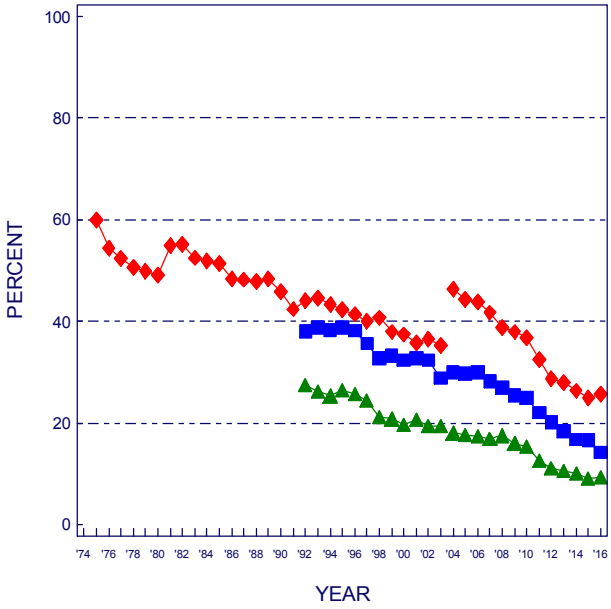
Risk**
% seeing "great risk" in using once or twice



Disapproval**
% disapproving of using once or twice



Availability**
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.

*In 2004 the question text was changed. Barbiturates was changed to Sedatives, including barbiturates and "have you taken barbiturates..." was changed to "have you taken sedatives..." In the list of examples downs, downers, goofballs, yellows, reds, blues, rainbows were changed to downs, or downers, and include Phenobarbital, Tuinal, and Seconal.

**In 2004 the question text was changed from barbiturates to sedatives/barbiturates and the list of examples was changed from downers, goofballs, reds, yellows, etc. to just downers. These changes likely explain the discontinuity in the 2004 results.

MDMA (Ecstasy, Molly) and Other "Club Drugs"

"Club drugs," so called because they have been popular at nightclubs and raves, include LSD, MDMA (known as ecstasy, and more recently, Molly), methamphetamine, GHB (gammahydroxybutyrate), ketamine (special K), and Rohypnol. (For discussion of LSD and meth-amphetamine, see prior pages.) We focus here initially on MDMA (ecstasy, Molly) and treat the other drugs in the last section below.

Trends in MDMA (Ecstasy, Molly) Use

Ecstasy (3, 4-methylenedioxymethamphetamine or MDMA) is used more for its mildly hallucinogenic properties than for its stimulant properties. Questions on ecstasy use were added to the surveys in 1996.

In 1996, annual prevalence of ecstasy use was 4.6% in both 10th and 12th grades—considerably higher than among college students (2.8%) and young adults (1.7%)—but use declined over the next two years. Use then rose sharply, bringing annual prevalence up to 3.5% 6.2%, and 9.2% for 8th, 10th, and 12th graders by 2001. From 2001 to 2005, use declined substantially, down to 1.7%, 2.6%, and 3.0%, respectively. Following some irregular changes in recent years, in 2014 compared to 2005, use was down slightly in 8th grade (to 0.9%) and 10th grade (to 2.3%) and up slightly in 12th grade (to 3.6%). "Molly," reputedly a purer form of MDMA, received much attention in 2013. Because that term was not used in the 2013 questionnaires, it is not clear whether students included it in their answers about ecstasy use that year. The inclusion of Molly as an example in some of the 2014 questionnaires seemed to make a modest difference in reported prevalence. (The 2014 data reported here show one point based on the unmodified questionnaires and another based on the modified ones.) Since 2014, the change had been downward and significantly so in 2016 in all three grades, despite the inclusion of Molly.

Perceived Risk

In 2001, 12th graders' perceived risk of ecstasy use jumped by 8 percentage points and in 2002, by another seven. Significant increases occurred in 2003 for all grades. This sharp rise in perceived risk likely caused the drop in use, as we predicted. From 2004 to 2011, we saw a troubling drop in perceived risk (first among 8th and 10th, and then among 12th graders), corresponding to the increase in use in the upper two grades and then in all three grades. This suggests a generational forgetting of the dangers of ecstasy use. In 2012, only 8th graders showed much further decline. The rebound in use after 2004 might be explained by the sizable drop in perceived risk. The addition of Molly as an example caused a considerable jump in perceived risk after 2013 in grades 8 and 10, suggesting that they see it as more dangerous than ecstasy.

Disapproval

Disapproval of ecstasy use declined some after 1998 but increased significantly in all three grades in 2002, perhaps due to the rise in perceived risk. The rise in disapproval continued through 2003 for 8th, 2004 for 10th, and 2006 for 12th graders, suggesting some cohort effect. After those peaks, disapproval dropped sharply among 8th graders and less among 10th graders before leveling, and it did not drop among 12th graders until 2010—again suggesting a cohort effect. The erosion in perceived risk and disapproval—which was sharpest among 8th graders—left these groups more vulnerable to a possible rebound in use; some rebound appears to have occurred during the past decade.

Availability

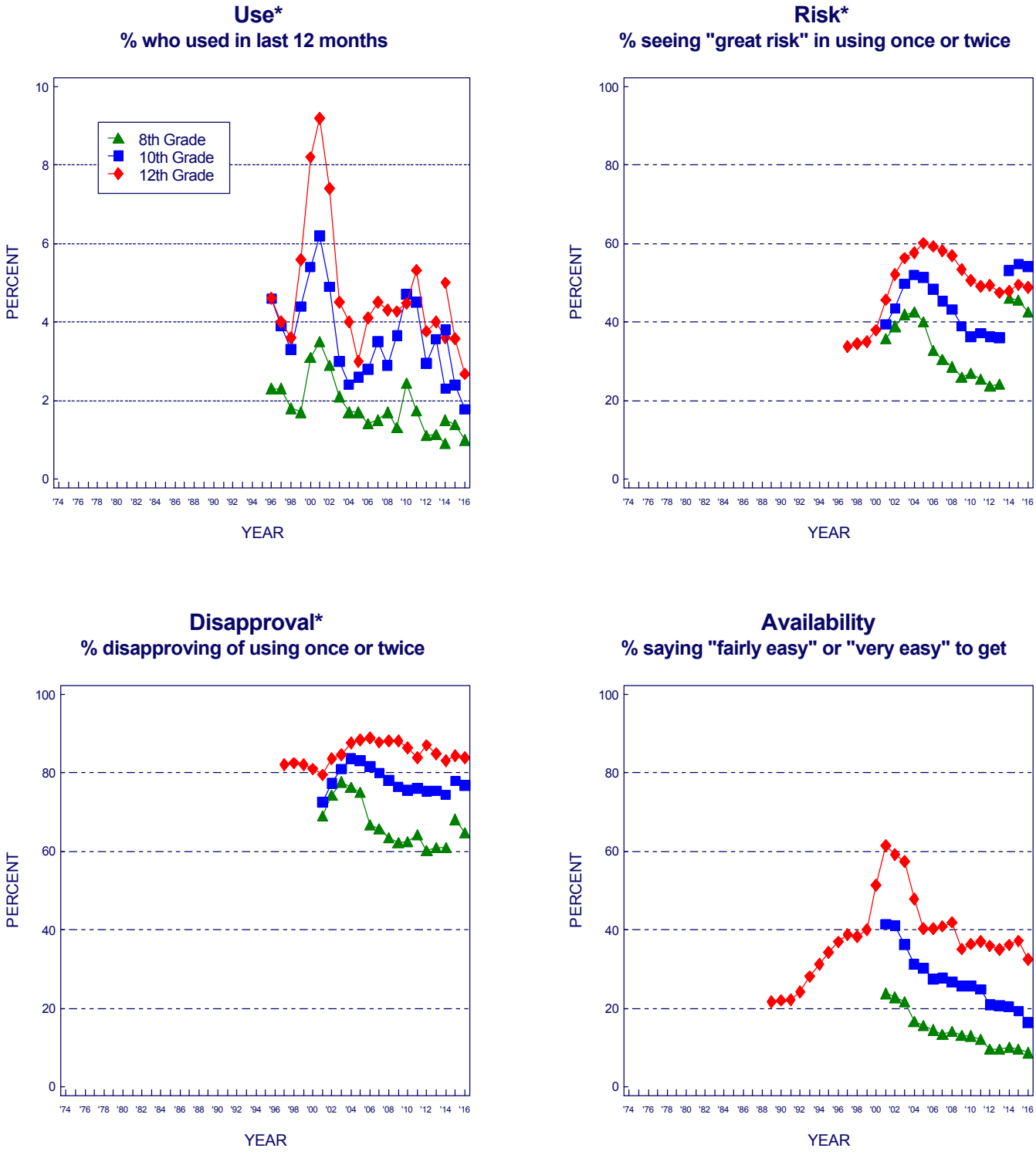
The figure shows a dramatic rise in 12th graders' perceived availability of ecstasy after 1991, particularly between 1999 and 2001, consistent with informal reports about growing importation of the drug. Perceived availability then declined considerably in all grades, including significant declines in 2016 at 10th and 12th grades. Decreased availability may help account for the declines in use in the past few years.

Rohypnol, GHB, and Ketamine

Rohypnol and ***GHB*** are labeled date rape drugs because they can have amnesiac effects and can be added to food or drink without a victim's knowledge. By 2011, both drugs had shown significant declines since their peak levels of annual use (Table 6). In 2011, annual prevalence for Rohypnol use was 0.8%, 0.6%, and 1.3%, and for GHB use, 0.6%, 0.5%, and 1.4% in grades 8, 10, and 12, respectively. Annual prevalence for another club drug, ***ketamine***, had also shown significant declines, and was at 0.8%, 1.2%, and 1.7% in 2011. Questions about GHB and ketamine use were dropped from the surveys of 8th and 10th graders in 2012. In 2016, annual prevalence among 12th graders for Rohypnol, GHB, and ketamine was 1.1%, 0.9%, and 1.2%, respectively. Annual prevalence of Rohypnol was 0.5% for 8th graders and 0.5% for 10th graders. No questions about risk, disapproval, or availability are asked for these drugs.

Ecstasy (MDMA): Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12



Source. The Monitoring the Future study, the University of Michigan.
*In 2014/2015, revised sets of questions on ecstasy were introduced in which molly was added to the description. This likely explains the discontinuity in the results for those years.

Alcohol

Alcohol has been widely used by young people in the U.S. for a very long time. In 2016, the proportions of 8th, 10th, and 12th graders who reported drinking an alcoholic beverage in the 30-day period prior to the survey were 7%, 20%, and 33%, respectively. Various measures of alcohol use are presented in the tables at the end of this report. Here we focus on episodic heavy or "binge" drinking (i.e., having five or more drinks in a row on one or more occasions in the prior two weeks) because heavy alcohol consumption is probably of greatest concern from a public health perspective. In 2016 lifetime, annual, 30-day, and binge drinking measures of alcohol use were at historic lows over the life of the study in all three grades (8, 10 and 12).

Trends in Use

Among 12th graders, binge drinking peaked in 1979 along with overall illicit drug use. The prevalence of binge drinking then declined substantially from 41% in 1983 to 28% in 1992, a drop of almost one third (also the low point of any illicit drug use). Although illicit drug use rose sharply in the 1990s, binge-drinking rose by only a small fraction, and that rise was followed by some decline at all three grades. By 2016, proportional declines since the recent peaks reached in the 1990s were 75%, 60%, and 51% for grades 8, 10, and 12, respectively (Table 8). The observed prevalence of binge drinking continued its decline from 2015 to 2016 (significant in 8th grade), to 2016 rates of 3%, 10%, and 16% for the 3 grades.

It should be noted that there is no evidence of any displacement effect in the aggregate between alcohol and marijuana—a hypothesis frequently heard. The two drugs have moved much more in parallel over the decades than in opposite directions, at least until about a five-year period in the 2000s, during which alcohol continued to decline while marijuana reversed course and rose. Moreover, these two behaviors have consistently been positively correlated at the individual level.

Perceived Risk

Across the past four decades, since the MTF study began, the majority of 12th graders have not viewed binge drinking on weekends as carrying a great risk. However, an increase from 36% to 49% occurred between 1982 and 1992. A decline to 43% followed by 1997 as use rose, before it stabilized. Since 2003, perceived risk has risen some in all grades, at least through 2011 or 2012. These changes are consistent with changes in actual binge drinking. We believe that the public service advertising campaigns in the 1980s against drunk driving, as well as those that urged use of designated drivers when drinking, contributed to the increase in perceived risk of binge drinking generally. Drunk driving by 12th graders declined during that period by an even larger proportion than binge drinking. Also, we showed that increases in the minimum drinking age during the 1980s were followed by reductions in drinking and increases in perceived risk associated with drinking, policy-driven effects that may still be deterring alcohol use among adolescents.

Disapproval

Disapproval of weekend binge drinking moved fairly parallel with perceived risk, suggesting that such drinking (and very likely the drunk-driving behavior associated with it) became increasingly unacceptable in the peer group. Note that the rates of disapproval and perceived risk for binge drinking are higher in the lower grades than in 12th grade. As with perceived risk, disapproval increased appreciably in all grades, though it leveled in 2015.

Availability

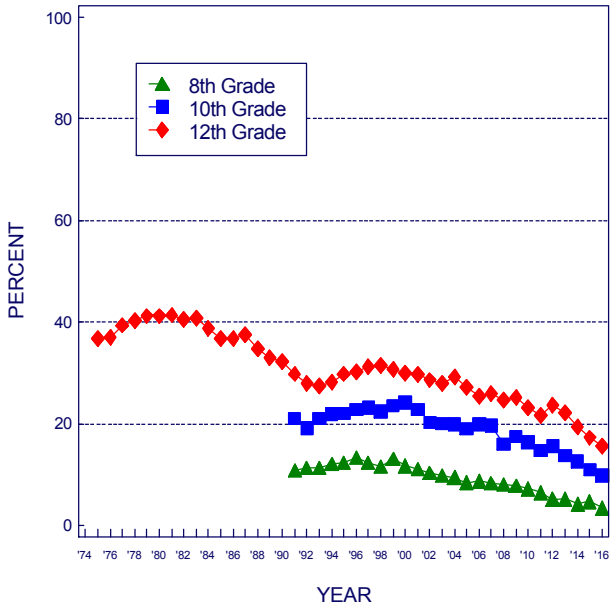
Perceived availability of alcohol, which until 1999 was asked only of 8th and 10th graders, was very high and mostly steady in the early 1990s. Since 1996, however, there have been substantial declines in 8th and 10th grades. For 12th grade, availability has declined only modestly with 85% in 2016 still saying that alcohol would be fairly or very easy to get. Overall, it appears that states, communities, and parents have been successful in reducing access to alcohol, particularly among the younger teens.

Alcohol: Trends in Binge Drinking, Risk, Disapproval, and Availability

Grades 8, 10, 12

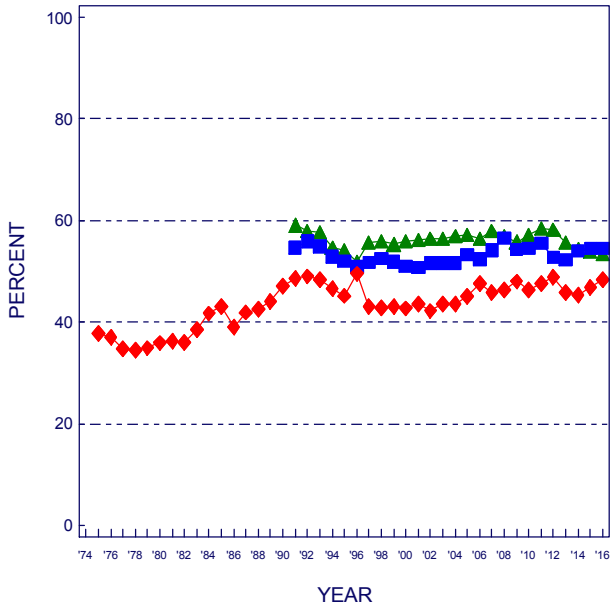
Use

% who had 5+ drinks in a row at least once in past two weeks



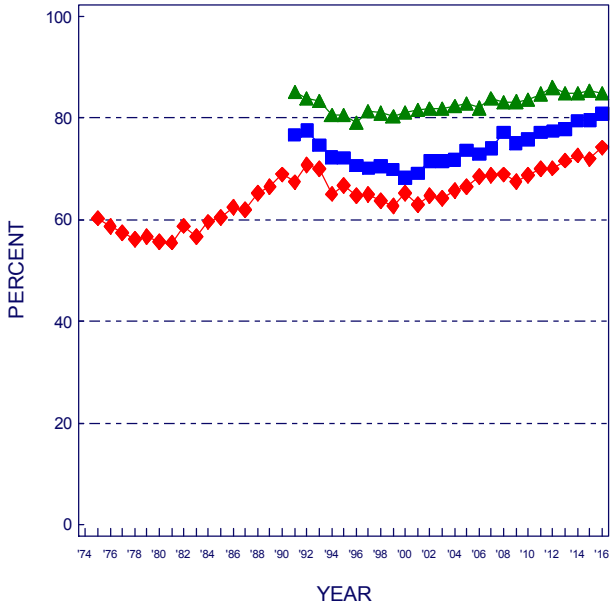
Risk

% seeing "great risk" in having 5+ drinks in a row once or twice each weekend



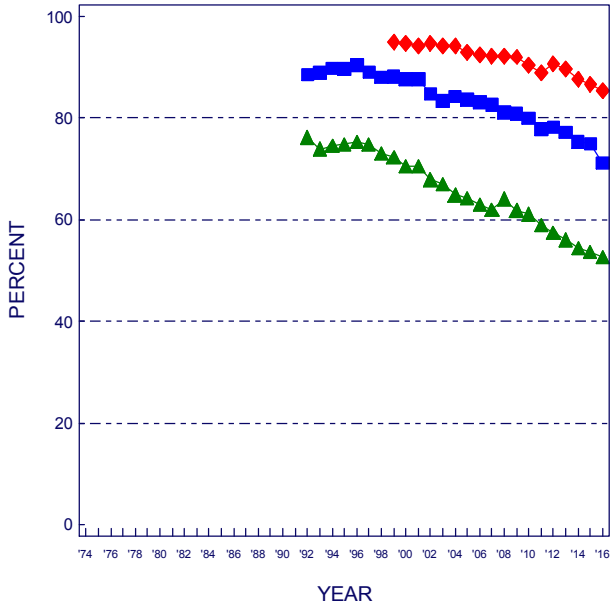
Disapproval

% disapproving of having 5+ drinks in a row once or twice each weekend



Availability

% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.

Cigarettes

Cigarette smoking is the leading cause of preventable disease and mortality in the United States, and is usually initiated in adolescence. That makes what happens with cigarette smoking in adolescence particularly important to study.

Trends in Use

Differences in smoking rates between various birth cohorts (or, in this case, school class cohorts) tend to stay with those cohorts throughout the life cycle. This means that it is critical to prevent smoking very early. It also means that the trends in a given historical period may differ across various grade levels as changes in use occurring earlier in adolescence work their way up the age spectrum (i.e., "cohort effects").

Among 12th graders, 30-day prevalence of smoking reached a peak in 1976 at 39%. (The peak likely occurred considerably earlier at lower grade levels as these same class cohorts passed through them in previous years.) After about a one-quarter drop in 12th-grade 30-day prevalence between 1976 and 1981, the rate remained remarkably stable until 1992 (28%). In the 1990s, smoking began to rise sharply, after 1991 among 8th and 10th graders and after 1992 among 12th graders. Over the next four to five years, smoking rates increased by about one half in the lower two grades and by almost one third in grade 12—very substantial increases to which MTF drew considerable public attention. Smoking peaked in 1996 for 8th and 10th graders and in 1997 for 12th graders before beginning a fairly steady and substantial decline that continued through 2004 for 8th and 10th graders. Between the peak levels in the mid-1990s and 2004, 30-day prevalence of smoking declined by 56% in 8th grade, 47% in 10th, and 32% in 12th. This important decline in adolescent smoking decelerated after about 2002. Still, by 2016, 30-day prevalence levels had fallen from peak levels by 87%, 84%, and 71% in grades 8, 10, and 12, respectively. An increase in 2009 in federal taxes on cigarettes (from $0.39 to $1.01 per pack) may have contributed to the recent decline in use. Of particular importance, smoking initiation by 8th graders declined by four fifths from a peak of 49% in 1996 to 10% by 2016.

Perceived Risk

Among 12th graders, the proportion seeing great risk in pack-a-day smoking rose before and during the first period of decline in use in the late 1970s. It leveled in 1980 (before use leveled), declined a bit in 1982, but then started to rise again gradually for five years. (It is possible that cigarette advertising effectively offset the influence of rising perceptions of risk during that period.) Perceived risk fell some in the early 1990s at all three grade levels as use increased sharply. Since then, there has generally been an increase (though not entirely consistently over the years) in perceived risk, reaching in 2015 the highest levels yet observed in grades 8 and 10 and close to the highest in grade 12. Risk has fallen back some in 8th and 10th grades over the past year. Note the differences in the extent of perceived risk among grade levels. There is a clear age effect: by the time most youngsters fully appreciate the hazards of smoking, many already have initiated the behavior.

Disapproval

Disapproval rates for smoking have been fairly high throughout the study and, unlike perceived risk, are higher in the lower grade levels. Among 12th graders, there was a gradual increase in disapproval of smoking from 1976 to 1986, followed by some erosion over the decade through 1997. After 1997, disapproval rose for some years in all three grades, but leveled briefly after 2006 or 2007, before rising even more. We measure a number of other smoking-related attitudes; these became increasingly negative, but leveled off six or seven years ago (see Table 3 in the 2016 MTF press release on teen tobacco use). Though disapproval has continued to increase, some attitudes and beliefs about cigarette smoking are no longer moving in a direction that would discourage use, suggesting that external changes in the environment may be required to further reduce youth smoking.

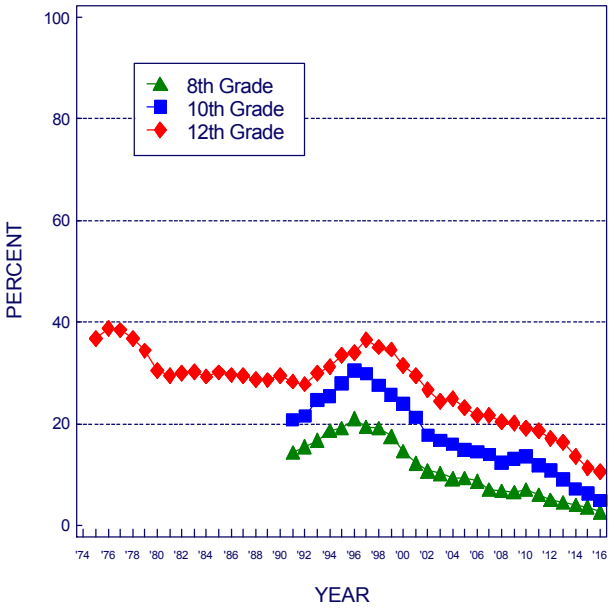
Availability

Since 1996, availability has declined considerably among 8th and 10th graders. Some 46% of 8th graders and 63% of 10th graders now say that cigarettes would be very easy or fairly easy to get, down from 78% in 1992 among 8th graders and 91% in 1995 among 10th graders.

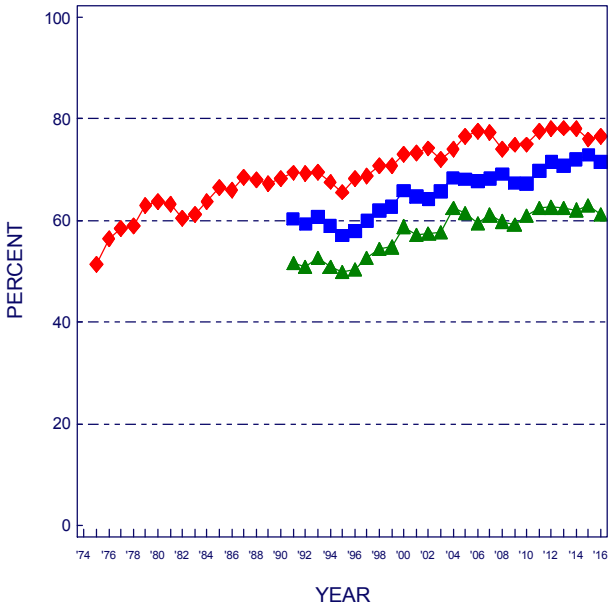
Cigarettes: Trends in 30-Day Use, Risk, Disapproval, and Availability

Grades 8, 10, 12

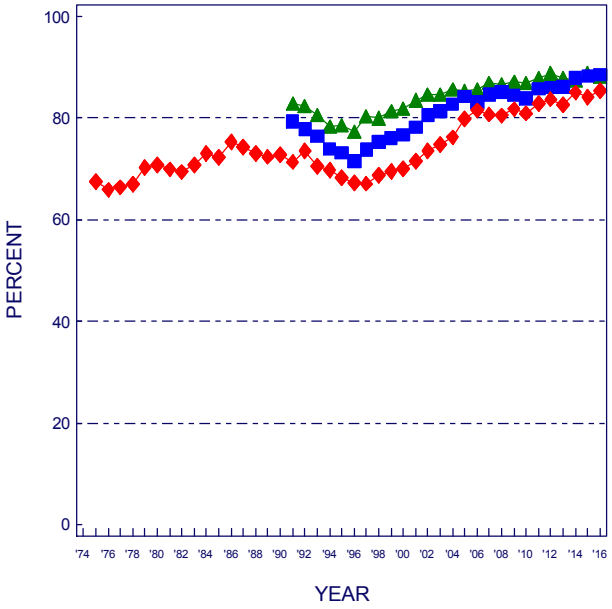
Use
% who used in last 30 days



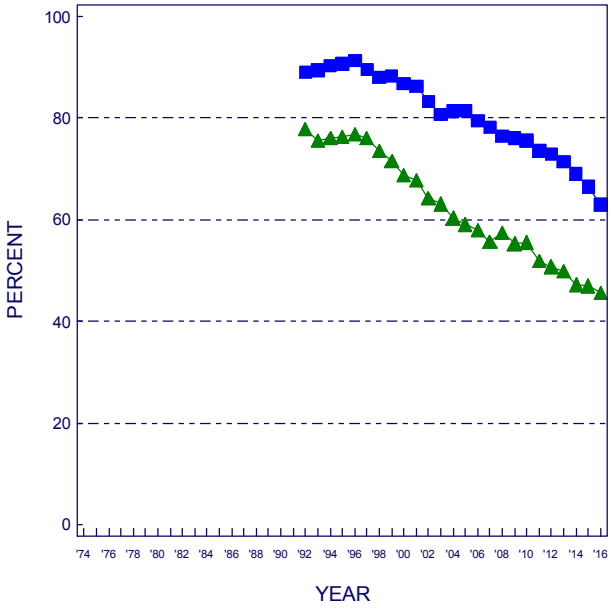
Risk
% seeing "great risk" in smoking a pack or more per day



Disapproval
% disapproving of smoking a pack or more per day



Availability
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.

Smokeless Tobacco

Traditionally, smokeless tobacco has come in two forms: "snuff" and "chew." Snuff is finely ground tobacco usually sold in tins, either loose or in packets. It is held in the mouth between the lip or cheek and the gums. Chew is a leafy form of tobacco, usually sold in pouches. It too is held in the mouth and may, as the name implies, be chewed. In both cases, nicotine is absorbed by the mucous membranes of the mouth. These forms are sometimes called "spit" tobacco because users expectorate the tobacco juices and saliva (stimulated by the tobacco) that accumulate in the mouth. "***Snus***" (rhymes with goose) is a relatively new variation on smokeless tobacco, as are some other ***dissolvable tobacco*** products that literally dissolve in the mouth. Given that snus appeared to be gaining in popularity, separate items regarding the use in the past 12 months of snus and dissolvable tobacco were added to the 12th-grade surveys in 2011 and to the 8th- and 10th-grade surveys in 2012. In addition, in 2011 snus and dissolvable tobacco were added as examples in the long-standing question on smokeless tobacco.

Trends in Use

The use of smokeless tobacco by teens had been decreasing gradually, and 30-day prevalence is now about half of the recent peak levels in the mid-1990s, though there was a reversal of the declines from about 2007 through 2010. Among 8th graders, 30-day prevalence declined from a 1994 peak of 7.7% to 3.2% in 2007. It reached a low of 2.8% in 2013, and then fell even lower to 2.5% in 2016. Among 10th graders, use declined from a 1994 peak of 10.5% to 4.9% by 2004, and then rose to 6.4% in 2013 before dropping again to 3.5% in 2016. Among 12th graders, 30-day use declined from a 1995 peak of 12.2% to 6.1% by 2006 then rose to 8.5% in 2010, before falling back to 6.6% in 2016. Thirty-day prevalence of daily use of smokeless tobacco fell gradually but appreciably for some years. Daily usage rates in 2016 were 0.6%, 1.0%, and 2.7% in grades 8, 10, and 12, respectively—down substantially from peak levels recorded in the 1990s—but most of the declines occurred in the 1990s, not since.

Smokeless tobacco use among American young people is almost exclusively a male behavior. Among males, the 30-day prevalence rates in 2016 were 3.6%, 5.8%, and 11.9% in grades 8, 10, and 12, versus 1.4%, 1.3%, and 1.5% for females. The respective current daily use rates for males were 1.2%, 1.7%, and 5.1% compared to 0.1%, 0.2%, and 0.3% for females.

Annual prevalence in 2016 for ***snus*** was 2.2%, 3.0%, and 5.8% among 8th, 10th, and 12th graders, respectively, reflecting a decline since 2012 in all three grades. For ***dissolvable tobacco***, the corresponding figures were 0.7%, 0.9%, and 1.1%, reflecting little change since 2012.

Perceived Risk

The most recent low point in the level of perceived risk for smokeless tobacco was 1995 in all three grades (though for 12th graders it was considerably lower in the mid-1980s). For a decade following 1995, there was a gradual but substantial increase in proportions saying that there is a great risk in using smokeless tobacco regularly. It thus appears that one important reason for the appreciable declines in smokeless tobacco use during the latter half of the 1990s was that an increasing proportion of young people were persuaded of the dangers of using it. However, the increases in perceived risk ended by 2004 in 12th grade, and it has declined some in the interval since then in all grades. The decline could be due to generational forgetting of the dangers of use, the increased marketing of snus and other smokeless products, and/or public statements about smokeless tobacco use being relatively less dangerous than cigarette smoking. By 2016, perceived risk leveled in all three grades.

Disapproval

Only 8th and 10th graders are asked about their personal disapproval of using smokeless tobacco regularly. The most recent low points for disapproval in both grades were 1995 and 1996. Disapproval rose among 8th graders from 74% in 1996 to 82% in 2005, about where it was in 2016 (81%). For 10th graders, disapproval rose from 71% in 1996 to 82% in 2008, also about where it was in 2016 (81%).

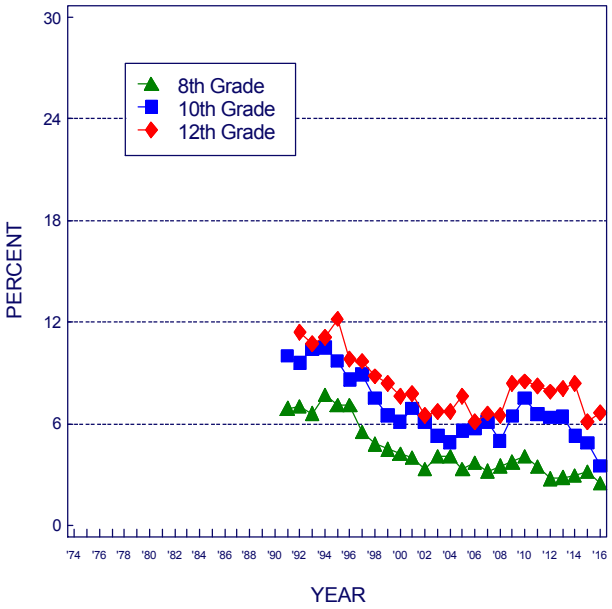
Availability

There are no questions on perceived availability of smokeless tobacco.

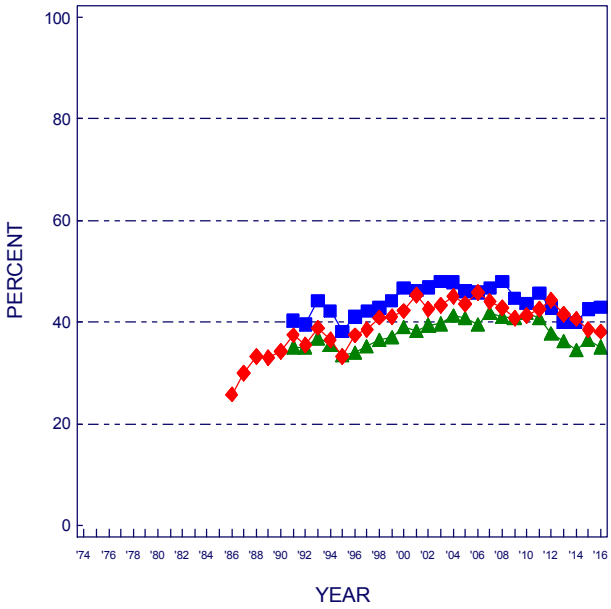
Smokeless Tobacco: Trends in 30-Day Use, Risk, and Disapproval

Grades 8, 10, 12

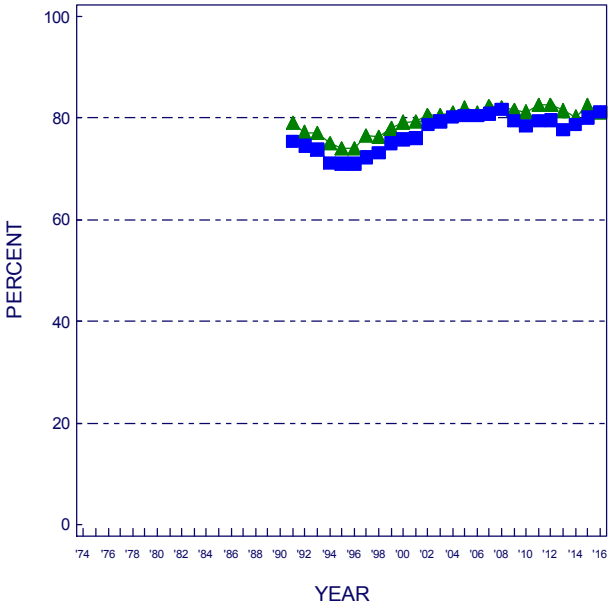
Use
% who used in last 30 days



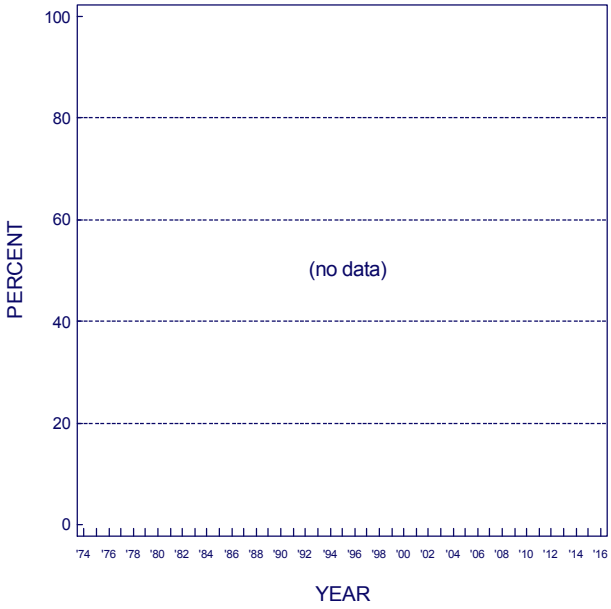
Risk
% seeing "great risk" in using regularly



Disapproval
% disapproving of using regularly



Availability
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.

Vaping

Vaping involves the use of a battery-powered device to heat a liquid or plant material so that it releases chemicals in an aerosol, vapor, or mist that users inhale. Examples of vaping devices include e-cigarettes, "mods," and e-pens. The vaping process reduces the number of harmful chemicals that users ingest in comparison to traditional, combustion-based forms of smoking. The vapor may contain nicotine, the active ingredients of marijuana, flavored propylene glycol, and/or flavored vegetable glycerin. The liquid that is vaporized comes in hundreds of flavors, many of which (e.g., bubble gum and milk chocolate cream) are likely to be attractive to younger teens.

Since 2015, MTF has included questions about vaping with any device, and asks respondents if they have used an "electronic vaporizer such as e-cigarettes." Since 2014, the survey has included questions about the use of the specific vaping device of an e-cigarette.

Trends in Use

Vaping declined in 2016, which marks the first significant reversal of a rapid rise in adolescent vaping. Previous to 2016 prevalence of vaping had grown from near-zero levels in 2011 to one of the most common forms of adolescent substance use by 2015. From 2015 to 2016, the percentage of students who vaped in the last 30 days declined by 2 or 3 percentage points to 6%, 11%, and 13% among 8th, 10th, and 12th graders, respectively. Each of these declines was statistically significant.

A similar decline was also present in use of e-cigarettes, which are specific vaping devices, in the last 30 days. From 2015 to 2016, e-cigarette prevalence declined significantly in all three grades-- from 10% to 6% among 8th-grade students, from 14% to 10% among 10th grade students, and from 16% to 12% among 12th grade students.

Despite these declines, vaping continued to have higher use among teens than traditional tobacco cigarettes or any other tobacco product. As a point of comparison, prevalence for tobacco cigarettes was 2.6%, 4.9%, and 10.5% among 8th, 10th, and 12th grade students respectively. Note that in 8th and 10th grades vaping is more than twice as common as use of regular cigarettes.

Perceived Risk

Perceived risk of vaping has increased as prevalence has declined. E-cigarettes are by far the most common vaping device, and the percentage of adolescents who believe that regular e-cigarette use poses a risk of harm increased from 19% to 21% in 8th grade, from 17% to 19% in 10th grade, and from 16% to 18% in 12th grade. However, even after these increases e-cigarettes have one of the lowest levels of perceived risk for regular use of all drugs, including alcohol.

Disapproval

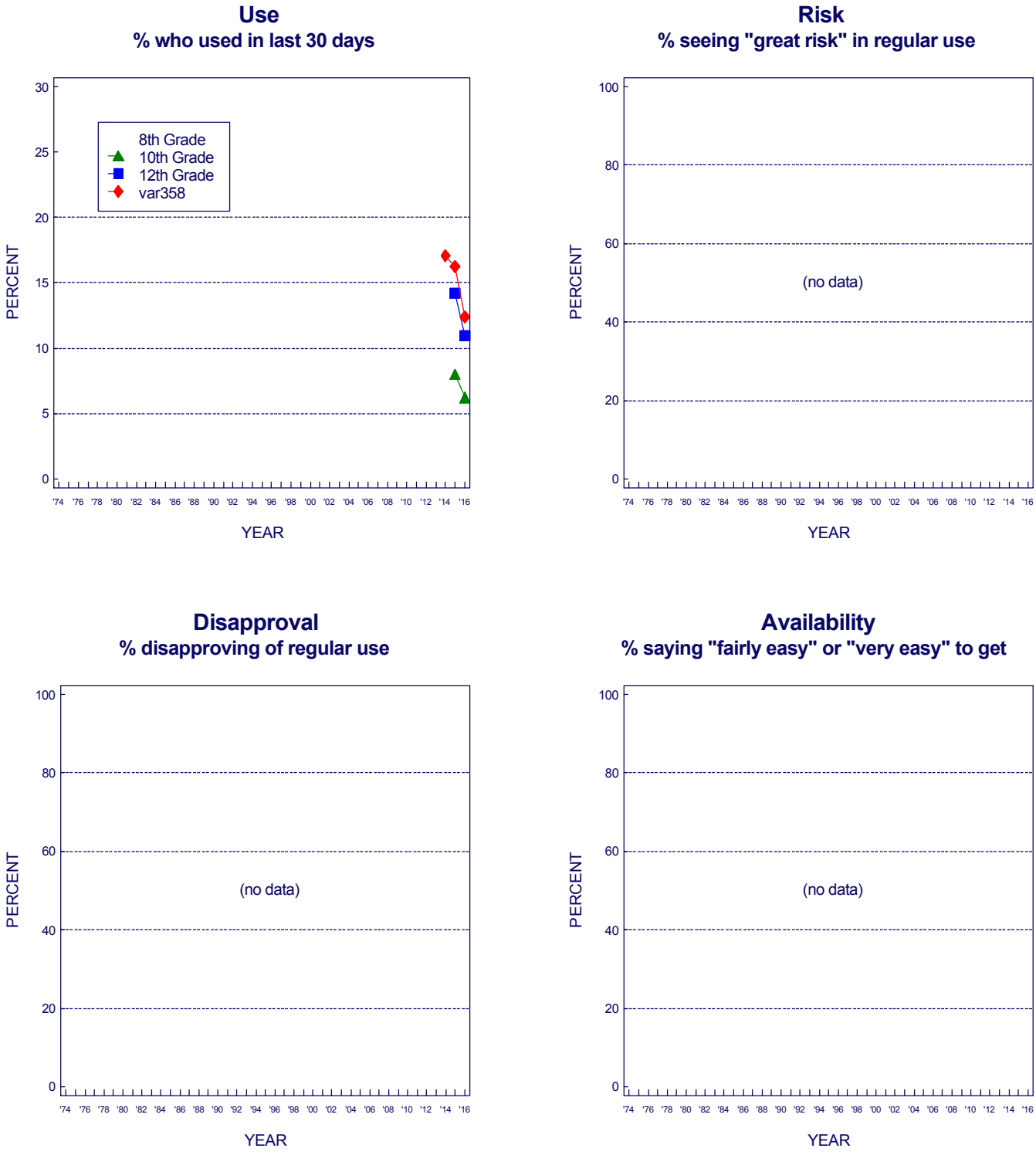
Disapproval of regular use of e-cigarettes is also relatively low, compared to most other substances. However, it did rise in 2016 from 65% to 67% in 8th and grade and from 60% to 65% in 10th grade (the increase was statistically significant in 10th grade but not in 8th grade; the question is not asked of 12th graders.)

Availability

Data on availability of vaping devices or e-cigarettes have not been gathered so far.

Electronic Vaporizers: Trends in 30-Day Use

Grades 8, 10, 12



Source. The Monitoring the Future study, the University of Michigan.

Small Cigars, Cigarillos, Large Cigars, and Tobacco Using a Hookah

Twelfth graders were first asked about smoking small cigars and smoking tobacco using a hookah (water pipe) in 2010. These questions were not asked of 8th and 10th graders. Only the prevalence and frequency of use in the past 12 months were reported; we use this prevalence period, requiring only a single question (which we call a "tripwire" question) to determine whether additional questions on the substance may be warranted in future surveys. Small cigar and hookah use are charted on the facing page.

Smoking Tobacco Using a Hookah. The past 12 months prevalence of hookah use had been rising since it was first measured in 2010, from 17.1% in 2010 to 22.9% in 2014; but it declined sharply in 2015 and 2016 to 13.0%. Only about 7% of the 12th-grade students in 2016 indicated use on more than two occasions during the prior 12 months, suggesting that a considerable amount of hookah use is light or experimental. (Males are only slightly more likely than females to use hookahs, at 15% for males and 11% for females in 2016.)

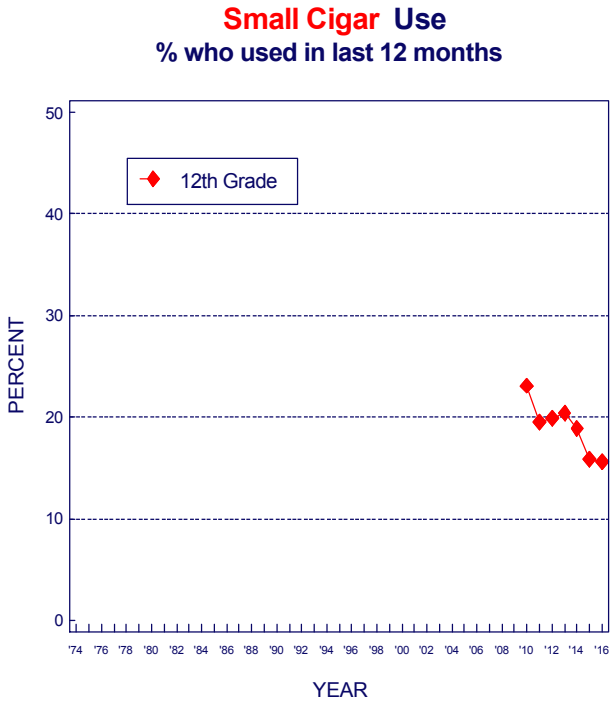
Small Cigars. Small or little cigars are the approximate size and shape of a cigarette, but they are classified as cigars because they are wrapped in brown paper, which contains some tobacco leaf, rather than in white paper. In 2016, the annual prevalence for small or little cigars (our question uses the term "small cigars") was 16%. Smoking small cigars has declined significantly since 2010, when annual prevalence was 23%. Unlike hookah smoking, use of small cigars shows a sizable gender difference: the 2016 annual prevalence for 12th grade males was 23% compared to 9% for females. The increases in the federal taxes on tobacco products, instituted in 2009, may well have played a role in decreasing the use of small cigars. The increase on a pack of small cigars fell under the same regulations as regular cigarettes (rising from $0.39 to $1.01 per pack). Some producers of small cigars subsequently increased the weight of their cigars slightly (taxation is based on weight, with cigars falling into a higher weight class with a lower tax rate) in order to avoid the higher taxes placed on cigarettes and to remove them from FDA control under current law. Eight percent of 12th graders indicated having used small cigars on more than two occasions during the past year, and only 1% on more than 20 occasions, so they tend to be smoked much less frequently than regular cigarettes. Some small cigars are flavored, which is likely to make them more attractive to young people. A concern in the public health community is that these products will have the effect of reversing the hard-won gains in reducing cigarette smoking among youth. Small cigars contain nicotine and combust tobacco in a similar way, and therefore carry similar dangers.

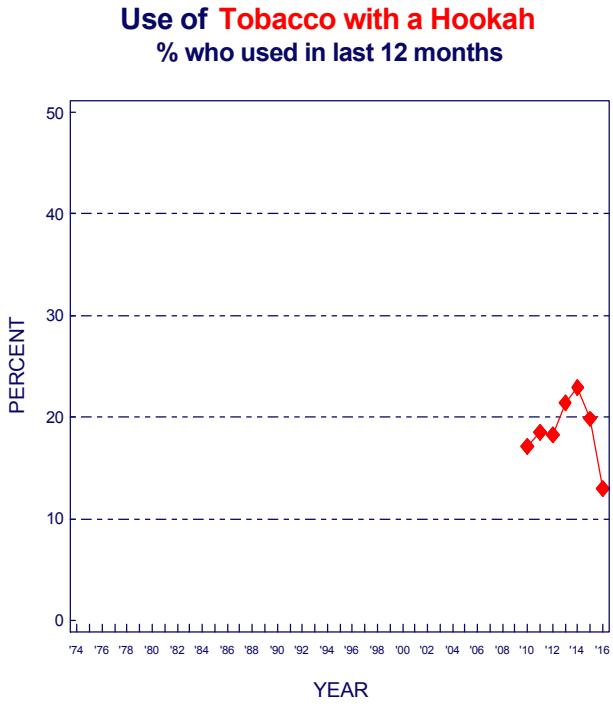
Small (Little) Cigars and Cigarillos. In a set of questions introduced in 2014 we asked about the use in the prior 30 days of little cigars OR cigarillos. (Cigarillos lie between little cigars and large cigars in size—length and thickness—and are wrapped in tobacco leaf like large cigars. They fall into the lower federal taxation bracket than cigarettes.) The distinction is made between flavored and unflavored (regular) little cigars or cigarillos, and it shows that the flavored ones are more widely used by teens. There was no significant change between 2014 and 2015 in the 30-day prevalence of either type, but in 2016, there were declines in all 3 grades, significant in 8th and 12th (Table 7). Thirty-day prevalence in 2016 was 2.8%, 4.9%, and 9.5% for flavored and 1.9%, 3.0%, and 6.1% for regular small cigars or cigarillos in grades 8, 10, and 12, respectively.

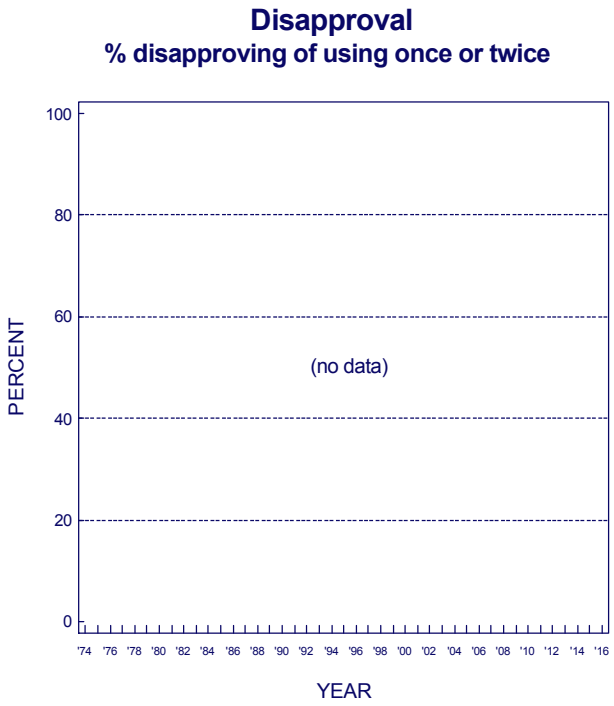
Large Cigars. A question on the 30-day prevalence of smoking large cigars also was added in 2014. The rates were 1.5%, 2.3%, and 6.5% in 2016—with all three grades showing declines in 2016 (significant in 8th and 10th grades).

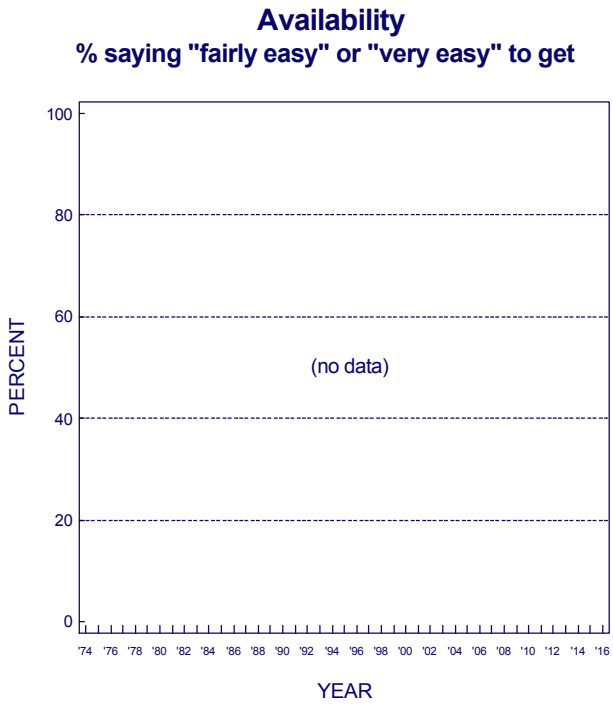
Small Cigars and Tobacco using a Hookah: Trends in Annual Use

Grade 12









Source. The Monitoring the Future study, the University of Michigan.

Steroids

Unlike all other drugs discussed in this Overview, anabolic steroids are not usually taken for their psychoactive effects, though they may have some, but rather for muscle and strength development. However, they are similar to most other drugs studied here in two respects: they are controlled substances for which there is an illicit market, and they can have adverse consequences for the user. Questions about steroid use were added beginning in 1989. Respondents are asked: "Steroids, or anabolic steroids, are sometimes prescribed by doctors to promote healing from certain types of injuries. Some athletes, and others, have used them to try to increase muscle development. The question asks, "On how many occasions (if any) have you taken steroids on your own—that is, without a doctor telling you to take them?" In 2006, the question text was changed slightly in some questionnaire forms—the phrase "to promote healing from certain types of injuries" was replaced by "to treat certain conditions." The resulting data did not show any effect from this rewording. In 2007, the remaining forms were changed in the same manner.

Trends in Use

Anabolic steroids have been used predominately by males; therefore, data based on all respondents can mask the higher rates and larger fluctuations that occur among males. (For example, in 2016, annual prevalence rates were 0.5%, 0.9%, and 1.3% for boys in grades 8, 10, and 12, compared with 0.5%, 0.5%, and 0.6% for girls.) Between 1991 and 1998, the overall annual prevalence rate was fairly stable among 8th and 10th graders, ranging between 0.9% and 1.2%. In 1999, however, use jumped from 1.2% to 1.7% in both 8th and 10th grades. (Almost all of that increase occurred among boys, increasing from 1.6% in 1998 to 2.5% in 1999 in 8th grade and from 1.9% to 2.8% in 10th grade. Thus, rates among boys increased by about half in a single year. By 2016 among all 8th graders, steroid use had declined by about two thirds to 0.5%. Among 10th graders, use continued to increase, reaching 2.2% in 2002, but then declined by about two thirds to 0.7% by 2016. In 12th grade, there was a different trend story. With data going back to 1989, we can see that steroid use first fell from 1.9% overall in 1989 to 1.1% in 1992—the low point. From 1992 to 2000, there was a more gradual increase in use, reaching 1.7% in 2000. In 2001, use rose significantly among 12th graders to 2.4% (possibly reflecting a cohort effect). Twelfth graders' use decreased significantly in 2005 to 1.5%, then stayed fairly level through 2015 (1.7%), and then declined significantly in 2016 to 1.0%. Use is now down from recent peak levels by about two-thirds among 8th and 10th graders, and about six-tenths among 12th graders. (The use of androstenedione—a steroid precursor—has also declined sharply since 2001, most sharply through 2007. It was classified as a Schedule II controlled substance in 2005 by the DEA.)

Perceived Risk

Perceived risk and disapproval were asked of 8th and 10th graders for only a few years. All grades seemed to have a peak in perceived risk around 1993. The longer-term data from 12th graders show a ten percentage-point drop between 1998 and 2000. A change this sharp is quite unusual and highly significant, suggesting that some particular event or events in 1998—quite possibly publicity about use of androstenedione by a famous home-run-hitting baseball player—made steroids seem less risky. It seems likely that perceived risk dropped substantially in the lower grades as well, consistent with the sharp upturn in their use that year. By 2006, perceived risk for 12th graders was up to 60%, with little change until 2013 when it showed a significant 4.4 percentage point decline, reaching 54%, the lowest point ever. It stands at 55% in 2016.

Disapproval

Among 12th graders, disapproval of steroid use has been quite high for some years. Between 1998 and 2003, there was a modest decrease, though not as dramatic as the drop in perceived risk. From 2003 to 2008, disapproval rose some—as perceived risk rose and use declined—then leveled and declined from 2012 through 2014, before leveling.

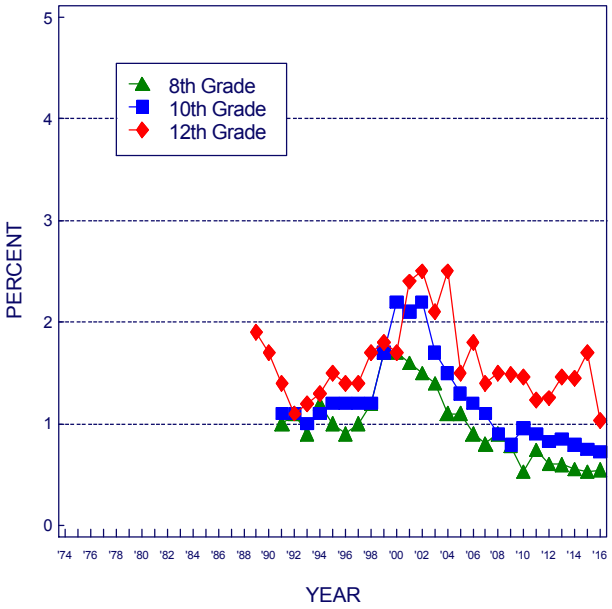
Availability

Perceived availability of steroids was relatively high prior to 2001 or 2002, but it declined appreciably at all grades through 2016 (2015 in the case of the 8th graders) reaching the lowest levels recorded by the study. A number of steroids have been scheduled by the DEA, no doubt contributing to the drop in availability.

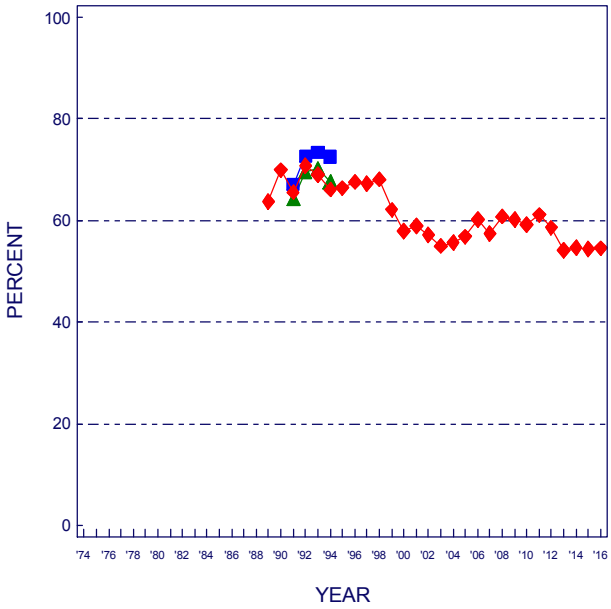
Steroids: Trends in Annual Use, Risk, Disapproval, and Availability

Grades 8, 10, 12

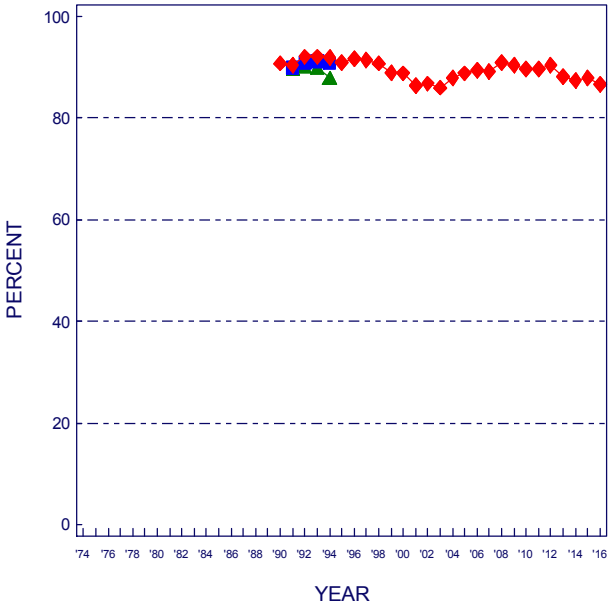
Use
% who used in last 12 months



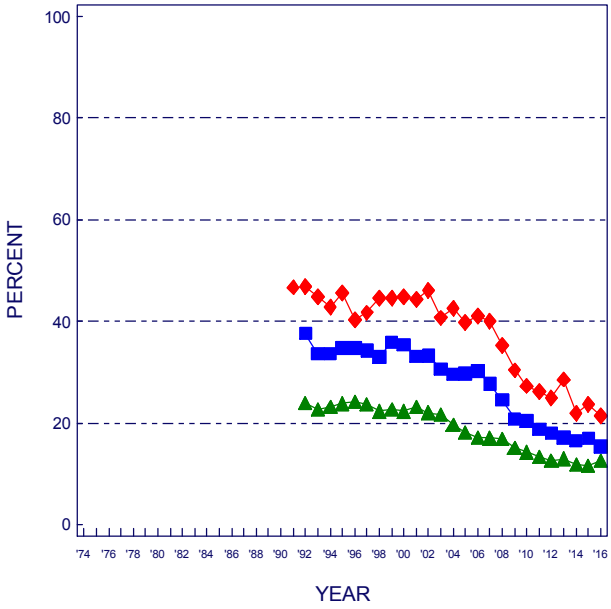
Risk*
% seeing "great risk" in using once or twice



Disapproval*
% disapproving of using once or twice



Availability
% saying "fairly easy" or "very easy" to get



Source. The Monitoring the Future study, the University of Michigan.
*Question discontinued in 8th- and 10th-grade questionnaires in 1995.

Subgroup Differences

Understanding the important subgroup variations in substance use among the nation's youth allows for more informed considerations of substance use etiology and prevention. It also helps to prioritize prevention and treatment efforts. In this section, we present a brief overview of some of the major demographic subgroup differences.

Space does not permit a full discussion or documentation of the many subgroup differences of the drugs covered in this report. However, the forthcoming *Volume I* in this series contains tables providing the 2016 subgroup prevalence levels for all of the classes of drugs discussed here; Chapters 4 and 5 in *Volume I* have in-depth discussion and interpretation of those subgroup differences. Comparisons are made by gender, race/ethnicity, college plans, region of the country, community size, and socioeconomic level (as measured by educational level of the parents). In addition, an annual Monitoring the Future Occasional Paper provides tables giving cross-time trends in the subgroup prevalence levels for all of the classes of drugs discussed here and, importantly, charts showing the subgroup trends for all drugs. This Occasional Paper, *Demographic subgroup trends among adolescents in the use of various licit and illicit drugs 1975-2016*, is Number 88 in the series and contains data through 2016. It is available on the MTF website: http://www.monitoringthefuture.org/pubs/occpapers/mtf-occ88.pdf. The graphs in the occasional paper present easily accessible views of trends and comparisons while the occasional paper's tables provide the specific numbers behind the figures.

Gender

Generally, males have somewhat higher rates of illicit drug use than females (especially higher rates of frequent use), most notably by 12th grade. Males in all three grades have much higher rates of smokeless tobacco and steroid use and, in the upper grades, higher rates of use of small cigars, large cigars, dissolvable tobacco, and snus specifically. The primary exception may be found in the misuse of prescription drugs like amphetamines, sedatives, and tranquilizers, where females have tended to have higher rates of use than males in the early grades. But misuse of prescription narcotics males: their use is reported only at grade 12 and males have consistently had higher rates of use. For most drugs, though, the gender differences among 8th graders are very small, with females fairly consistently reporting slightly higher rates than males through 2015; in 2016 males were equal to or higher than females in the use of several drugs. Among 10th graders, males have generally, though not always, reported higher rates than females.

Among 12th graders, for many years males consistently reported distinctly higher 30-day alcohol usage rates than females; however, the differences have been narrowing and in 2016 females have slightly higher prevalences in 8th and 10th grades and only a slightly lower one in 12th grade (32% vs. 35%). Gender differences in binge drinking have followed a similar pattern—females report higher or the same rates in 8th grade, males somewhat higher rates in 10th grade until 2016, and males higher rates in 12th grade (though again the gap is narrowing).

Gender differences in 30-day cigarette smoking among 8th and 10th graders have generally been minimal, but 10th grade males have reported slightly higher rates than females in recent years. Among 12th graders, females generally had higher rates of smoking than males through 1990, but since then males have generally had the higher rates (13% vs. 8% in 2016).

The gender differences in substance use appear to emerge for many drugs as students grow older. In 8th grade, females have higher rates of use for some drugs, such as inhalants and amphetamines. Prevalence rates for both genders then increase with age (with the single exception of inhalants), but the increase is often sharper among males. At each grade level, usage rates for both genders generally tend to move much in parallel across time for the various substances, and the absolute differences between the genders tend to be largest in the historical periods in which overall prevalence rates are highest.

Race/Ethnicity

Among the most dramatic and interesting subgroup differences are those found among the three largest racial/ethnic groups—Whites, African Americans, and Hispanics. For a number of years White students had substantially higher rates of using any illicit drug than did African American students, but the differences have narrowed in recent years as a result of increasing marijuana use among African American students and a leveling among White students. (Marijuana use tends to drive the overall index of any illicit drug use and in

2016 is significantly higher among African American students than among White students in 8th grade and somewhat higher in 10th grade.) Still, African American students have tended to have lower levels of use for certain licit and illicit drugs at all three grade levels—in particular for hallucinogens, synthetic marijuana, and all forms of prescription drugs used without a doctor's orders. For 12th graders, crack and heroin use among African Americans has been higher than among Whites in recent years; and their use of bath salts is now higher in all three grades than bath salts use by either Whites or Hispanics.

African American students' use of alcohol and cigarettes tends to be significantly lower than Whites in all three grades. In fact, African Americans' use of cigarettes has been dramatically lower than Whites' use—a difference that emerged largely during the life of the study (i.e., since 1975).

Hispanic students generally have had rates of use that place them between the other two groups in 12th grade—usually closer to the rates for Whites than for African Americans. In the last few years, however, Hispanics have attained the highest reported rates of use of any illicit drug in all three grades—in large part due to their increase in marijuana use. Indeed, both African Americans and Hispanics have shown a considerably greater increase in marijuana use than Whites, at least until 2016 when their use fell significantly in both grades 8 and 10. In 12th grade Hispanics have the highest use rates for a number of substances—marijuana, synthetic marijuana, inhalants, hallucinogens, LSD, cocaine, crack, methamphetamine, and crystal methamphetamine. In 8th grade, Hispanics have tended to report the highest rates of the three racial/ethnic groups on nearly all classes of drugs. Like African American students, Hispanic students generally have lower rates than White students of misusing any of the prescription drugs, particularly in the upper grades.

Again, we refer the reader to OP 88 for a detailed picture of these complex subgroup differences and how they have changed over the years.

College Plans

While in high school, those students who are not college-bound (a decreasing proportion of the total youth population over the longer term) are considerably more likely to be at risk for using illicit drugs, drinking heavily, and particularly smoking cigarettes. Again, these differences are largest in periods of highest prevalence. In the lower grades, the college-bound had a greater increase in cigarette smoking than did their non-college-bound peers in the early to mid-1990s; but the college-bound also showed a considerably larger decline since then, leaving them with dramatically lower smoking rates at present than they had in the 1990s.

Region of the Country

The differences associated with region of the country are so sufficiently varied and complex that we cannot do justice to them here. In the past, the Northeast and West tended to have the highest proportions of students using any illicit drug, and the South, the lowest; however, these rankings have not applied to many of the specific drugs and do not apply to all grades today. The cocaine epidemic of the early 1980s was much more pronounced in the West and Northeast than in the other two regions, although the differences decreased as the overall epidemic subsided. The upsurge of ecstasy use in 1999 occurred primarily in the Northeast, but that drug's newfound popularity then spread to the three other regions of the country. While the South and West have generally had lower rates of drinking among students than the Northeast and the Midwest, those differences have narrowed somewhat in recent years and are now fairly small in all three grades. Cigarette smoking rates have generally been lowest in the West; but in 2016, after substantial declines in cigarette smoking in all three grades, the regional differences are smaller.

Population Density

There have not been very large or consistent differences in overall illicit drug use associated with population density since MTF began, helping to demonstrate just how universal the illicit drug phenomenon has been in this country. Use of any illicit drug has tended to be lowest in the more rural areas at 12th grade over most of the life of the study; and use of any illicit drug other than marijuana generally has been lower in large cities in 12th grade. Crack and heroin use have generally not been concentrated in urban areas, as is commonly believed, meaning that no parents and schools should assume that their children are immune to these threats simply because they do not live in a city. Since the late 1990s, students in non-urban areas have emerged with much higher smoking rates than others. For alcohol use there have not been large differences as a function of population density.

Socioeconomic Level

The average level of education of the student's parents, as reported by the student, is used as a proxy for socioeconomic status of the family. For many drugs the differences in use by socioeconomic class are very small, and the trends have been highly parallel. One very interesting difference occurred for cocaine, the use of which was *positively* associated with socioeconomic level in the early 1980s, meaning that higher parental education levels were associated with higher prevalence of cocaine use. However, with the advent of crack, which offered cocaine at a lower price, that association nearly disappeared by 1986.

Cigarette smoking showed a similar narrowing of class differences, but in this case a large *negative* association with socioeconomic level diminished considerably between roughly 1985 and 1993. In more recent years, that negative association has re-emerged in the lower grades as use declined faster among students from more educated families. We believe that the removal of the Joe Camel ad campaign, which seemed to reach males from educated families in particular, may have played a role in this.

With regard to alcohol, in recent years there has been essentially no association between parental education and binge drinking among 12th graders, nor among 10th graders in 2016, but a negative correlation among 8th graders has been fairly consistent. Similarly, while binge drinking in 8th and 10th grades is negatively correlated with parental education, in 12th grade there is virtually no association.

Lessons Learned

Implications for Prevention

The wide divergence in historical trajectories of the various drugs over time helps to illustrate that, to a considerable degree, the determinants of use are often specific to each drug. These determinants include both perceived benefits and perceived adverse outcomes that young people come to associate with each drug, as well as peer norms about their use and the availability of each drug.

Unfortunately, word of the supposed benefits of using a drug usually spreads much faster than information about the adverse consequences. Supposed benefits take only rumor and a few testimonials, the spread of which have been hastened and expanded greatly by the media and in particular the Internet. It usually takes much longer for the evidence of adverse consequences (e.g., adverse reactions, death, disease, overdose, addiction) to cumulate, be recognized, and then be disseminated. Thus, when a new drug comes onto the scene, it has a considerable "honeymoon period" during which its benefits are alleged and its consequences are not yet known. We believe that ecstasy illustrated this dynamic. Synthetic marijuana and so-called "bath salts" are two more recent examples. "Vaping" may be in a honeymoon period today.

Although encouraging the avoidance or delay of *any* type of substance use is likely beneficial, especially at young ages, prevention efforts also need to be drug-specific. That is, to a considerable degree, prevention must occur drug by drug because people will not necessarily generalize the adverse consequences of the use of one drug to the use of others. Many beliefs and attitudes held by young people are drug specific. The figures in this *Overview* on perceived risk and disapproval for the various drugs—attitudes and beliefs that we have shown to be important in explaining many drug trends over the years—amply illustrate this assertion. These attitudes and beliefs are at quite different levels for the various drugs and, more importantly, often trend quite differently over time.

Marijuana is one drug that is affected by some very specific policies, including medicalization and legalization of recreational use by adults. The effects on youth behaviors and attitudes of recent changes in a number of states will need to be carefully monitored to determine their longer-term effects. Currently, marijuana does not hold the same appeal for youth as it did in the past, and today's annual prevalence among 12th graders of 36% is considerably lower than rates exceeding 50% observed in the 1970s. However, if states that legalize recreational marijuana allow marijuana advertising and marketing, then prevalence could rebound and approach or even surpass past levels.

"Generational Forgetting" Helps Keep the Drug Epidemic Going

Another point worth keeping in mind is that there tends to be a continuous flow of new drugs onto the scene and of older ones being rediscovered by young people. Many drugs have made a comeback years after they first fell from popularity, often because knowledge among youth of their adverse consequences faded as generational replacement took place. We call this process "generational forgetting." Examples include LSD and methamphetamine, two drugs used widely in the 1960s that made a comeback in the 1990s after their initial popularity faded as a result of their adverse consequences becoming widely recognized during periods of high use. Heroin, cocaine, PCP, and crack are some others that have followed a similar pattern. LSD, inhalants, and ecstasy have all shown some effects of generational forgetting in recent years—that is, perceived risk has declined appreciably for those drugs, particularly among the younger students—which puts future cohorts at greater risk of having a resurgence in use. In the case of LSD, perceived risk among 8th graders has declined noticeably, and more students are saying that they are not familiar with the drug. It would appear that a resurgence in availability (which declined very sharply after about 2001, most likely due to the DEA closing a major lab in 2000) could generate another increase in use.

As for newly emerging drugs, examples include nitrite inhalants and PCP in the 1970s; crack and crystal methamphetamine in the 1980s; Rohypnol, GHB, and ecstasy in the 1990s; dextromethorphan, and salvia in the early 2000s; and "bath salts," "synthetic marijuana," and "vaping" more recently. The frequent introduction of new drugs (or new forms or new modes of administration of older drugs, as illustrated by crack, crystal meth-amphetamine, and non-injected heroin) helps keep this nation's drug problem alive. Because of the lag times described previously, the forces of containment are always playing catch-up with the forces of encouragement and exploitation. Organized efforts to reduce the grace period experienced by new drugs would seem to be among the most promising responses for minimizing the damage they will cause. Such efforts regarding ecstasy by the National Institute on Drug Abuse and others appeared to pay off.

As for other approaches to prevention, it may be useful to emphasize that almost any new drug should be considered dangerous because such drugs are made and sold by people unconcerned with possible adverse consequences on users. Those who manufacture synthetic drugs are constantly changing the chemical formulations in order to skirt laws prohibiting their sale, and they make no effort to assess the safety of each new formulation. As a result there are many drugs on the market with little or no information about their adverse effects, and many injuries and deaths result from their use. If young people understood this, they might be less likely to use.

TABLE 1

Trends in Lifetime Prevalence of Use of Various Drugs for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Any Illicit Drug[b]	30.4	29.8	32.1	35.7	38.9	42.2	*43.3*	42.3	41.9	41.0	40.9	39.5	37.5	36.4	35.7
Any Illicit Drug other than Marijuana[b]	19.7	19.7	21.2	22.0	23.6	*24.2*	24.0	23.1	22.7	22.1‡	*23.2*	21.1	19.8	19.3	18.6
Any Illicit Drug including Inhalants[b]	36.8	36.3	38.8	41.9	44.9	47.4	*48.2*	47.4	46.9	46.2	45.5	43.7	41.9	41.3	41.0
Marijuana/Hashish	22.7	21.1	23.4	27.8	31.6	35.6	**37.8**	36.5	36.4	35.3	35.3	34.0	32.4	31.4	30.8
Inhalants	17.0	16.9	18.2	18.6	**19.4**	19.1	18.6	18.1	17.5	16.4	15.3	13.6	13.4	13.7	14.1
Hallucinogens	6.1	6.3	7.0	7.7	8.9	10.0	*10.2*	9.5	9.0	8.5‡	**9.2**	7.6	6.9	6.3	5.9
LSD	5.5	5.7	6.5	6.9	8.1	8.9	**9.1**	8.3	7.9	7.2	6.5	5.0	3.7	3.0	2.6
Hallucinogens other than LSD	2.4	2.5	2.7	3.6	3.9	4.8	*4.9*	4.8	4.4	4.5‡	**6.7**	6.0	5.8	5.6	5.4
Ecstasy (MDMA)[c], original	–	–	–	–	–	4.9	5.2	4.5	5.3	7.2	**8.0**	6.9	5.4	4.7	4.0
Revised	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cocaine	4.6	4.0	4.1	4.5	5.1	6.0	6.6	7.0	**7.2**	6.5	5.9	5.7	5.3	5.5	5.5
Crack	2.0	1.9	2.0	2.5	2.8	3.2	3.4	**3.8**	**3.8**	3.5	3.2	3.2	2.9	2.9	2.8
Other cocaine	4.1	3.5	3.6	3.9	4.2	5.2	5.9	6.1	**6.3**	5.6	5.1	4.8	4.5	4.7	4.7
Heroin	1.1	1.3	1.3	1.6	1.9	2.1	2.1	**2.2**	**2.2**	2.1	1.7	1.7	1.5	1.5	1.5
With a needle	–	–	–	–	1.1	1.2	1.1	1.1	**1.3**	1.0	0.9	0.9	0.9	0.9	0.9
Without a needle	–	–	–	–	1.3	1.7	1.7	1.6	1.6	**1.8**	1.3	1.3	1.3	1.2	1.1
Amphetamines[b]	12.9	12.5	13.8	14.3	15.2	*15.5*	15.2	14.5	14.0	13.5	13.9	13.1	11.8	11.2	10.3
Methamphetamine	–	–	–	–	–	–	–	–	**6.5**	6.2	5.8	5.3	5.0	4.5	3.9
Tranquilizers	5.5	5.3	5.4	5.5	5.8	6.5	6.6	6.9	*7.0*	6.9‡	**7.9**	**7.9**	7.3	7.1	6.8
Alcohol	*80.1*	79.2‡	68.4	68.4	68.2	68.4	**68.8**	67.4	66.4	66.6	65.5	62.7	61.7	60.5	58.6
Been drunk	**46.3**	44.9	44.6	44.3	44.5	45.1	45.7	44.0	43.7	44.0	43.4	40.5	38.9	39.4	38.4
Flavored alcoholic beverages	–	–	–	–	–	–	–	–	–	–	–	–	–	**54.7**	**54.7**
Cigarettes	53.5	53.0	54.0	54.6	55.8	**57.8**	57.4	56.0	54.5	51.8	49.1	44.2	40.8	39.6	37.4
Smokeless Tobacco	–	26.2	25.6	**26.3**	26.0	25.7	22.7	21.1	19.4	17.9	16.6	15.2	14.1	13.6	13.8
Steroids	1.9	1.8	1.8	2.1	2.1	1.8	2.1	2.3	2.8	3.0	**3.3**	**3.3**	3.0	2.5	2.1

Table continued on next page.

TABLE 1 (continued)
Trends in Lifetime Prevalence of Use of Various Drugs for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change	Peak year–2016 change: Absolute change	Peak year–2016 change: Proportional change (%) [a]	Low year–2016 change: Absolute change	Low year–2016 change: Proportional change
Any Illicit Drug[b]	34.0	32.7	32.6	33.2	34.4	34.7	34.1	36.0‡	**34.9**	34.3	32.6	-1.7 s	-2.3 ss	-6.5	—	—
Any Illicit Drug other than Marijuana[b]	18.2	17.7	16.8	16.5	16.8	16.1	15.5	16.8‡	**15.8**	15.1	14.3	-0.8	-1.5 s	-9.4	—	—
Any Illicit Drug including Inhalants[b]	39.3	38.0	37.9	37.9	38.8	38.7	37.9	39.3‡	**37.9**	37.4	34.9	-2.6 ss	-3.1 sss	-8.1	—	—
Marijuana/Hashish	28.9	27.9	27.9	29.0	30.4	31.0	30.7	32.0	30.5	30.0	28.6	-1.4 s	-9.2 sss	-24.3	+0.7	+2.6
Inhalants	13.7	13.5	13.1	12.5	12.1	10.6	10.0	8.9	8.8	7.5	6.5	-1.0 ss	-12.9 sss	-66.6	—	—
Hallucinogens	5.7	5.8	5.6	5.3	5.8	5.7	5.0	5.0	4.3	4.3	4.3	0.0	-4.9 sss	-53.6	—	—
LSD	2.5	2.6	2.7	2.5	2.8	2.7	2.5	2.6	2.4	2.8	3.1	+0.2	-6.0 sss	-66.3	+0.6 ss	+26.8
Hallucinogens other than LSD	5.2	5.1	4.8	4.7	5.0	4.9	4.3	4.1	3.5	3.1	3.0	-0.1	-3.7 sss	-55.3	—	—
Ecstasy (MDMA)[c], original	4.3	4.5	4.1	4.6	5.5	5.5	4.6	4.7	3.5	—	—	—	—	—	—	—
Revised	—	—	—	—	—	—	—	—	**5.0**	4.0	3.1	-0.9	-2.0 sss	-39.2	—	—
Cocaine	5.3	5.2	4.8	4.2	3.8	3.4	3.3	3.1	2.9	2.7	2.3	-0.4	-4.8 sss	-67.5	—	—
Crack	2.6	2.5	2.2	2.0	1.9	1.6	1.5	1.5	1.3	1.3	1.0	-0.2 s	-2.8 sss	-73.4	—	—
Other cocaine	4.7	4.6	4.1	3.7	3.4	3.1	2.9	2.7	2.5	2.3	2.1	-0.3	-4.2 sss	-66.9	—	—
Heroin	1.4	1.4	1.3	1.4	1.4	1.2	1.0	1.0	0.9	0.7	0.6	-0.1	-1.6 sss	-73.2	—	—
With a needle	0.9	0.8	0.8	0.8	0.9	0.8	0.6	0.7	0.7	0.5	0.4	-0.1	-0.9 sss	-67.8	—	—
Without a needle	1.0	1.0	0.9	0.9	1.0	0.9	0.7	0.7	0.6	0.5	0.4	0.0	-1.3 sss	-75.4	—	—
Amphetamines[b]	10.1	9.5	8.6	8.6	8.9	8.6	8.3	10.5‡	**9.7**	9.1	8.1	-0.9 ss	-1.6 sss	-16.0	—	—
Methamphetamine	3.4	2.5	2.5	2.2	2.2	1.8	1.6	1.5	1.4	1.1	0.8	-0.2	-5.7 sss	-87.3	—	—
Tranquilizers	7.0	6.7	6.3	6.5	6.6	6.0	5.8	5.2	5.3	5.2	5.5	+0.3	-2.3 sss	-29.8	+0.3	-29.8
Alcohol	57.0	56.3	55.1	54.6	53.6	51.5	50.0	48.4	46.4	45.2	41.9	-3.3 sss	-26.8 sss	-39.0	—	—
Been drunk	37.6	36.6	35.1	35.9	34.2	32.5	32.8	31.7	29.2	28.2	26.4	-1.8 ss	-19.9 sss	-43.0	—	—
Flavored alcoholic beverages	53.1	51.3	49.3	47.9	46.7	44.5	42.7	41.1	38.8	37.4	33.8	-3.5 sss	-20.8 sss	-38.1	—	—
Cigarettes	35.0	33.3	31.3	31.2	30.9	28.7	27.0	25.6	22.9	21.1	18.2	-2.9 sss	-39.5 sss	-68.4	—	—
Smokeless Tobacco	13.3	12.9	12.3	13.5	14.5	13.8	13.5	12.8	12.1	11.3	10.3	-1.0	-16.0 sss	-60.9	—	—
E-Vaporizers	—	—	—	—	—	—	—	—	—	**29.9**	26.6	-3.3 sss	-3.3 sss	-11.0	—	—
Steroids	2.0	1.8	1.6	1.5	1.5	1.5	1.4	1.5	1.4	1.5	1.3	-0.2	-2.0 sss	-60.9	—	—

Source. The Monitoring the Future study, the University of Michigan.

Notes. ' – ' indicates data not available. ' ‡ ' indicates a change in the question text. When a question change occurs, peak levels after that change are used to calculate the peak year to current year difference.

Values in bold equal peak levels since 1991. Values in italics equal peak level before wording change. Underlined values equal lowest level since recent peak level.

Level of significance of difference between classes: s = .05, ss = .01, sss = .001.

Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]The proportional change is the percent by which the most recent year deviates from the peak year [or the low year] for the drug in question. So, if a drug was at 20% prevalence in the peak year and declined to 10% prevalence in the most recent year, that would reflect a proportional decline of 50%.

[b]In 2013, for the questions on the use of amphetamines, the text was changed on two of the questionnaire forms for 8th and 10th graders and four of the questionnaire forms for 12th graders. This change also impacted the any illicit drug indices. Data prsented here include only the changed forms beginning in 2013.

[c]In 2014, the text was changed on one of the questionnaire forms for 8th, 10th, and 12th graders to include "molly" in the description. The remaining forms were changed in 2015. Data for both versions of the question are presented here.

TABLE 2
Trends in Annual Prevalence of Use of Various Drugs for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Any Illicit Drug[c]	20.2	19.7	23.2	27.6	31.0	33.6	*34.1*	32.2	31.9	31.4	31.8	30.2	28.4	27.6	27.1
Any Illicit Drug other than Marijuana[c]	12.0	12.0	13.6	14.6	16.4	*17.0*	16.8	15.8	15.6	15.3‡	*16.3*	14.6	13.7	13.5	13.1
Any Illicit Drug including Inhalants[c]	23.5	23.2	26.7	31.1	34.1	36.6	*36.7*	35.0	34.6	34.1	34.3	32.3	30.8	30.1	30.1
Marijuana/Hashish	15.0	14.3	17.7	22.5	26.1	29.0	**30.1**	28.2	27.9	27.2	27.5	26.1	24.6	23.8	23.4
Synthetic marijuana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Inhalants	7.6	7.8	8.9	9.6	**10.2**	9.9	9.1	8.5	7.9	7.7	6.9	6.1	6.2	6.7	7.0
Hallucinogens	3.8	4.1	4.8	5.2	6.6	*7.2*	6.9	6.3	6.1	5.4‡	**6.0**	4.5	4.1	4.0	3.9
LSD	3.4	3.8	4.3	4.7	5.9	**6.3**	6.0	5.3	5.3	4.5	4.1	2.4	1.6	1.6	1.5
Hallucinogens other than LSD	1.3	1.4	1.7	2.2	2.7	*3.2*	*3.2*	3.1	2.9	2.8‡	**4.0**	3.7	3.6	3.6	3.4
Ecstasy (MDMA)[d], original	–	–	–	–	–	3.1	3.4	2.9	3.7	5.3	**6.0**	4.9	3.1	2.6	2.4
Revised	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Salvia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cocaine	2.2	2.1	2.3	2.8	3.3	4.0	4.3	**4.5**	**4.5**	3.9	3.5	3.7	3.3	3.5	3.5
Crack	1.0	1.1	1.2	1.5	1.8	2.0	2.1	**2.4**	2.2	2.1	1.8	2.0	1.8	1.7	1.6
Other cocaine	2.0	1.8	2.0	2.3	2.8	3.4	3.7	3.7	**4.0**	3.3	3.0	3.1	2.8	3.1	3.0
Heroin	0.5	0.6	0.6	0.9	1.2	**1.3**	**1.3**	1.2	**1.3**	**1.3**	0.9	1.0	0.8	0.9	0.8
With a needle	–	–	–	–	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	0.5	0.5	0.5	0.5	0.5	0.5
Without a needle	–	–	–	–	0.9	0.9	1.0	0.9	1.0	**1.1**	0.7	0.7	0.6	0.7	0.7
OxyContin	–	–	–	–	–	–	–	–	–	–	–	2.7	3.2	3.3	3.4
Vicodin	–	–	–	–	–	–	–	–	–	–	–	6.0	**6.6**	5.8	5.7
Amphetamines[c]	7.5	7.3	8.4	9.1	10.0	10.4	10.1	9.3	9.0	9.2	9.6	8.9	8.0	7.6	7.0
Ritalin	–	–	–	–	–	–	–	–	–	–	**4.2**	3.8	3.5	3.6	3.3
Adderall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Methamphetamine	–	–	–	–	–	–	–	–	**4.1**	3.5	3.4	3.2	3.0	2.6	2.4
Bath salts (synthetic stimulants)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tranquilizers	2.8	2.8	2.9	3.1	3.7	4.1	4.1	4.4	4.4	*4.5*‡	**5.5**	5.3	4.8	4.8	4.7
OTC Cough/Cold Medicines	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Rohypnol	–	–	–	–	–	*1.1*	*1.1*	*1.1*	0.8	0.7	0.9‡	0.8	0.8	**0.9**	0.8
GHB[b]	–	–	–	–	–	–	–	–	–	**1.4**	1.2	1.2	1.2	1.1	0.8
Ketamine [b]	–	–	–	–	–	–	–	–	–	**2.0**	1.9	**2.0**	1.7	1.3	1.0
Alcohol	67.4	66.3‡	59.7	60.5	60.4	60.9	**61.4**	59.7	59.0	59.3	58.2	55.3	54.4	54.0	51.9
Been drunk	35.8	34.3	34.3	35.0	35.9	36.7	**36.9**	35.5	36.0	35.9	35.0	32.1	31.2	32.5	30.8
Flavored alcoholic beverages	–	–	–	–	–	–	–	–	–	–	–	–	–	**44.5**	43.9
Alcoholic beverages containing caffeine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dissolvable tobacco products	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Snus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Steroids	1.2	1.1	1.0	1.2	1.3	1.1	1.2	1.3	1.7	1.9	**2.0**	**2.0**	1.7	1.6	1.3

Table continued on next page.

TABLE 2 (continued)
Trends in Annual Prevalence of Use of Various Drugs for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change	Peak year–2016 change: Absolute change	Peak year–2016 change: Proportional change (%) [a]	Low year–2016 change: Absolute change	Low year–2016 change: Proportional change
Any Illicit Drug[c]	25.8	24.8	24.9	25.9	27.3	27.6	27.1	28.6‡	**27.2**	26.8	25.3	-1.4 s	-1.9 s	-6.9	—	—
Any Illicit Drug other than Marijuana[c]	12.7	12.4	11.9	11.6	11.8	11.3	10.8	11.4‡	**10.9**	10.5	9.7	-0.8 s	-1.2 s	-11.0	—	—
Any Illicit Drug including Inhalants[c]	28.7	27.6	27.6	28.5	29.7	29.8	29.0	30.5‡	**28.5**	28.4	26.3	-2.1 ss	-2.2 ss	-7.8	—	—
Marijuana/Hashish	22.0	21.4	21.5	22.9	24.5	25.0	24.7	25.8	24.2	23.7	22.6	-1.1	-7.5 sss	-24.8	+1.2	+5.8
Synthetic marijuana	—	—	—	—	—	—	**8.0**	6.4	4.8	4.2	3.1	-1.0 sss	-4.9 sss	-60.7	—	—
Inhalants	6.9	6.4	6.4	6.1	6.0	5.0	4.5	3.8	3.6	3.2	2.6	-0.5 s	-7.5 sss	-74.0	—	—
Hallucinogens	3.6	3.8	3.8	3.5	3.8	3.7	3.2	3.1	2.8	2.8	2.8	0.0	-3.2 sss	-53.5	—	—
LSD	1.4	1.7	1.9	1.6	1.8	1.8	1.6	1.6	1.7	1.9	2.0	+0.1	-4.4 sss	-69.0	+0.6 ss	+39.5
Hallucinogens other than LSD	3.3	3.3	3.2	3.0	3.3	3.1	2.7	2.5	2.1	1.9	1.8	-0.1	-2.2 sss	-55.2	—	—
Ecstasy (MDMA)[d], original	2.7	3.0	2.9	3.0	3.8	3.7	2.5	2.8	2.2	—	—	—	—	—	—	—
Revised	—	—	—	—	—	—	—	—	**3.4**	2.4	1.8	-0.6 sss	-1.6 sss	-46.8	—	—
Salvia	—	—	—	—	3.5	**3.6**	2.7	2.3	1.4	1.2	1.2	0.0	-2.4 sss	-67.1	—	—
Cocaine	3.5	3.4	2.9	2.5	2.2	2.0	1.9	1.8	1.6	1.7	1.4	-0.3 s	-3.0 sss	-68.3	—	—
Crack	1.5	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.8	0.6	-0.2 ss	-1.8 sss	-75.6	—	—
Other cocaine	3.1	2.9	2.6	2.1	1.9	1.7	1.7	1.5	1.5	1.5	1.2	-0.2	-2.8 sss	-69.1	—	—
Heroin	0.8	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.4	0.3	-0.1 s	-1.0 sss	-77.4	—	—
With a needle	0.5	0.5	0.5	0.5	0.6	0.5	0.4	0.4	0.4	0.3	0.3	0.0	-0.4 sss	-62.4	—	—
Without a needle	0.6	0.7	0.6	0.5	0.6	0.5	0.4	0.4	0.3	0.3	0.2	-0.1	-0.9 sss	-82.5	—	—
OxyContin	3.5	3.5	3.4	**3.9**	3.8	3.4	2.9	2.9	2.4	2.3	2.1	-0.2	-1.8 sss	-45.9	—	—
Vicodin	6.3	6.2	6.1	6.5	5.9	5.1	4.3	3.7	3.0	2.5	1.8	-0.7 ss	-4.8 sss	-72.5	—	—
Amphetamines[c]	6.8	6.5	5.8	5.9	6.2	5.9	5.6	7.0‡	**6.6**	6.2	5.4	-0.8 ss	-1.2 sss	-17.9	—	—
Ritalin	3.5	2.8	2.6	2.5	2.2	2.1	1.7	1.7	1.5	1.4	1.1	-0.3	-3.1 sss	-74.8	—	—
Adderall	—	—	—	4.3	**4.5**	4.1	4.4	4.4	4.1	4.5	3.9	-0.6 ss	-0.5 s	-10.3	—	—
Methamphetamine	2.0	1.4	1.3	1.3	1.3	1.2	1.0	1.0	0.8	0.6	0.5	-0.1	-3.6 sss	-88.1	—	—
Bath salts (synthetic stimulants)	—	—	—	—	—	—	**0.9**	**0.9**	0.8	0.7	0.8	+0.1	-0.1	-13.3	+0.1	+18.8
Tranquilizers	4.6	4.5	4.3	4.5	4.4	3.9	3.7	3.3	3.4	3.4	3.5	+0.1	-2.0 sss	-36.2	+0.2	+5.7
OTC Cough/Cold Medicines	**5.4**	5.0	4.7	5.2	4.8	4.4	4.4	4.0	3.2	3.1	3.2	+0.1	-2.2 sss	-40.6	+0.1	+2.1
Rohypnol	0.7	0.8	0.7	0.6	0.8	0.9	0.7	0.6	0.5	0.5	0.7	+0.2 s	-0.2	-25.2	+0.2 s	+43.4
GHB[b]	0.9	0.7	0.9	0.9	0.8	0.8	—	—	—	—	—	—	—	—	—	—
Ketamine [b]	1.1	1.0	1.2	1.3	1.2	1.2	—	—	—	—	—	—	—	—	—	—
Alcohol	50.7	50.2	48.7	48.4	47.4	45.3	44.3	42.8	40.7	39.9	36.7	-3.2 sss	-24.7 sss	-40.2	—	—
Been drunk	30.7	29.7	28.1	28.7	27.1	25.9	26.4	25.4	23.6	22.5	20.7	-1.8 ss	-16.2 sss	-44.0	—	—
Flavored alcoholic beverages	42.4	40.8	39.0	37.8	35.9	33.7	32.5	31.3	29.4	28.8	25.3	-3.5 sss	-19.1 sss	-43.0	—	—
Alcoholic beverages containing caffeine	—	—	—	—	—	**19.7**	18.6	16.6	14.3	13.0	11.2	-1.8	-8.4 sss	-43.0	—	—
Dissolvable tobacco products	—	—	—	—	—	—	**1.4**	**1.4**	**1.2**	1.1	0.9	-0.2	-0.5	-34.1	—	—
Snus	—	—	—	—	—	—	**5.6**	4.8	4.1	3.8	3.6	-0.2	-2.0 sss	-36.0	—	—
Steroids	1.3	1.1	1.1	1.0	0.9	0.9	0.9	0.9	0.9	1.0	0.8	-0.2 ss	-1.3 sss	-62.5	—	—

Source. The Monitoring the Future study, the University of Michigan.

Notes. ' – ' indicates data not available. ' ‡ ' indicates a change in the question text. When a question change occurs, peak levels after that change are used to calculate the peak year to current year difference.

Values in bold equal peak levels since 1991. Values in italics equal peak level before wording change. Underlined values equal lowest level since recent peak level.

Level of significance of difference between classes: s = .05, ss = .01, sss = .001.

Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]The proportional change is the percent by which the most recent year deviates from the peak year [or the low year] for the drug in question. So, if a drug was at 20% prevalence in the peak year and declined to 10% prevalence in the most recent year, that would reflect a proportional decline of 50%.

[b]Question was discontinued among 8th and 10th graders in 2012.

[c]In 2013, for the questions on the use of amphetamines, the text was changed on two of the questionnaire forms for 8th and 10th graders and four of the questionnaire forms for 12th graders. This change also impacted the any illicit drug indices. Data prese here include only the changed forms beginning in 2013.

[d]In 2014, the text was changed on one of the questionnaire forms for 8th, 10th, and 12th graders to include "molly" in the description. The remaining forms were changed in 2015. Data for both versions of the question are presented here.

TABLE 3
Trends in 30-Day Prevalence of Use of Various Drugs for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Any Illicit Drug[b]	10.9	10.5	13.3	16.8	18.6	*20.6*	20.5	19.5	19.5	19.2	19.4	18.2	17.3	16.2	15.8
Any Illicit Drug other than Marijuana[b]	5.4	5.5	6.5	7.1	*8.4*	*8.4*	*8.4*	8.2	7.9	8.0‡	*8.2*	7.7	7.1	7.0	6.7
Any Illicit Drug including Inhalants[b]	13.0	12.5	15.4	18.9	20.7	*22.4*	22.2	21.1	21.1	21.0	20.8	19.5	18.6	17.5	17.5
Marijuana/Hashish	8.3	7.7	10.2	13.9	15.6	17.7	**17.9**	16.9	16.9	16.3	16.6	15.3	14.8	13.6	13.4
Inhalants	3.2	3.3	3.8	4.0	**4.3**	3.9	3.7	3.4	3.3	3.2	2.8	2.7	2.7	2.9	2.9
Hallucinogens	1.5	1.6	1.9	2.2	*3.1*	2.7	3.0	2.8	2.5	2.0‡	**2.3**	1.7	1.5	1.5	1.5
LSD	1.3	1.5	1.6	1.9	**2.8**	2.1	2.4	2.3	2.0	1.4	1.5	0.7	0.6	0.6	0.6
Hallucinogens other than LSD	0.5	0.5	0.7	1.0	1.0	*1.2*	*1.2*	*1.2*	1.1	1.1‡	**1.4**	**1.4**	1.2	1.3	1.2
Ecstasy (MDMA)[c], original	—	—	—	—	—	1.5	1.3	1.2	1.6	**2.4**	**2.4**	1.8	1.0	0.9	0.9
Revised	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cocaine	0.8	0.9	0.9	1.2	1.5	1.7	1.8	**1.9**	**1.9**	1.7	1.5	1.6	1.4	1.6	1.6
Crack	0.4	0.5	0.5	0.7	0.8	0.9	0.8	**1.0**	0.9	0.9	0.9	**1.0**	0.8	0.8	0.8
Other cocaine	0.7	0.7	0.8	1.1	1.2	1.3	1.5	1.6	**1.7**	1.4	1.3	1.3	1.2	1.4	1.3
Heroin	0.2	0.3	0.3	0.4	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	0.4	0.5	0.4	0.5	0.5
With a needle	—	—	—	—	0.3	**0.4**	0.3	**0.4**	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Without a needle	—	—	—	—	0.4	0.4	**0.5**	0.4	0.4	0.4	0.3	0.4	0.3	0.3	0.3
Amphetamines[b]	3.0	3.3	3.9	4.0	4.5	*4.8*	4.5	4.3	4.2	4.5	4.7	4.4	3.9	3.6	3.3
Methamphetamine	—	—	—	—	—	—	—	—	**1.5**	**1.5**	1.4	**1.5**	1.4	1.1	0.9
Tranquilizers	1.1	1.1	1.1	1.3	1.6	1.7	1.7	1.9	1.9	*2.1*‡	2.3	**2.4**	2.2	2.1	2.1
Alcohol	*39.8*	38.4‡	36.3	37.6	37.8	**38.8**	38.6	37.4	37.2	36.6	35.5	33.3	33.2	32.9	31.4
Been drunk	19.2	17.8	18.2	19.3	20.3	20.4	**21.2**	20.4	20.6	20.3	19.7	17.4	17.7	18.1	17.0
Flavored alcoholic beverages	—	—	—	—	—	—	—	—	—	—	—	—	—	**23.0**	21.6
Cigarettes	20.7	21.2	23.4	24.7	26.6	**28.3**	**28.3**	27.0	25.2	22.6	20.2	17.7	16.6	16.1	15.3
Smokeless Tobacco	—	9.2	9.1	**9.7**	9.6	8.5	8.0	7.0	6.3	5.8	6.1	5.2	5.3	5.1	5.3
E-cigarettes	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Large Cigars	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Flavored Little Cigars	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Regular Little Cigars	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Steroids	0.6	0.6	0.6	0.7	0.6	0.5	0.7	0.7	0.9	0.9	0.9	**1.0**	0.9	0.9	0.7

Table continued on next page.

TABLE 3 (continued)
Trends in 30-Day Prevalence of Use of Various Drugs for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change	Peak year–2016 change: Absolute change	Peak year–2016 change: Proportional change (%) [a]	Low year–2016 change: Absolute change	Low year–2016 change: Proportional change
Any Illicit Drug[b]	14.9	14.8	14.6	15.8	16.7	17.0	16.8	17.3‡	**16.5**	15.9	15.5	-0.4	-1.0	-6.0	—	—
Any Illicit Drug other than Marijuana[b]	6.4	6.4	5.9	5.7	5.7	5.7	5.2	5.4‡	**5.4**	5.1	4.6	-0.5 s	-0.9 ss	-15.7	—	—
Any Illicit Drug including Inhalants[b]	16.5	16.5	16.1	17.3	18.0	18.3	17.6	18.4‡	**17.3**	16.8	16.0	-0.7	-1.3 s	-7.4	—	—
Marijuana/Hashish	12.5	12.4	12.5	13.8	14.8	15.2	15.1	15.6	14.4	14.0	13.7	-0.3	-4.2 sss	-23.4	+1.4 ss	+10.9
Inhalants	2.7	2.6	2.6	2.5	2.4	2.1	1.7	1.5	1.4	1.3	1.2	-0.1	-3.1 sss	-72.8	—	—
Hallucinogens	1.3	1.4	1.4	1.3	1.4	1.3	1.1	1.1	1.0	1.0	1.0	0.0	-1.3 sss	-57.3	—	—
LSD	0.6	0.6	0.7	0.5	0.7	0.7	0.5	0.6	0.6	0.7	0.7	0.0	-2.1 sss	-74.9	+0.1	+26.7
Hallucinogens other than LSD	1.1	1.1	1.1	1.0	1.2	1.0	0.9	0.8	0.7	0.6	0.5	-0.1	-0.9 sss	-62.9	—	—
Ecstasy (MDMA)[c], original	1.0	1.1	1.2	1.2	1.5	1.4	0.8	1.0	0.8	—	—	—	—	—	—	—
Revised	—	—	—	—	—	—	—	—	**1.1**	0.8	0.6	-0.3 ss	-0.5 s	-49.1	—	—
Cocaine	1.6	1.4	1.3	1.0	0.9	0.8	0.8	0.8	0.7	0.8	0.5	-0.3 ss	-1.3 sss	-71.8	—	—
Crack	0.7	0.7	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	-0.1	-0.7 sss	-73.9	—	—
Other cocaine	1.4	1.1	1.1	0.8	0.8	0.7	0.7	0.6	0.6	0.7	0.4	-0.3 sss	-1.3 sss	-75.9	—	—
Heroin	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.0	-0.4 sss	-64.4	—	—
With a needle	0.3	0.3	0.3	0.2	0.3	0.3	0.2	0.2	0.3	0.1	0.2	0.0	-0.2 sss	-57.6	0.0	+15.6
Without a needle	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.1	-0.1	-0.4 sss	-74.8	—	—
Amphetamines[b]	3.0	3.2	2.6	2.7	2.7	2.8	2.5	3.2‡	**3.2**	2.7	2.5	-0.3	-0.7 sss	-22.3	—	—
Methamphetamine	0.7	0.5	0.7	0.5	0.6	0.5	0.5	0.4	0.3	0.3	0.3	-0.1	-1.3 sss	-83.1	—	—
Tranquilizers	2.1	2.0	1.9	1.9	1.9	1.7	1.5	1.5	1.5	1.5	1.4	-0.1	-1.0 sss	-43.0	—	—
Alcohol	31.0	30.1	28.1	28.4	26.8	25.5	25.9	24.3	22.6	21.8	19.8	-2.0 sss	-19.0 sss	-49.0	—	—
Been drunk	17.4	16.5	14.9	15.2	14.6	13.5	14.7	13.5	11.9	11.0	10.1	-0.9 s	-11.1 sss	-52.4	—	—
Flavored alcoholic beverages	21.7	20.4	18.6	17.9	17.0	15.2	14.9	14.0	12.9	12.8	10.9	-1.9 sss	-12.2 sss	-52.7	—	—
Cigarettes	14.4	13.6	12.6	12.7	12.8	11.7	10.6	9.6	8.0	7.0	5.9	-1.1 sss	-22.4 sss	-79.3	—	—
Smokeless Tobacco	5.1	5.2	4.9	6.0	6.5	5.9	5.6	5.7	5.4	4.7	4.1	-0.5	-5.5 sss	-57.3	—	—
E-Vaporizers	—	—	—	—	—	—	—	—	—	**12.8**	9.9	-2.9 sss	-2.9 sss	-22.8	—	—
Large Cigars	—	—	—	—	—	—	—	—	3.9	**4.2**	3.3	-0.9 sss	-0.9 sss	-20.9	—	—
Flavored Little Cigars	—	—	—	—	—	—	—	—	**7.4**	7.1	5.6	-1.5 sss	-1.8 sss	-24.4	—	—
Regular Little Cigars	—	—	—	—	—	—	—	—	4.5	**4.9**	3.6	-1.3 sss	-1.3 sss	-26.9	—	—
Steroids	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.4	-0.1	-0.6 sss	-57.6	—	—

Source. The Monitoring the Future study, the University of Michigan.

Notes. ' – ' indicates data not available. ' ‡ ' indicates a change in the question text. When a question change occurs, peak levels after that change are used to calculate the peak year to current year difference.

Values in bold equal peak levels since 1991. Values in italics equal peak level before wording change. Underlined values equal lowest level since recent peak level.

Level of significance of difference between classes: s = .05, ss = .01, sss = .001.

Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]The proportional change is the percent by which the most recent year deviates from the peak year [or the low year] for the drug in question. So, if a drug was at 20% prevalence in the peak year and declined to 10% prevalence in the most recent year, that would reflect a proportional decline of 50%.

[b]In 2013, for the questions on the use of amphetamines, the text was changed on two of the questionnaire forms for 8th and 10th graders and four of the questionnaire forms for 12th graders. This change also impacted the any illicit drug indices. Data presented here include only the changed forms beginning in 2013.

[c]In 2014, the text was changed on one of the questionnaire forms for 8th, 10th, and 12th graders to include "molly" in the description. The remaining forms were changed in 2015. Data for both versions of the question are presented here.

TABLE 4
Trends in Daily Prevalence of Use of Selected Drugs and Heavy Use of Alcohol and Tobacco for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Marijuana	0.9	0.9	1.2	2.1	2.7	3.2	3.4	3.4	3.5	3.5	**3.7**	3.5	3.4	3.0	2.9
Alcohol	1.7	1.6‡	2.0	1.8	1.9	2.0	2.1	**2.2**	2.0	1.7	2.0	1.9	1.7	1.5	1.5
5+ drinks in a row in last 2 weeks	20.0	19.0	19.5	20.3	21.1	**21.9**	**21.9**	21.5	21.7	21.2	20.4	18.9	18.6	18.8	17.5
Been drunk	0.4	0.4	0.5	0.6	0.7	0.7	**0.9**	0.8	**0.9**	0.8	0.7	0.6	0.7	0.7	0.6
Cigarettes	12.4	11.9	13.5	14.0	15.5	16.8	**16.9**	15.4	15.0	13.4	11.6	10.2	9.3	9.0	8.0
1/2 pack+/day	6.5	6.1	6.9	7.2	7.9	**8.7**	8.6	7.9	7.6	6.4	5.7	4.9	4.5	4.1	3.7
Smokeless tobacco	—	**3.0**	2.7	2.9	2.5	2.3	2.5	2.1	1.7	1.9	2.0	1.4	1.6	1.7	1.6

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TABLE 4 (continued)
Trends in Daily Prevalence of Use of Selected Drugs and Heavy Use of Alcohol and Tobacco for Grades 8, 10, and 12 Combined

(Entries are percentages.)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change	Peak year–2016 change: Absolute change	Peak year–2016 change: Proportional change (%) [a]	Low year–2016 change: Absolute change	Low year–2016 change: Proportional change
Marijuana	2.8	2.7	2.8	2.8	3.4	3.6	3.6	3.7	3.3	3.3	3.0	-0.3	-0.7 sss	-18.6	+0.3	+9.9
Alcohol	1.5	1.6	1.4	1.3	1.4	1.0	1.2	1.1	1.0	0.8	0.7	-0.2 s	-1.5 sss	-69.4	—	—
5+ drinks in a row in last 2 weeks	17.4	17.2	15.5	16.1	14.9	13.6	14.3	13.2	11.7	10.7	9.4	-1.4 sss	-12.6 sss	-57.3	—	—
Been drunk	0.7	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.5	0.3	0.3	0.0	-0.6 sss	-66.7	—	—
Cigarettes	7.6	7.1	6.4	6.4	6.4	5.7	5.2	4.7	3.6	3.2	2.5	-0.7 sss	-14.5 sss	-85.5	—	—
1/2 pack+/day	3.4	3.0	2.7	2.6	2.5	2.1	1.9	1.8	1.4	1.1	0.9	-0.3 s	-7.9 sss	-89.9	—	—
Smokeless tobacco	1.5	1.6	1.6	1.8	2.1	1.8	1.9	1.7	1.8	1.7	1.4	-0.3	-1.6 sss	-52.9	—	—

Source. The Monitoring the Future study, the University of Michigan.

Notes. ' – ' indicates data not available. ' ‡ ' indicates a change in the question text. When a question change occurs, peak levels after that change are used to calculate the peak year to current year difference.

Values in bold equal peak levels since 1991. Values in italics equal peak level before wording change. Underlined values equal lowest level since recent peak level.

Level of significance of difference between classes: s = .05, ss = .01, sss = .001.

Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]The proportional change is the percent by which the most recent year deviates from the peak year [or the low year] for the drug in question. So, if a drug was at 20% prevalence in the peak year and declined to 10% prevalence in the most recent year, that would reflect a proportional decline of 50%.

TABLE 5
Trends in Lifetime Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Any Illicit Drug [a]																											
8th Grade	18.7	20.6	22.5	25.7	28.5	31.2	29.4	29.0	28.3	26.8	26.8	24.5	22.8	21.5	21.4	20.9	19.0	19.6	19.9	21.4	20.1	18.5‡	21.1	20.3	20.5	17.2	-3.3 sss
10th Grade	30.6	29.8	32.8	37.4	40.9	45.4	47.3	44.9	46.2	45.6	45.6	44.6	41.4	39.8	38.2	36.1	35.6	34.1	36.0	37.0	37.7	36.8‡	39.1	37.4	34.7	33.7	-1.1
12th Grade	44.1	40.7	42.9	45.6	48.4	50.8	54.3	54.1	54.7	54.0	53.9	53.0	51.1	51.1	50.4	48.2	46.8	47.4	46.7	48.2	49.9	49.1‡	49.8	49.1	48.9	48.3	-0.6
Any Illicit Drug other than Marijuana [a,b]																											
8th Grade	14.3	15.6	16.8	17.5	18.8	19.2	17.7	16.9	16.3	15.8‡	17.0	13.7	13.6	12.2	12.1	12.2	11.1	11.2	10.4	10.6	9.8	8.7‡	10.4	10.0	10.3	8.9	-1.4 s
10th Grade	19.1	19.2	20.9	21.7	24.3	25.5	25.0	23.6	24.0	23.1‡	23.6	22.1	19.7	18.8	18.0	17.5	18.2	15.9	16.7	16.8	15.6	14.9‡	16.4	15.9	14.6	14.0	-0.6
12th Grade	26.9	25.1	26.7	27.6	28.1	28.5	30.0	29.4	29.4	29.0‡	30.7	29.5	27.7	28.7	27.4	26.9	25.5	24.9	24.0	24.7	24.9	24.1‡	24.8	22.6	21.1	20.7	-0.4
Any Illicit Drug including Inhalants [a,c]																											
8th Grade	28.5	29.6	32.3	35.1	38.1	39.4	38.1	37.8	37.2	35.1	34.5	31.6	30.3	30.2	30.0	29.2	27.7	28.3	27.9	28.6	26.4	25.1‡	25.9	25.2	24.9	20.6	-4.2 sss
10th Grade	36.1	36.2	38.7	42.7	45.9	49.8	50.9	49.3	49.9	49.3	48.8	47.7	44.9	43.1	42.1	40.1	39.8	38.7	40.0	40.6	40.8	40.0‡	41.6	40.4	37.2	35.9	-1.3
12th Grade	47.6	44.4	46.6	49.1	51.5	53.5	56.3	56.1	56.3	57.0	56.0	54.6	52.8	53.0	53.5	51.2	49.1	49.3	48.4	49.9	51.8	50.3‡	52.3	49.9	51.4	49.3	-2.2
Marijuana/Hashish																											
8th Grade	10.2	11.2	12.6	16.7	19.9	23.1	22.6	22.2	22.0	20.3	20.4	19.2	17.5	16.3	16.5	15.7	14.2	14.6	15.7	17.3	16.4	15.2	16.5	15.6	15.5	12.8	-2.6 ss
10th Grade	23.4	21.4	24.4	30.4	34.1	39.8	42.3	39.6	40.9	40.3	40.1	38.7	36.4	35.1	34.1	31.8	31.0	29.9	32.3	33.4	34.5	33.8	35.8	33.7	31.1	29.7	-1.3
12th Grade	36.7	32.6	35.3	38.2	41.7	44.9	49.6	49.1	49.7	48.8	49.0	47.8	46.1	45.7	44.8	42.3	41.8	42.6	42.0	43.8	45.5	45.2	45.5	44.4	44.7	44.5	-0.1
Inhalants [c,d]																											
8th Grade	17.6	17.4	19.4	19.9	21.6	21.2	21.0	20.5	19.7	17.9	17.1	15.2	15.8	17.3	17.1	16.1	15.6	15.7	14.9	14.5	13.1	11.8	10.8	10.8	9.4	7.7	-1.7 ss
10th Grade	15.7	16.6	17.5	18.0	19.0	19.3	18.3	18.3	17.0	16.6	15.2	13.5	12.7	12.4	13.1	13.3	13.6	12.8	12.3	12.0	10.1	9.9	8.7	8.7	7.2	6.6	-0.6
12th Grade	17.6	16.6	17.4	17.7	17.4	16.6	16.1	15.2	15.4	14.2	13.0	11.7	11.2	10.9	11.4	11.1	10.5	9.9	9.5	9.0	8.1	7.9	6.9	6.5	5.7	5.0	-0.7
Hallucinogens [b,f]																											
8th Grade	3.2	3.8	3.9	4.3	5.2	5.9	5.4	4.9	4.8	4.6‡	5.2	4.1	4.0	3.5	3.8	3.4	3.1	3.3	3.0	3.4	3.3	2.8	2.5	2.0	2.0	1.9	-0.1
10th Grade	6.1	6.4	6.8	8.1	9.3	10.5	10.5	9.8	9.7	8.9‡	8.9	7.8	6.9	6.4	5.8	6.1	6.4	5.5	6.1	6.1	6.0	5.2	5.4	5.0	4.6	4.4	-0.2
12th Grade	9.6	9.2	10.9	11.4	12.7	14.0	15.1	14.1	13.7	13.0‡	14.7	12.0	10.6	9.7	8.8	8.3	8.4	8.7	7.4	8.6	8.3	7.5	7.6	6.3	6.4	6.7	+0.4

(Table continued on next page.)

TABLE 5 (cont.)
Trends in Lifetime Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
LSD [b]																											
8th Grade	2.7	3.2	3.5	3.7	4.4	5.1	4.7	4.1	4.1	3.9	3.4	2.5	2.1	1.8	1.9	1.6	1.6	1.9	1.7	1.8	1.7	1.3	1.4	1.1	1.3	1.2	0.0
10th Grade	5.6	5.8	6.2	7.2	8.4	9.4	9.5	8.5	8.5	7.6	6.3	5.0	3.5	2.8	2.5	2.7	3.0	2.6	3.0	3.0	2.8	2.6	2.7	2.6	3.0	3.2	+0.2
12th Grade	8.8	8.6	10.3	10.5	11.7	12.6	13.6	12.6	12.2	11.1	10.9	8.4	5.9	4.6	3.5	3.3	3.4	4.0	3.1	4.0	4.0	3.8	3.9	3.7	4.3	4.9	+0.6
Hallucinogens other than LSD [b]																											
8th Grade	1.4	1.7	1.7	2.2	2.5	3.0	2.6	2.5	2.4	2.3‡	3.9	3.3	3.2	3.0	3.3	2.8	2.6	2.5	2.4	2.7	2.8	2.3	1.9	1.5	1.2	1.3	0.0
10th Grade	2.2	2.5	2.8	3.8	3.9	4.7	4.8	5.0	4.7	4.8‡	6.6	6.3	5.9	5.8	5.2	5.5	5.7	4.8	5.4	5.3	5.2	4.5	4.4	4.1	3.3	3.1	-0.3
12th Grade	3.7	3.3	3.9	4.9	5.4	6.8	7.5	7.1	6.7	6.9‡	10.4	9.2	9.0	8.7	8.1	7.8	7.7	7.8	6.8	7.7	7.3	6.6	6.4	5.1	4.8	4.7	-0.1
Ecstasy (MDMA) [g]																											
8th Grade, original	—	—	—	—	—	3.4	3.2	2.7	2.7	4.3	5.2	4.3	3.2	2.8	2.8	2.5	2.3	2.4	2.2	3.3	2.6	2.0	1.8	1.4	—	—	—
Revised	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.4	2.3	1.7	-0.6 s
10th Grade,original	—	—	—	—	—	5.6	5.7	5.1	6.0	7.3	8.0	6.6	5.4	4.3	4.0	4.5	5.2	4.3	5.5	6.4	6.6	5.0	5.7	3.7	—	—	—
Revised	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.2	3.8	2.8	-1.1 sss
12th Grade, original	—	—	—	—	—	6.1	6.9	5.8	8.0	11.0	11.7	10.5	8.3	7.5	5.4	6.5	6.5	6.2	6.5	7.3	8.0	7.2	7.1	5.6	—	—	—
Revised	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7.9	5.9	4.9	-1.0 s
Cocaine																											
8th Grade	2.3	2.9	2.9	3.6	4.2	4.5	4.4	4.6	4.7	4.5	4.3	3.6	3.6	3.4	3.7	3.4	3.1	3.0	2.6	2.6	2.2	1.9	1.7	1.8	1.6	1.4	-0.2
10th Grade	4.1	3.3	3.6	4.3	5.0	6.5	7.1	7.2	7.7	6.9	5.7	6.1	5.1	5.4	5.2	4.8	5.3	4.5	4.6	3.7	3.3	3.3	3.3	2.6	2.7	2.1	-0.6 s
12th Grade	7.8	6.1	6.1	5.9	6.0	7.1	8.7	9.3	9.8	8.6	8.2	7.8	7.7	8.1	8.0	8.5	7.8	7.2	6.0	5.5	5.2	4.9	4.5	4.6	4.0	3.7	-0.4
Crack																											
8th Grade	1.3	1.6	1.7	2.4	2.7	2.9	2.7	3.2	3.1	3.1	3.0	2.5	2.5	2.4	2.4	2.3	2.1	2.0	1.7	1.5	1.5	1.0	1.2	1.2	1.0	0.9	-0.1
10th Grade	1.7	1.5	1.8	2.1	2.8	3.3	3.6	3.9	4.0	3.7	3.1	3.6	2.7	2.6	2.5	2.2	2.3	2.0	2.1	1.8	1.6	1.4	1.5	1.0	1.1	0.8	-0.3
12th Grade	3.1	2.6	2.6	3.0	3.0	3.3	3.9	4.4	4.6	3.9	3.7	3.8	3.6	3.9	3.5	3.5	3.2	2.8	2.4	2.4	1.9	2.1	1.8	1.8	1.7	1.4	-0.4
Other Cocaine [h]																											
8th Grade	2.0	2.4	2.4	3.0	3.4	3.8	3.5	3.7	3.8	3.5	3.3	2.8	2.7	2.6	2.9	2.7	2.6	2.4	2.1	2.1	1.8	1.6	1.4	1.4	1.3	1.1	-0.2
10th Grade	3.8	3.0	3.3	3.8	4.4	5.5	6.1	6.4	6.8	6.0	5.0	5.2	4.5	4.8	4.6	4.3	4.8	4.0	4.1	3.4	3.0	3.0	2.9	2.2	2.3	1.9	-0.4
12th Grade	7.0	5.3	5.4	5.2	5.1	6.4	8.2	8.4	8.8	7.7	7.4	7.0	6.7	7.3	7.1	7.9	6.8	6.5	5.3	5.1	4.9	4.4	4.2	4.1	3.4	3.3	-0.1

(Table continued on next page.)

TABLE 5 (cont.)
Trends in Lifetime Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change	
Heroin [l,j]																												
8th Grade	1.2	1.4	1.4	2.0	2.3	2.4	2.1	2.3	2.3	1.9	1.7	1.6	1.6	1.6	1.5	1.4	1.3	1.4	1.3	1.3	1.2	0.8	1.0	0.9	0.5	0.5	0.0	
10th Grade	1.2	1.2	1.3	1.5	1.7	2.1	2.1	2.3	2.3	2.2	1.7	1.8	1.5	1.5	1.5	1.4	1.5	1.2	1.5	1.3	1.2	1.1	1.0	0.9	0.7	0.6	-0.1	
12th Grade	0.9	1.2	1.1	1.2	1.6	1.8	2.1	2.0	2.0	2.4	1.8	1.7	1.5	1.5	1.5	1.4	1.5	1.3	1.2	1.6	1.4	1.1	1.0	1.0	0.8	0.7	-0.1	
With a Needle [j]																												
8th Grade	—	—	—	—	1.5	1.6	1.3	1.4	1.6	1.1	1.2	1.0	1.0	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.6	0.6	0.8	0.3	0.3	0.0	
10th Grade	—	—	—	—	1.0	1.1	1.1	1.2	1.3	1.0	0.8	1.0	0.9	0.8	0.8	0.9	0.9	0.7	0.9	0.8	0.8	0.7	0.7	0.6	0.5	0.5	0.0	
12th Grade	—	—	—	—	0.7	0.8	0.9	0.8	0.9	0.8	0.7	0.8	0.7	0.7	0.9	0.8	0.7	0.7	0.6	1.1	0.9	0.7	0.7	0.8	0.6	0.5	-0.2	
Without a Needle [j]																												
8th Grade	—	—	—	—	1.5	1.6	1.4	1.5	1.4	1.3	1.1	1.0	1.1	1.0	0.9	0.9	0.7	0.9	0.8	0.7	0.7	0.5	0.5	0.4	0.3	0.4	+0.1	
10th Grade	—	—	—	—	1.1	1.7	1.7	1.7	1.6	1.7	1.3	1.3	1.0	1.1	1.1	1.0	1.1	0.8	1.0	0.9	0.8	0.8	0.7	0.5	0.4	0.3	-0.1	
12th Grade	—	—	—	—	1.4	1.7	2.1	1.6	1.8	2.4	1.5	1.6	1.8	1.4	1.3	1.1	1.4	1.1	0.9	1.4	1.3	0.8	0.9	0.7	0.7	0.6	-0.1	
Narcotics other than Heroin [k,l]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
12th Grade	6.6	6.1	6.4	6.6	7.2	8.2	9.7	9.8	10.2	10.6	9.9‡	13.5	13.2	13.5	12.8	13.4	13.1	13.2	13.2	13.0	13.0	12.2	11.1	9.5	8.4	7.8	-0.6	
Amphetamines [k,m]																												
8th Grade	10.5	10.8	11.8	12.3	13.1	13.5	12.3	11.3	10.7	9.9	10.2	8.7	8.4	7.5	7.4	7.3	6.5	6.8	6.0	5.7	5.2	4.5‡	6.9	6.7	6.8	5.7	-1.1	ss
10th Grade	13.2	13.1	14.9	15.1	17.4	17.7	17.0	16.0	15.7	15.7	16.0	14.9	13.1	11.9	11.1	11.2	11.1	9.0	10.3	10.6	9.0	8.9‡	11.2	10.6	9.7	8.8	-0.9	
12th Grade	15.4	13.9	15.1	15.7	15.3	15.3	16.5	16.4	16.3	15.6	16.2	16.8	14.4	15.0	13.1	12.4	11.4	10.5	9.9	11.1	12.2	12.0‡	13.8	12.1	10.8	10.0	-0.8	
Methamphetamine [n,o]																												
8th Grade	—	—	—	—	—	—	—	—	4.5	4.2	4.4	3.5	3.9	2.5	3.1	2.7	1.8	2.3	1.6	1.8	1.3	1.3	1.4	1.0	0.8	0.6	-0.2	
10th Grade	—	—	—	—	—	—	—	—	7.3	6.9	6.4	6.1	5.2	5.3	4.1	3.2	2.8	2.4	2.8	2.5	2.1	1.8	1.6	1.4	1.3	0.7	-0.6	ss
12th Grade	—	—	—	—	—	—	—	—	8.2	7.9	6.9	6.7	6.2	6.2	4.5	4.4	3.0	2.8	2.4	2.3	2.1	1.7	1.5	1.9	1.0	1.2	+0.1	

(Table continued on next page.)

TABLE 5 (cont.)
Trends in Lifetime Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change	
Crystal Methamphetamine (Ice) [o]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
12th Grade	3.3	2.9	3.1	3.4	3.9	4.4	4.4	5.3	4.8	4.0	4.1	4.7	3.9	4.0	4.0	3.4	3.4	2.8	2.1	1.8	2.1	1.7	2.0	1.3	1.2	1.4	+0.2	
Sedatives (Barbiturates) [k,p]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
12th Grade	6.2	5.5	6.3	7.0	7.4	7.6	8.1	8.7	8.9	9.2	8.7	9.5	8.8	9.9	10.5	10.2	9.3	8.5	8.2	7.5	7.0	6.9	7.5	6.8	5.9	5.2	-0.7	
Tranquilizers [b,k]																												
8th Grade	3.8	4.1	4.4	4.6	4.5	5.3	4.8	4.6	4.4	4.4‡	5.0	4.3	4.4	4.0	4.1	4.3	3.9	3.9	3.9	4.4	3.4	3.0	2.9	2.9	3.0	3.0	0.0	
10th Grade	5.8	5.9	5.7	5.4	6.0	7.1	7.3	7.8	7.9	8.0‡	9.2	8.8	7.8	7.3	7.1	7.2	7.4	6.8	7.0	7.3	6.8	6.3	5.5	5.8	5.8	6.1	+0.3	
12th Grade	7.2	6.0	6.4	6.6	7.1	7.2	7.8	8.5	9.3	8.9‡	10.3	11.4	10.2	10.6	9.9	10.3	9.5	8.9	9.3	8.5	8.7	8.5	7.7	7.4	6.9	7.6	+0.7	
Any Prescription Drug [q]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24.0	23.9	22.2	21.5	20.9	21.6	21.7	21.2‡	22.2	19.9	18.3	18.0	-0.3	
Rohypnol [r]																												
8th Grade	—	—	—	—	—	1.5	1.1	1.4	1.3	1.0	1.1	0.8	1.0	1.0	1.1	1.0	1.0	0.7	0.7	0.9	2.0	1.0	0.7	0.6	0.8	0.9	+0.1	
10th Grade	—	—	—	—	—	1.5	1.7	2.0	1.8	1.3	1.5	1.3	1.0	1.2	1.0	0.8	1.3	0.9	0.7	1.4	1.2	0.8	1.1	1.0	0.5	1.0	+0.5	
12th Grade	—	—	—	—	—	1.2	1.8	3.0	2.0	1.5	1.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Alcohol [s]																												
Any Use																												
8th Grade	70.1	69.3‡	55.7	55.8	54.5	55.3	53.8	52.5	52.1	51.7	50.5	47.0	45.6	43.9	41.0	40.5	38.9	38.9	36.6	35.8	33.1	29.5	27.8	26.8	26.1	22.8	-3.3	ss
10th Grade	83.8	82.3‡	71.6	71.1	70.5	71.8	72.0	69.8	70.6	71.4	70.1	66.9	66.0	64.2	63.2	61.5	61.7	58.3	59.1	58.2	56.0	54.0	52.1	49.3	47.1	43.4	-3.7	ss
12th Grade	88.0	87.5‡	80.0	80.4	80.7	79.2	81.7	81.4	80.0	80.3	79.7	78.4	76.6	76.8	75.1	72.7	72.2	71.9	72.3	71.0	70.0	69.4	68.2	66.0	64.0	61.2	-2.8	

(Table continued on next page.)

TABLE 5 (cont.)
Trends in Lifetime Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Been Drunk [o]																											
8th Grade	26.7	26.8	26.4	25.9	25.3	26.8	25.2	24.8	24.8	25.1	23.4	21.3	20.3	19.9	19.5	19.5	17.9	18.0	17.4	16.3	14.8	12.8	12.2	10.8	10.9	8.6	-2.3 sss
10th Grade	50.0	47.7	47.9	47.2	46.9	48.5	49.4	46.7	48.9	49.3	48.2	44.0	42.4	42.3	42.1	41.4	41.2	37.2	38.6	36.9	35.9	34.6	33.5	30.2	28.6	26.0	-2.5 s
12th Grade	65.4	63.4	62.5	62.9	63.2	61.8	64.2	62.4	62.3	62.3	63.9	61.6	58.1	60.3	57.5	56.4	55.1	54.7	56.5	54.1	51.0	54.2	52.3	49.8	46.7	46.3	-0.5
Flavored Alcoholic Beverages [e,n]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	37.9	35.5	35.5	34.0	32.8	29.4	30.0	27.0	23.5	21.9	19.2	19.3	16.3	-3.0 s
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	58.6	58.8	58.1	55.7	53.5	51.4	51.3	48.4	46.7	44.9	42.3	38.7	33.3	-5.4 ss
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	71.0	73.6	69.9	68.4	65.5	67.4	62.6	62.4	60.5	58.9	57.5	55.6	53.6	-2.0
Cigarettes																											
Any Use																											
8th Grade	44.0	45.2	45.3	46.1	46.4	49.2	47.3	45.7	44.1	40.5	36.6	31.4	28.4	27.9	25.9	24.6	22.1	20.5	20.1	20.0	18.4	15.5	14.8	13.5	13.3	9.8	-3.5 sss
10th Grade	55.1	53.5	56.3	56.9	57.6	61.2	60.2	57.7	57.6	55.1	52.8	47.4	43.0	40.7	38.9	36.1	34.6	31.7	32.7	33.0	30.4	27.7	25.7	22.6	19.9	17.5	-2.4 s
12th Grade	63.1	61.8	61.9	62.0	64.2	63.5	65.4	65.3	64.6	62.5	61.0	57.2	53.7	52.8	50.0	47.1	46.2	44.7	43.6	42.2	40.0	39.5	38.1	34.4	31.1	28.3	-2.8 s
Smokeless Tobacco [t]																											
8th Grade	22.2	20.7	18.7	19.9	20.0	20.4	16.8	15.0	14.4	12.8	11.7	11.2	11.3	11.0	10.1	10.2	9.1	9.8	9.6	9.9	9.7	8.1	7.9	8.0	8.6	6.9	-1.7 s
10th Grade	28.2	26.6	28.1	29.2	27.6	27.4	26.3	22.7	20.4	19.1	19.5	16.9	14.6	13.8	14.5	15.0	15.1	12.2	15.2	16.8	15.6	15.4	14.0	13.6	12.3	10.2	-2.2 s
12th Grade	—	32.4	31.0	30.7	30.9	29.8	25.3	26.2	23.4	23.1	19.7	18.3	17.0	16.7	17.5	15.2	15.1	15.6	16.3	17.6	16.9	17.4	17.2	15.1	13.2	14.2	+1.0
Electronic Vaporizers [bb]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21.7	17.5	-4.2 sss
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	32.8	29.0	-3.7 ss
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	35.5	33.8	-1.7
Steroids [k,u]																											
8th Grade	1.9	1.7	1.6	2.0	2.0	1.8	1.8	2.3	2.7	3.0	2.8	2.5	2.5	1.9	1.7	1.6	1.5	1.4	1.3	1.1	1.2	1.2	1.1	1.0	1.0	0.9	-0.1
10th Grade	1.8	1.7	1.7	1.8	2.0	1.8	2.0	2.0	2.7	3.5	3.5	3.5	3.0	2.4	2.0	1.8	1.8	1.4	1.3	1.6	1.4	1.3	1.3	1.4	1.2	1.3	+0.1
12th Grade	2.1	2.1	2.0	2.4	2.3	1.9	2.4	2.7	2.9	2.5	3.7	4.0	3.5	3.4	2.6	2.7	2.2	2.2	2.2	2.0	1.8	1.8	2.1	1.9	2.3	1.6	-0.7 s

(Table continued on next page.)

TABLE 5 (cont.)
Trends in Lifetime Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Previously surveyed drugs that have been dropped.																											
Nitrites [e]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	1.6	1.5	1.4	1.7	1.5	1.8	2.0	2.7	1.7	0.8	1.9	1.5	1.6	1.3	1.1	1.2	1.2	0.6	1.1	—	—	—	—	—	—	—	—
PCP [e]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	2.9	2.4	2.9	2.8	2.7	4.0	3.9	3.9	3.4	3.4	3.5	3.1	2.5	1.6	2.4	2.2	2.1	1.8	1.7	1.8	2.3	1.6	1.3	—	—	—	—
Methaqualone [e,k]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	1.3	1.6	0.8	1.4	1.2	2.0	1.7	1.6	1.8	0.8	1.1	1.5	1.0	1.3	1.3	1.2	1.0	0.8	0.7	0.4	0.6	0.8	—	—	—	—	—

Source. The Monitoring the Future study, the University of Michigan.

Note: See footnotes following Table 8.

TABLE 6
Trends in Annual Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Any Illicit Drug [a]																											
8th Grade	11.3	12.9	15.1	18.5	21.4	23.6	22.1	21.0	20.5	19.5	19.5	17.7	16.1	15.2	15.5	14.8	13.2	14.1	14.5	16.0	14.7	13.4‡	15.2	14.6	14.8	12.0	-2.9 sss
10th Grade	21.4	20.4	24.7	30.0	33.3	37.5	38.5	35.0	35.9	36.4	37.2	34.8	32.0	31.1	29.8	28.7	28.1	26.9	29.4	30.2	31.1	30.1‡	32.1	29.9	27.9	26.8	-1.1
12th Grade	29.4	27.1	31.0	35.8	39.0	40.2	42.4	41.4	42.1	40.9	41.4	41.0	39.3	38.8	38.4	36.5	35.9	36.6	36.5	38.3	40.0	39.7‡	40.1	38.7	38.6	38.3	-0.3
Any Illicit Drug other than Marijuana [a,b]																											
8th Grade	8.4	9.3	10.4	11.3	12.6	13.1	11.8	11.0	10.5	10.2‡	10.8	8.8	8.8	7.9	8.1	7.7	7.0	7.4	7.0	7.1	6.4	5.5‡	6.3	6.4	6.3	5.4	-0.9 s
10th Grade	12.2	12.3	13.9	15.2	17.5	18.4	18.2	16.6	16.7	16.7‡	17.9	15.7	13.8	13.5	12.9	12.7	13.1	11.3	12.2	12.1	11.2	10.8‡	11.2	11.2	10.5	9.8	-0.7
12th Grade	16.2	14.9	17.1	18.0	19.4	19.8	20.7	20.2	20.7	20.4‡	21.6	20.9	19.8	20.5	19.7	19.2	18.5	18.3	17.0	17.3	17.6	17.0‡	17.8	15.9	15.2	14.3	-0.9
Any Illicit Drug including Inhalants [a,c]																											
8th Grade	16.7	18.2	21.1	24.2	27.1	28.7	27.2	26.2	25.3	24.0	23.9	21.4	20.4	20.2	20.4	19.7	18.0	19.0	18.8	20.3	18.2	17.0‡	17.6	16.8	17.0	13.5	-3.5 sss
10th Grade	23.9	23.5	27.4	32.5	35.6	39.6	40.3	37.1	37.7	38.0	38.7	36.1	33.5	32.9	31.7	30.7	30.2	28.8	31.2	31.8	32.5	31.5‡	33.2	31.0	28.9	27.7	-1.2
12th Grade	31.2	28.8	32.5	37.6	40.2	41.9	43.3	42.4	42.8	42.5	42.6	42.1	40.5	39.1	40.3	38.0	37.0	37.3	37.6	39.2	41.5	40.2‡	42.3	39.2	40.2	38.7	-1.5
Marijuana/Hashish																											
8th Grade	6.2	7.2	9.2	13.0	15.8	18.3	17.7	16.9	16.5	15.6	15.4	14.6	12.8	11.8	12.2	11.7	10.3	10.9	11.8	13.7	12.5	11.4	12.7	11.7	11.8	9.4	-2.4 sss
10th Grade	16.5	15.2	19.2	25.2	28.7	33.6	34.8	31.1	32.1	32.2	32.7	30.3	28.2	27.5	26.6	25.2	24.6	23.9	26.7	27.5	28.8	28.0	29.8	27.3	25.4	23.9	-1.5
12th Grade	23.9	21.9	26.0	30.7	34.7	35.8	38.5	37.5	37.8	36.5	37.0	36.2	34.9	34.3	33.6	31.5	31.7	32.4	32.8	34.8	36.4	36.4	36.4	35.1	34.9	35.6	+0.7
Synthetic Marijuana [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.4	4.0	3.3	3.1	2.7	-0.5
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8.8	7.4	5.4	4.3	3.3	-1.0 s
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11.4	11.3	7.9	5.8	5.2	3.5	-1.7 ss
Inhalants [c,d]																											
8th Grade	9.0	9.5	11.0	11.7	12.8	12.2	11.8	11.1	10.3	9.4	9.1	7.7	8.7	9.6	9.5	9.1	8.3	8.9	8.1	8.1	7.0	6.2	5.2	5.3	4.6	3.8	-0.8 s
10th Grade	7.1	7.5	8.4	9.1	9.6	9.5	8.7	8.0	7.2	7.3	6.6	5.8	5.4	5.9	6.0	6.5	6.6	5.9	6.1	5.7	4.5	4.1	3.5	3.3	2.9	2.4	-0.4
12th Grade	6.6	6.2	7.0	7.7	8.0	7.6	6.7	6.2	5.6	5.9	4.5	4.5	3.9	4.2	5.0	4.5	3.7	3.8	3.4	3.6	3.2	2.9	2.5	1.9	1.9	1.7	-0.2

(Table continued on next page.)

TABLE 6 (cont.)
Trends in Annual Prevalence of Use of Various Drugs
in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Hallucinogens [b,f]																											
8th Grade	1.9	2.5	2.6	2.7	3.6	4.1	3.7	3.4	2.9	2.8‡	3.4	2.6	2.6	2.2	2.4	2.1	1.9	2.1	1.9	2.2	2.2	1.6	1.6	1.3	1.3	1.2	-0.1
10th Grade	4.0	4.3	4.7	5.8	7.2	7.8	7.6	6.9	6.9	6.1‡	6.2	4.7	4.1	4.1	4.0	4.1	4.4	3.9	4.1	4.2	4.1	3.5	3.4	3.3	3.1	2.9	-0.1
12th Grade	5.8	5.9	7.4	7.6	9.3	10.1	9.8	9.0	9.4	8.1‡	9.1	6.6	5.9	6.2	5.5	4.9	5.4	5.9	4.7	5.5	5.2	4.8	4.5	4.0	4.2	4.3	+0.2
LSD [b]																											
8th Grade	1.7	2.1	2.3	2.4	3.2	3.5	3.2	2.8	2.4	2.4	2.2	1.5	1.3	1.1	1.2	0.9	1.1	1.3	1.1	1.2	1.1	0.8	1.0	0.7	0.9	0.8	-0.1
10th Grade	3.7	4.0	4.2	5.2	6.5	6.9	6.7	5.9	6.0	5.1	4.1	2.6	1.7	1.6	1.5	1.7	1.9	1.8	1.9	1.9	1.8	1.7	1.7	1.9	2.0	2.1	+0.2
12th Grade	5.2	5.6	6.8	6.9	8.4	8.8	8.4	7.6	8.1	6.6	6.6	3.5	1.9	2.2	1.8	1.7	2.1	2.7	1.9	2.6	2.7	2.4	2.2	2.5	2.9	3.0	+0.1
Hallucinogens other than LSD [b]																											
8th Grade	0.7	1.1	1.0	1.3	1.7	2.0	1.8	1.6	1.5	1.4‡	2.4	2.1	2.1	1.9	2.0	1.8	1.6	1.6	1.5	1.8	1.8	1.3	1.2	1.0	0.8	0.8	0.0
10th Grade	1.3	1.4	1.9	2.4	2.8	3.3	3.3	3.4	3.2	3.1‡	4.3	4.0	3.6	3.7	3.5	3.7	3.8	3.3	3.5	3.5	3.5	3.0	2.7	2.6	1.9	2.0	0.0
12th Grade	2.0	1.7	2.2	3.1	3.8	4.4	4.6	4.6	4.3	4.4‡	5.9	5.4	5.4	5.6	5.0	4.6	4.8	5.0	4.2	4.8	4.3	4.0	3.7	3.0	2.9	2.7	-0.2
PCP [e]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	1.4	1.4	1.4	1.6	1.8	2.6	2.3	2.1	1.8	2.3	1.8	1.1	1.3	0.7	1.3	0.7	0.9	1.1	1.0	1.0	1.3	0.9	0.7	0.8	1.4	1.3	-0.1
Ecstasy (MDMA) [g]																											
8th Grade, original		—	—	—	—	2.3	2.3	1.8	1.7	3.1	3.5	2.9	2.1	1.7	1.7	1.4	1.5	1.7	1.3	2.4	1.7	1.1	1.1	0.9	—	—	—
Revised		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.5	1.4	1.0	-0.4 s
10th Grade,original		—	—	—	—	4.6	3.9	3.3	4.4	5.4	6.2	4.9	3.0	2.4	2.6	2.8	3.5	2.9	3.7	4.7	4.5	3.0	3.6	2.3	—	—	—
Revised		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.8	2.4	1.8	-0.6 ss
12th Grade, original		—	—	—	—	4.6	4.0	3.6	5.6	8.2	9.2	7.4	4.5	4.0	3.0	4.1	4.5	4.3	4.3	4.5	5.3	3.8	4.0	3.6	—	—	—
Revised		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.0	3.6	2.7	-0.9 s
Salvia [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.7	1.6	1.4	1.2	0.6	0.7	0.9	+0.3
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.7	3.9	2.5	2.3	1.8	1.2	0.9	-0.3
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.7	5.5	5.9	4.4	3.4	1.8	1.9	1.8	-0.1

(Table continued on next page.)

TABLE 6 (cont.)
Trends in Annual Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Cocaine																											
8th Grade	1.1	1.5	1.7	2.1	2.6	3.0	2.8	3.1	2.7	2.6	2.5	2.3	2.2	2.0	2.2	2.0	2.0	1.8	1.6	1.6	1.4	1.2	1.0	1.0	0.9	0.8	-0.1
10th Grade	2.2	1.9	2.1	2.8	3.5	4.2	4.7	4.7	4.9	4.4	3.6	4.0	3.3	3.7	3.5	3.2	3.4	3.0	2.7	2.2	1.9	2.0	1.9	1.5	1.8	1.3	-0.5 ss
12th Grade	3.5	3.1	3.3	3.6	4.0	4.9	5.5	5.7	6.2	5.0	4.8	5.0	4.8	5.3	5.1	5.7	5.2	4.4	3.4	2.9	2.9	2.7	2.6	2.6	2.5	2.3	-0.3
Crack																											
8th Grade	0.7	0.9	1.0	1.3	1.6	1.8	1.7	2.1	1.8	1.8	1.7	1.6	1.6	1.3	1.4	1.3	1.3	1.1	1.1	1.0	0.9	0.6	0.6	0.7	0.5	0.5	0.0
10th Grade	0.9	0.9	1.1	1.4	1.8	2.1	2.2	2.5	2.4	2.2	1.8	2.3	1.6	1.7	1.7	1.3	1.3	1.3	1.2	1.0	0.9	0.8	0.8	0.5	0.7	0.4	-0.3 s
12th Grade	1.5	1.5	1.5	1.9	2.1	2.1	2.4	2.5	2.7	2.2	2.1	2.3	2.2	2.3	1.9	2.1	1.9	1.6	1.3	1.4	1.0	1.2	1.1	1.1	1.1	0.8	-0.3
Other Cocaine [h]																											
8th Grade	1.0	1.2	1.3	1.7	2.1	2.5	2.2	2.4	2.3	1.9	1.9	1.8	1.6	1.6	1.7	1.6	1.5	1.4	1.3	1.3	1.1	1.0	0.8	0.8	0.8	0.6	-0.2
10th Grade	2.1	1.7	1.8	2.4	3.0	3.5	4.1	4.0	4.4	3.8	3.0	3.4	2.8	3.3	3.0	2.9	3.1	2.6	2.3	1.9	1.7	1.8	1.6	1.3	1.5	1.1	-0.4 s
12th Grade	3.2	2.6	2.9	3.0	3.4	4.2	5.0	4.9	5.8	4.5	4.4	4.4	4.2	4.7	4.5	5.2	4.5	4.0	3.0	2.6	2.6	2.4	2.4	2.4	2.1	2.0	-0.1
Heroin [i,j]																											
8th Grade	0.7	0.7	0.7	1.2	1.4	1.6	1.3	1.3	1.4	1.1	1.0	0.9	0.9	1.0	0.8	0.8	0.8	0.9	0.7	0.8	0.7	0.5	0.5	0.5	0.3	0.3	0.0
10th Grade	0.5	0.6	0.7	0.9	1.1	1.2	1.4	1.4	1.4	1.4	0.9	1.1	0.7	0.9	0.9	0.9	0.8	0.8	0.9	0.8	0.8	0.6	0.6	0.5	0.5	0.3	-0.1
12th Grade	0.4	0.6	0.5	0.6	1.1	1.0	1.2	1.0	1.1	1.5	0.9	1.0	0.8	0.9	0.8	0.8	0.9	0.7	0.7	0.9	0.8	0.6	0.6	0.6	0.5	0.3	-0.2
With a Needle [j]																											
8th Grade	—	—	—	—	0.9	1.0	0.8	0.8	0.9	0.6	0.7	0.6	0.6	0.7	0.6	0.5	0.6	0.5	0.5	0.6	0.5	0.4	0.3	0.4	0.2	0.2	0.0
10th Grade	—	—	—	—	0.6	0.7	0.7	0.8	0.6	0.5	0.4	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.4	0.5	0.4	0.2	0.3	+0.1
12th Grade	—	—	—	—	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.3	0.7	0.6	0.4	0.4	0.5	0.3	0.3	-0.1
Without a Needle [j]																											
8th Grade	—	—	—	—	0.8	1.0	0.8	0.8	0.9	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.4	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.0
10th Grade	—	—	—	—	0.8	0.9	1.1	1.0	1.1	1.1	0.7	0.8	0.5	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.4	0.3	0.3	0.2	-0.2
12th Grade	—	—	—	—	1.0	1.0	1.2	0.8	1.0	1.6	0.8	0.8	0.8	0.7	0.8	0.6	1.0	0.5	0.6	0.8	0.7	0.4	0.4	0.5	0.4	0.3	-0.1

(Table continued on next page.)

TABLE 6 (cont.)
Trends in Annual Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Narcotics other than Heroin [k,l]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	3.5	3.3	3.6	3.8	4.7	5.4	6.2	6.3	6.7	7.0	6.7‡	9.4	9.3	9.5	9.0	9.0	9.2	9.1	9.2	8.7	8.7	7.9	7.1	6.1	5.4	4.8	-0.6
OxyContin [k,n,v]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	1.3	1.7	1.7	1.8	2.6	1.8	2.1	2.0	2.1	1.8	1.6	2.0	1.0	0.8	0.9	+0.1
10th Grade	—	—	—	—	—	—	—	—	—	—	—	3.0	3.6	3.5	3.2	3.8	3.9	3.6	5.1	4.6	3.9	3.0	3.4	3.0	2.6	2.1	-0.5
12th Grade	—	—	—	—	—	—	—	—	—	—	—	4.0	4.5	5.0	5.5	4.3	5.2	4.7	4.9	5.1	4.9	4.3	3.6	3.3	3.7	3.4	-0.2
Vicodin [k,n,v]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	2.5	2.8	2.5	2.6	3.0	2.7	2.9	2.5	2.7	2.1	1.3	1.4	1.0	0.9	0.8	0.0
10th Grade	—	—	—	—	—	—	—	—	—	—	—	6.9	7.2	6.2	5.9	7.0	7.2	6.7	8.1	7.7	5.9	4.4	4.6	3.4	2.5	1.7	-0.8
12th Grade	—	—	—	—	—	—	—	—	—	—	—	9.6	10.5	9.3	9.5	9.7	9.6	9.7	9.7	8.0	8.1	7.5	5.3	4.8	4.4	2.9	-1.5 ss
Amphetamines [k,m]																											
8th Grade	6.2	6.5	7.2	7.9	8.7	9.1	8.1	7.2	6.9	6.5	6.7	5.5	5.5	4.9	4.9	4.7	4.2	4.5	4.1	3.9	3.5	2.9‡	4.2	4.3	4.1	3.5	-0.6
10th Grade	8.2	8.2	9.6	10.2	11.9	12.4	12.1	10.7	10.4	11.1	11.7	10.7	9.0	8.5	7.8	7.9	8.0	6.4	7.1	7.6	6.6	6.5‡	7.9	7.6	6.8	6.1	-0.7
12th Grade	8.2	7.1	8.4	9.4	9.3	9.5	10.2	10.1	10.2	10.5	10.9	11.1	9.9	10.0	8.6	8.1	7.5	6.8	6.6	7.4	8.2	7.9‡	9.2	8.1	7.7	6.7	-1.0
Ritalin [k,n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	2.9	2.8	2.6	2.5	2.4	2.6	2.1	1.6	1.8	1.5	1.3	0.7	1.1	0.9	0.6	0.8	+0.2
10th Grade	—	—	—	—	—	—	—	—	—	—	4.8	4.8	4.1	3.4	3.4	3.6	2.8	2.9	3.6	2.7	2.6	1.9	1.8	1.8	1.6	1.2	-0.5
12th Grade	—	—	—	—	—	—	—	—	—	—	5.1	4.0	4.0	5.1	4.4	4.4	3.8	3.4	2.1	2.7	2.6	2.6	2.3	1.8	2.0	1.2	-0.8 s
Adderall [k,n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.0	2.3	1.7	1.7	1.8	1.3	1.0	1.5	+0.5
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.7	5.3	4.6	4.5	4.4	4.6	5.2	4.2	-1.1
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.4	6.5	6.5	7.6	7.4	6.8	7.5	6.2	-1.3

(Table continued on next page.)

TABLE 6 (cont.)
Trends in Annual Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Methamphetamine [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	3.2	2.5	2.8	2.2	2.5	1.5	1.8	1.8	1.1	1.2	1.0	1.2	0.8	1.0	1.0	0.6	0.5	0.4	-0.1
10th Grade	—	—	—	—	—	—	—	—	4.6	4.0	3.7	3.9	3.3	3.0	2.9	1.8	1.6	1.5	1.6	1.6	1.4	1.0	1.0	0.8	0.8	0.4	-0.4 s
12th Grade	—	—	—	—	—	—	—	—	4.7	4.3	3.9	3.6	3.2	3.4	2.5	2.5	1.7	1.2	1.2	1.0	1.4	1.1	0.9	1.0	0.6	0.6	0.0
Crystal Methamphetamine (Ice) [o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	1.4	1.3	1.7	1.8	2.4	2.8	2.3	3.0	1.9	2.2	2.5	3.0	2.0	2.1	2.3	1.9	1.6	1.1	0.9	0.9	1.2	0.8	1.1	0.8	0.5	0.8	+0.3
Bath salts (synthetic stimulants) [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.8	1.0	0.5	0.4	0.9	+0.5 ss
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.6	0.9	0.9	0.7	0.8	+0.1
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.3	0.9	0.9	1.0	0.8	-0.2
Sedatives (Barbiturates) [k,p]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	3.4	2.8	3.4	4.1	4.7	4.9	5.1	5.5	5.8	6.2	5.7	6.7	6.0	6.5	7.2	6.6	6.2	5.8	5.2	4.8	4.3	4.5	4.8	4.3	3.6	3.0	-0.6
Tranquilizers [b,k]																											
8th Grade	1.8	2.0	2.1	2.4	2.7	3.3	2.9	2.6	2.5	2.6‡	2.8	2.6	2.7	2.5	2.8	2.6	2.4	2.4	2.6	2.8	2.0	1.8	1.8	1.7	1.7	1.7	0.0
10th Grade	3.2	3.5	3.3	3.3	4.0	4.6	4.9	5.1	5.4	5.6‡	7.3	6.3	5.3	5.1	4.8	5.2	5.3	4.6	5.0	5.1	4.5	4.3	3.7	3.9	3.9	4.1	+0.2
12th Grade	3.6	2.8	3.5	3.7	4.4	4.6	4.7	5.5	5.8	5.7‡	6.9	7.7	6.7	7.3	6.8	6.6	6.2	6.2	6.3	5.6	5.6	5.3	4.6	4.7	4.7	4.9	+0.2
Any Prescription Drug [q]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17.1	16.8	15.8	15.4	14.4	15.0	15.2	14.8‡	15.9	13.9	12.9	12.0	-1.0

(Table continued on next page.)

TABLE 6 (cont.)
Trends in Annual Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
OTC Cough/Cold Medicines [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.2	4.0	3.6	3.8	3.2	2.7	3.0	2.9	2.0	1.6	2.6	+1.0 ss
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.3	5.4	5.3	6.0	5.1	5.5	4.7	4.3	3.7	3.3	3.0	-0.3
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6.9	5.8	5.5	5.9	6.6	5.3	5.6	5.0	4.1	4.6	4.0	-0.5
Rohypnol [r]																											
8th Grade	—	—	—	—	—	1.0	0.8	0.8	0.5	0.5	0.7	0.3	0.5	0.6	0.7	0.5	0.7	0.5	0.4	0.5	0.8	0.4	0.4	0.3	0.3	0.5	+0.2
10th Grade	—	—	—	—	—	1.1	1.3	1.2	1.0	0.8	1.0	0.7	0.6	0.7	0.5	0.5	0.7	0.4	0.4	0.6	0.6	0.5	0.6	0.5	0.2	0.5	+0.3
12th Grade	—	—	—	—	—	1.1	1.2	1.4	1.0	0.8	0.9‡	1.6	1.3	1.6	1.2	1.1	1.0	1.3	1.0	1.5	1.3	1.5	0.9	0.7	1.0	1.1	+0.1
GHB [n,w]																											
8th Grade	—	—	—	—	—	—	—	—	—	1.2	1.1	0.8	0.9	0.7	0.5	0.8	0.7	1.1	0.7	0.6	0.6	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	1.1	1.0	1.4	1.4	0.8	0.8	0.7	0.6	0.5	1.0	0.6	0.5	—	—	—	—	—	—
12th Grade	—	—	—	—	—	—	—	—	—	1.9	1.6	1.5	1.4	2.0	1.1	1.1	0.9	1.2	1.1	1.4	1.4	1.4	1.0	1.0	0.7	0.9	+0.2
Ketamine [n,x]																											
8th Grade	—	—	—	—	—	—	—	—	—	1.6	1.3	1.3	1.1	0.9	0.6	0.9	1.0	1.2	1.0	1.0	0.8	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	2.1	2.1	2.2	1.9	1.3	1.0	1.0	0.8	1.0	1.3	1.1	1.2	—	—	—	—	—	—
12th Grade	—	—	—	—	—	—	—	—	—	2.5	2.5	2.6	2.1	1.9	1.6	1.4	1.3	1.5	1.7	1.6	1.7	1.5	1.4	1.5	1.4	1.2	-0.2
Alcohol [s]																											
Any Use																											
8th Grade	54.0	53.7‡	45.4	46.8	45.3	46.5	45.5	43.7	43.5	43.1	41.9	38.7	37.2	36.7	33.9	33.6	31.8	32.1	30.3	29.3	26.9	23.6	22.1	20.8	21.0	17.6	-3.4 sss
10th Grade	72.3	70.2‡	63.4	63.9	63.5	65.0	65.2	62.7	63.7	65.3	63.5	60.0	59.3	58.2	56.7	55.8	56.3	52.5	52.8	52.1	49.8	48.5	47.1	44.0	41.9	38.3	-3.5 ss
12th Grade	77.7	76.8‡	72.7	73.0	73.7	72.5	74.8	74.3	73.8	73.2	73.3	71.5	70.1	70.6	68.6	66.5	66.4	65.5	66.2	65.2	63.5	63.5	62.0	60.2	58.2	55.6	-2.6
Been Drunk [o]																											
8th Grade	17.5	18.3	18.2	18.2	18.4	19.8	18.4	17.9	18.5	18.5	16.6	15.0	14.5	14.5	14.1	13.9	12.6	12.7	12.2	11.5	10.5	8.6	8.4	7.3	7.7	5.7	-2.0 sss
10th Grade	40.1	37.0	37.8	38.0	38.5	40.1	40.7	38.3	40.9	41.6	39.9	35.4	34.7	35.1	34.2	34.5	34.4	30.0	31.2	29.9	28.8	28.2	27.1	24.6	23.4	20.5	-2.9 ss
12th Grade	52.7	50.3	49.6	51.7	52.5	51.9	53.2	52.0	53.2	51.8	53.2	50.4	48.0	51.8	47.7	47.9	46.1	45.6	47.0	44.0	42.2	45.0	43.5	41.4	37.7	37.3	-0.3

(Table continued on next page.)

TABLE 6 (cont.)
Trends in Annual Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change	
Flavored Alcoholic Beverages [e,n,y]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	30.4	27.9	26.8	26.0	25.0	22.2	21.9	19.2	17.0	15.7	13.4	13.4	11.2	-2.2	s
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	49.7	48.5	48.8	45.9	43.4	41.5	41.0	38.3	37.8	35.6	33.2	31.4	26.1	-5.3	sss
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	55.2	55.8	58.4	54.7	53.6	51.8	53.4	47.9	47.0	44.4	44.2	43.6	42.8	40.0	-2.8	
Alcoholic Beverages containing Caffeine [n,o,z]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11.8	10.9	10.2	9.5	8.4	6.5	-1.9	ss
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22.5	19.7	16.9	14.3	12.8	10.6	-2.2	ss
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	26.4	26.4	23.5	20.0	18.3	17.0	-1.3	
Tobacco using a Hookah [e]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17.1	18.5	18.3	21.4	22.9	19.8	13.0	-6.9	sss
Small cigars [e]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.1	19.5	19.9	20.4	18.9	15.9	15.6	-0.3	
Dissolvable Tobacco Products [e,n]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.0	1.1	1.1	0.9	0.7	-0.2	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.6	1.2	1.3	1.1	0.9	-0.2	
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.5	1.6	1.9	1.1	1.4	1.1	-0.3	
Snus [e,n]																												
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.4	2.0	2.2	1.9	2.2	+0.3	
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6.9	5.2	4.5	4.0	3.0	-1.0	
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7.9	7.9	7.7	5.8	5.8	5.8	+0.1	

(Table continued on next page.)

TABLE 6 (cont.)
Trends in Annual Prevalence of Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Steroids [k,u]																											
8th Grade	1.0	1.1	0.9	1.2	1.0	0.9	1.0	1.2	1.7	1.7	1.6	1.5	1.4	1.1	1.1	0.9	0.8	0.9	0.8	0.5	0.7	0.6	0.6	0.6	0.5	0.5	0.0
10th Grade	1.1	1.1	1.0	1.1	1.2	1.2	1.2	1.2	1.7	2.2	2.1	2.2	1.7	1.5	1.3	1.2	1.1	0.9	0.8	1.0	0.9	0.8	0.8	0.8	0.7	0.7	0.0
12th Grade	1.4	1.1	1.2	1.3	1.5	1.4	1.4	1.7	1.8	1.7	2.4	2.5	2.1	2.5	1.5	1.8	1.4	1.5	1.5	1.5	1.2	1.3	1.5	1.5	1.7	1.0	-0.7 ss
Previously surveyed drugs that have been dropped.																											
Nitrites [e]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	0.9	0.5	0.9	1.1	1.1	1.6	1.2	1.4	0.9	0.6	0.6	1.1	0.9	0.8	0.6	0.5	0.8	0.6	0.9	—	—	—	—	—	—	—	—
Provigil [k,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.8	1.3	1.5	—	—	—	—	—	—
Methaqualone [e,k]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	0.5	0.6	0.2	0.8	0.7	1.1	1.0	1.1	1.1	0.3	0.8	0.9	0.6	0.8	0.9	0.8	0.5	0.5	0.6	0.3	0.3	0.4	—	—	—	—	—
Bidis [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	3.9	2.7	2.7	2.0	1.7	1.6	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	6.4	4.9	3.1	2.8	2.1	1.6	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	—	—	—	—	—	—	—	—	—	9.2	7.0	5.9	4.0	3.6	3.3	2.3	1.7	1.9	1.5	1.4	—	—	—	—	—	—	—
Kreteks [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	2.6	2.6	2.0	1.9	1.4	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	6.0	4.9	3.8	3.7	2.8	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	—	—	—	—	—	—	—	—	—	—	10.1	8.4	6.7	6.5	7.1	6.2	6.8	6.8	5.5	4.6	2.9	3.0	1.6	1.6	—	—	—

Source. The Monitoring the Future study, the University of Michigan.

Note: See footnotes following Table 8.

TABLE 7
Trends in 30-Day Prevalence of Use of Various Drugs in Grades 8, 10, and 12

	Percentage who used in last 30 days																									2015–2016 change
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Any Illicit Drug [a]																											
8th Grade	5.7	6.8	8.4	10.9	12.4	14.6	12.9	12.1	12.2	11.9	11.7	10.4	9.7	8.4	8.5	8.1	7.4	7.6	8.1	9.5	8.5	7.7‡	8.7	8.3	8.1	6.9	-1.2 s
10th Grade	11.6	11.0	14.0	18.5	20.2	23.2	23.0	21.5	22.1	22.5	22.7	20.8	19.5	18.3	17.3	16.8	16.9	15.8	17.8	18.5	19.2	18.6‡	19.2	18.5	16.5	15.9	-0.5
12th Grade	16.4	14.4	18.3	21.9	23.8	24.6	26.2	25.6	25.9	24.9	25.7	25.4	24.1	23.4	23.1	21.5	21.9	22.3	23.3	23.8	25.2	25.2‡	25.2	23.7	23.6	24.4	+0.8
Any Illicit Drug other than Marijuana [a,b]																											
8th Grade	3.8	4.7	5.3	5.6	6.5	6.9	6.0	5.5	5.5	5.6‡	5.5	4.7	4.7	4.1	4.1	3.8	3.6	3.8	3.5	3.5	3.4	2.6‡	3.6	3.3	3.1	2.7	-0.5
10th Grade	5.5	5.7	6.5	7.1	8.9	8.9	8.8	8.6	8.6	8.5‡	8.7	8.1	6.9	6.9	6.4	6.3	6.9	5.3	5.7	5.8	5.4	5.0‡	4.9	5.6	4.9	4.4	-0.5
12th Grade	7.1	6.3	7.9	8.8	10.0	9.5	10.7	10.7	10.4	10.4‡	11.0	11.3	10.4	10.8	10.3	9.8	9.5	9.3	8.6	8.6	8.9	8.4‡	8.2	7.7	7.6	6.9	-0.7
Any Illicit Drug including Inhalants [a,c]																											
8th Grade	8.8	10.0	12.0	14.3	16.1	17.5	16.0	14.9	15.1	14.4	14.0	12.6	12.1	11.2	11.2	10.9	10.1	10.4	10.6	11.7	10.5	9.5‡	10.0	9.5	9.3	7.9	-1.4 s
10th Grade	13.1	12.6	15.5	20.0	21.6	24.5	24.1	22.5	23.1	23.6	23.6	21.7	20.5	19.3	18.4	17.7	18.1	16.8	18.8	19.4	20.1	19.3‡	20.0	19.1	17.1	16.4	-0.6
12th Grade	17.8	15.5	19.3	23.0	24.8	25.5	26.9	26.6	26.4	26.4	26.5	25.9	24.6	23.3	24.2	22.1	22.8	22.8	24.1	24.5	26.2	25.2‡	26.5	24.3	24.7	24.6	-0.1
Marijuana/Hashish																											
8th Grade	3.2	3.7	5.1	7.8	9.1	11.3	10.2	9.7	9.7	9.1	9.2	8.3	7.5	6.4	6.6	6.5	5.7	5.8	6.5	8.0	7.2	6.5	7.0	6.5	6.5	5.4	-1.1 s
10th Grade	8.7	8.1	10.9	15.8	17.2	20.4	20.5	18.7	19.4	19.7	19.8	17.8	17.0	15.9	15.2	14.2	14.2	13.8	15.9	16.7	17.6	17.0	18.0	16.6	14.8	14.0	-0.8
12th Grade	13.8	11.9	15.5	19.0	21.2	21.9	23.7	22.8	23.1	21.6	22.4	21.5	21.2	19.9	19.8	18.3	18.8	19.4	20.6	21.4	22.6	22.9	22.7	21.2	21.3	22.5	+1.2
Inhalants [c,d]																											
8th Grade	4.4	4.7	5.4	5.6	6.1	5.8	5.6	4.8	5.0	4.5	4.0	3.8	4.1	4.5	4.2	4.1	3.9	4.1	3.8	3.6	3.2	2.7	2.3	2.2	2.0	1.8	-0.2
10th Grade	2.7	2.7	3.3	3.6	3.5	3.3	3.0	2.9	2.6	2.6	2.4	2.4	2.2	2.4	2.2	2.3	2.5	2.1	2.2	2.0	1.7	1.4	1.3	1.1	1.2	1.0	-0.2
12th Grade	2.4	2.3	2.5	2.7	3.2	2.5	2.5	2.3	2.0	2.2	1.7	1.5	1.5	1.5	2.0	1.5	1.2	1.4	1.2	1.4	1.0	0.9	1.0	0.7	0.7	0.8	0.0
Hallucinogens [b,f]																											
8th Grade	0.8	1.1	1.2	1.3	1.7	1.9	1.8	1.4	1.3	1.2‡	1.6	1.2	1.2	1.0	1.1	0.9	1.0	0.9	0.9	1.0	1.0	0.6	0.8	0.5	0.6	0.6	0.0
10th Grade	1.6	1.8	1.9	2.4	3.3	2.8	3.3	3.2	2.9	2.3‡	2.1	1.6	1.5	1.6	1.5	1.5	1.7	1.3	1.4	1.6	1.4	1.2	1.1	1.2	0.9	0.9	0.0
12th Grade	2.2	2.1	2.7	3.1	4.4	3.5	3.9	3.8	3.5	2.6‡	3.3	2.3	1.8	1.9	1.9	1.5	1.7	2.2	1.6	1.9	1.6	1.6	1.4	1.5	1.6	1.4	-0.1

(Table continued on next page.)

TABLE 7 (cont.)
Trends in 30-Day Prevalence of Use of Various Drugs in Grades 8, 10, and 12

	Percentage who used in last 30 days																										2015–2016 change
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
LSD [b]																											
8th Grade	0.6	0.9	1.0	1.1	1.4	1.5	1.5	1.1	1.1	1.0	1.0	0.7	0.6	0.5	0.5	0.4	0.5	0.5	0.5	0.6	0.5	0.3	0.5	0.3	0.4	0.4	0.0
10th Grade	1.5	1.6	1.6	2.0	3.0	2.4	2.8	2.7	2.3	1.6	1.5	0.7	0.6	0.6	0.6	0.7	0.7	0.7	0.5	0.7	0.7	0.5	0.6	0.6	0.6	0.7	+0.1
12th Grade	1.9	2.0	2.4	2.6	4.0	2.5	3.1	3.2	2.7	1.6	2.3	0.7	0.6	0.7	0.7	0.6	0.6	1.1	0.5	0.8	0.8	0.8	0.8	1.0	1.1	1.0	-0.1
Hallucinogens other than LSD [b]																											
8th Grade	0.3	0.4	0.5	0.7	0.8	0.9	0.7	0.7	0.6	0.6‡	1.1	1.0	1.0	0.8	0.9	0.7	0.7	0.7	0.7	0.8	0.7	0.5	0.5	0.4	0.3	0.3	0.0
10th Grade	0.4	0.5	0.7	1.0	1.0	1.0	1.2	1.4	1.2	1.2‡	1.4	1.4	1.2	1.4	1.3	1.3	1.4	1.0	1.1	1.2	1.1	0.9	0.8	0.8	0.6	0.5	0.0
12th Grade	0.7	0.5	0.8	1.2	1.3	1.6	1.7	1.6	1.6	1.7‡	1.9	2.0	1.5	1.7	1.6	1.3	1.4	1.6	1.4	1.5	1.2	1.3	1.0	1.0	0.9	0.7	-0.2
Ecstasy (MDMA) [g]																											
8th Grade, original		—	—	—	—	1.0	1.0	0.9	0.8	1.4	1.8	1.4	0.7	0.8	0.6	0.7	0.6	0.8	0.6	1.1	0.6	0.5	0.5	0.4	—	—	—
Revised		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.7	0.5	0.3	-0.2
10th Grade,original		—	—	—	—	1.8	1.3	1.3	1.8	2.6	2.6	1.8	1.1	0.8	1.0	1.2	1.2	1.1	1.3	1.9	1.6	1.0	1.2	0.8	—	—	—
Revised		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.1	0.9	0.5	-0.4 sss
12th Grade, original		—	—	—	—	2.0	1.6	1.5	2.5	3.6	2.8	2.4	1.3	1.2	1.0	1.3	1.6	1.8	1.8	1.4	2.3	0.9	1.5	1.4	—	—	—
Revised		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.5	1.1	0.9	-0.2
Cocaine																											
8th Grade	0.5	0.7	0.7	1.0	1.2	1.3	1.1	1.4	1.3	1.2	1.2	1.1	0.9	0.9	1.0	1.0	0.9	0.8	0.8	0.6	0.8	0.5	0.5	0.5	0.5	0.3	-0.1
10th Grade	0.7	0.7	0.9	1.2	1.7	1.7	2.0	2.1	1.8	1.8	1.3	1.6	1.3	1.7	1.5	1.5	1.3	1.2	0.9	0.9	0.7	0.8	0.8	0.6	0.8	0.4	-0.4 ss
12th Grade	1.4	1.3	1.3	1.5	1.8	2.0	2.3	2.4	2.6	2.1	2.1	2.3	2.1	2.3	2.3	2.5	2.0	1.9	1.3	1.3	1.1	1.1	1.1	1.0	1.1	0.9	-0.3
Crack																											
8th Grade	0.3	0.5	0.4	0.7	0.7	0.8	0.7	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.5	0.3	0.3	0.3	0.3	0.2	-0.1
10th Grade	0.3	0.4	0.5	0.6	0.9	0.8	0.9	1.1	0.8	0.9	0.7	1.0	0.7	0.8	0.7	0.7	0.5	0.5	0.4	0.5	0.4	0.4	0.4	0.3	0.3	0.2	-0.1
12th Grade	0.7	0.6	0.7	0.8	1.0	1.0	0.9	1.0	1.1	1.0	1.1	1.2	0.9	1.0	1.0	0.9	0.9	0.8	0.6	0.7	0.5	0.6	0.6	0.7	0.6	0.5	0.0
Other Cocaine [h]																											
8th Grade	0.5	0.5	0.6	0.9	1.0	1.0	0.8	1.0	1.1	0.9	0.9	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.5	0.6	0.3	0.3	0.4	0.4	0.3	-0.1
10th Grade	0.6	0.6	0.7	1.0	1.4	1.3	1.6	1.8	1.6	1.6	1.2	1.3	1.1	1.5	1.3	1.3	1.1	1.0	0.8	0.7	0.6	0.7	0.7	0.5	0.7	0.3	-0.4 ss
12th Grade	1.2	1.0	1.2	1.3	1.3	1.6	2.0	2.0	2.5	1.7	1.8	1.9	1.8	2.2	2.0	2.4	1.7	1.7	1.1	1.1	1.0	1.0	0.9	0.9	1.1	0.6	-0.5 ss

(Table continued on next page.)

TABLE 7 (cont.)
Trends in 30-Day Prevalence of Use of Various Drugs in Grades 8, 10, and 12

	Percentage who used in last 30 days																									2015–2016 change
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Heroin [i,j]																											
8th Grade	0.3	0.4	0.4	0.6	0.6	0.7	0.6	0.6	0.6	0.5	0.6	0.5	0.4	0.5	0.5	0.3	0.4	0.4	0.4	0.4	0.4	0.2	0.3	0.3	0.1	0.2	0.0
10th Grade	0.2	0.2	0.3	0.4	0.6	0.5	0.6	0.7	0.7	0.5	0.3	0.5	0.3	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.2	0.2	0.0
12th Grade	0.2	0.3	0.2	0.3	0.6	0.5	0.5	0.5	0.5	0.7	0.4	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.2	-0.1
With a Needle [j]																											
8th Grade	—	—	—	—	0.4	0.5	0.4	0.5	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.0
10th Grade	—	—	—	—	0.3	0.3	0.3	0.4	0.3	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.1	0.2	+0.1 s
12th Grade	—	—	—	—	0.3	0.4	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.2	0.2	0.1	0.4	0.4	0.3	0.2	0.3	0.2	0.2	-0.1
Without a Needle [j]																											
8th Grade	—	—	—	—	0.3	0.4	0.4	0.3	0.4	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.0
10th Grade	—	—	—	—	0.3	0.3	0.4	0.5	0.5	0.4	0.2	0.4	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.1	-0.1
12th Grade	—	—	—	—	0.6	0.4	0.6	0.4	0.4	0.7	0.3	0.5	0.4	0.3	0.5	0.3	0.4	0.2	0.3	0.4	0.4	0.2	0.2	0.4	0.3	0.1	-0.1
Narcotics other than Heroin [k,l]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	1.1	1.2	1.3	1.5	1.8	2.0	2.3	2.4	2.6	2.9	3.0‡	4.0	4.1	4.3	3.9	3.8	3.8	3.8	4.1	3.6	3.6	3.0	2.8	2.2	2.1	1.7	-0.4
Amphetamines [k,m]																											
8th Grade	2.6	3.3	3.6	3.6	4.2	4.6	3.8	3.3	3.4	3.4	3.2	2.8	2.7	2.3	2.3	2.1	2.0	2.2	1.9	1.8	1.8	1.3‡	2.3	2.1	1.9	1.7	-0.2
10th Grade	3.3	3.6	4.3	4.5	5.3	5.5	5.1	5.1	5.0	5.4	5.6	5.2	4.3	4.0	3.7	3.5	4.0	2.8	3.3	3.3	3.1	2.8‡	3.3	3.7	3.1	2.7	-0.4
12th Grade	3.2	2.8	3.7	4.0	4.0	4.1	4.8	4.6	4.5	5.0	5.6	5.5	5.0	4.6	3.9	3.7	3.7	2.9	3.0	3.3	3.7	3.3‡	4.2	3.8	3.2	3.0	-0.2
Methamphetamine [n,o]																											
8th Grade	—	—	—	—	—	—	—	—	1.1	0.8	1.3	1.1	1.2	0.6	0.7	0.6	0.6	0.7	0.5	0.7	0.4	0.5	0.4	0.2	0.3	0.3	0.0
10th Grade	—	—	—	—	—	—	—	—	1.8	2.0	1.5	1.8	1.4	1.3	1.1	0.7	0.4	0.7	0.6	0.7	0.5	0.6	0.4	0.3	0.3	0.2	-0.1
12th Grade	—	—	—	—	—	—	—	—	1.7	1.9	1.5	1.7	1.7	1.4	0.9	0.9	0.6	0.6	0.5	0.5	0.6	0.5	0.4	0.5	0.4	0.3	-0.1

(Table continued on next page.)

TABLE 7 (cont.)
Trends in 30-Day Prevalence of Use of Various Drugs in Grades 8, 10, and 12

	Percentage who used in last 30 days																										2015–2016 change
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Crystal Methamphetamine (Ice) [o]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	0.6	0.5	0.6	0.7	1.1	1.1	0.8	1.2	0.8	1.0	1.1	1.2	0.8	0.8	0.9	0.7	0.6	0.6	0.5	0.6	0.6	0.4	0.8	0.4	0.3	0.4	+0.1
Sedatives (Barbiturates) [k,p]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	1.4	1.1	1.3	1.7	2.2	2.1	2.1	2.6	2.6	3.0	2.8	3.2	2.9‡	2.9	3.3	3.0	2.7	2.8	2.5	2.2	1.8	2.0	2.2	2.0	1.7	1.5	-0.2
Tranquilizers [b,k]																											
8th Grade	0.8	0.8	0.9	1.1	1.2	1.5	1.2	1.2	1.1	1.4‡	1.2	1.2	1.4	1.2	1.3	1.3	1.1	1.2	1.2	1.2	1.0	0.8	0.9	0.8	0.8	0.8	0.0
10th Grade	1.2	1.5	1.1	1.5	1.7	1.7	2.2	2.2	2.2	2.5‡	2.9	2.9	2.4	2.3	2.3	2.4	2.6	1.9	2.0	2.2	1.9	1.7	1.6	1.6	1.7	1.5	-0.2
12th Grade	1.4	1.0	1.2	1.4	1.8	2.0	1.8	2.4	2.5	2.6‡	2.9	3.3	2.8	3.1	2.9	2.7	2.6	2.6	2.7	2.5	2.3	2.1	2.0	2.1	2.0	1.9	-0.1
Any Prescription Drug [q]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8.6	8.1	7.8	7.2	7.3	6.9	7.2	7.0‡	7.1	6.4	5.9	5.4	-0.5
Rohypnol [r]																											
8th Grade	—	—	—	—	—	0.5	0.3	0.4	0.3	0.3	0.4	0.2	0.1	0.2	0.2	0.4	0.3	0.1	0.2	0.2	0.6	0.1	0.1	0.2	0.1	0.2	+0.1
10th Grade	—	—	—	—	—	0.5	0.5	0.4	0.5	0.4	0.2	0.4	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.4	0.1	0.3	+0.2
12th Grade	—	—	—	—	—	0.5	0.3	0.3	0.3	0.4	0.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Alcohol [s]																											
Any Use																											
8th Grade	25.1	26.1‡	24.3	25.5	24.6	26.2	24.5	23.0	24.0	22.4	21.5	19.6	19.7	18.6	17.1	17.2	15.9	15.9	14.9	13.8	12.7	11.0	10.2	9.0	9.7	7.3	-2.4 sss
10th Grade	42.8	39.9‡	38.2	39.2	38.8	40.4	40.1	38.8	40.0	41.0	39.0	35.4	35.4	35.2	33.2	33.8	33.4	28.8	30.4	28.9	27.2	27.6	25.7	23.5	21.5	19.9	-1.6
12th Grade	54.0	51.3‡	48.6	50.1	51.3	50.8	52.7	52.0	51.0	50.0	49.8	48.6	47.5	48.0	47.0	45.3	44.4	43.1	43.5	41.2	40.0	41.5	39.2	37.4	35.3	33.2	-2.1

(Table continued on next page.)

TABLE 7 (cont.)
Trends in 30-Day Prevalence of Use of Various Drugs
in Grades 8, 10, and 12

	Percentage who used in last 30 days																									2015–2016 change
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Been Drunk [o]																											
8th Grade	7.6	7.5	7.8	8.7	8.3	9.6	8.2	8.4	9.4	8.3	7.7	6.7	6.7	6.2	6.0	6.2	5.5	5.4	5.4	5.0	4.4	3.6	3.5	2.7	3.1	1.8	-1.3 sss
10th Grade	20.5	18.1	19.8	20.3	20.8	21.3	22.4	21.1	22.5	23.5	21.9	18.3	18.2	18.5	17.6	18.8	18.1	14.4	15.5	14.7	13.7	14.5	12.8	11.2	10.3	9.0	-1.2
12th Grade	31.6	29.9	28.9	30.8	33.2	31.3	34.2	32.9	32.9	32.3	32.7	30.3	30.9	32.5	30.2	30.0	28.7	27.6	27.4	26.8	25.0	28.1	26.0	23.5	20.6	20.4	-0.2
Flavored Alcoholic Beverages [e,n]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	14.6	12.9	13.1	12.2	10.2	9.5	9.4	8.6	7.6	6.3	5.7	5.5	4.0	-1.5 ss
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	25.1	23.1	24.7	21.8	20.2	19.0	19.4	15.8	16.3	15.5	14.0	12.8	11.0	-1.8
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	31.1	30.5	29.3	29.1	27.4	27.4	24.1	23.1	21.8	21.0	19.9	20.8	18.3	-2.5
Cigarettes																											
Any Use																											
8th Grade	14.3	15.5	16.7	18.6	19.1	21.0	19.4	19.1	17.5	14.6	12.2	10.7	10.2	9.2	9.3	8.7	7.1	6.8	6.5	7.1	6.1	4.9	4.5	4.0	3.6	2.6	-1.0 ss
10th Grade	20.8	21.5	24.7	25.4	27.9	30.4	29.8	27.6	25.7	23.9	21.3	17.7	16.7	16.0	14.9	14.5	14.0	12.3	13.1	13.6	11.8	10.8	9.1	7.2	6.3	4.9	-1.5 ss
12th Grade	28.3	27.8	29.9	31.2	33.5	34.0	36.5	35.1	34.6	31.4	29.5	26.7	24.4	25.0	23.2	21.6	21.6	20.4	20.1	19.2	18.7	17.1	16.3	13.6	11.4	10.5	-0.9
Smokeless Tobacco [t]																											
8th Grade	6.9	7.0	6.6	7.7	7.1	7.1	5.5	4.8	4.5	4.2	4.0	3.3	4.1	4.1	3.3	3.7	3.2	3.5	3.7	4.1	3.5	2.8	2.8	3.0	3.2	2.5	-0.7
10th Grade	10.0	9.6	10.4	10.5	9.7	8.6	8.9	7.5	6.5	6.1	6.9	6.1	5.3	4.9	5.6	5.7	6.1	5.0	6.5	7.5	6.6	6.4	6.4	5.3	4.9	3.5	-1.3 s
12th Grade	—	11.4	10.7	11.1	12.2	9.8	9.7	8.8	8.4	7.6	7.8	6.5	6.7	6.7	7.6	6.1	6.6	6.5	8.4	8.5	8.3	7.9	8.1	8.4	6.1	6.6	+0.5
Electronic Vaporizers [bb]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8.0	6.2	-1.8 s
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14.2	11.0	-3.3 ss
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16.3	12.5	-3.8 ss
Large Cigars [bb]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.9	2.4	1.5	-0.9 s
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.9	3.4	2.3	-1.1 s
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6.4	7.0	6.5	-0.6

(Table continued on next page.)

TABLE 7 (cont.)
Trends in 30-Day Prevalence of Use of Various Drugs in Grades 8, 10, and 12

	Percentage who used in last 30 days																										2015–2016 change
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Flavored Little Cigars [bb]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.1	4.1	2.8	-1.3 ss
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6.9	6.1	4.9	-1.2
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11.9	11.4	9.5	-1.9 s
Regular Little Cigars [bb]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.5	3.3	1.9	-1.5 ss
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4.4	3.8	3.0	-0.8
12th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7.0	7.8	6.1	-1.7 s
Steroids [k,u]																											
8th Grade	0.4	0.5	0.5	0.5	0.6	0.4	0.5	0.5	0.7	0.8	0.7	0.8	0.7	0.5	0.5	0.5	0.4	0.5	0.4	0.3	0.4	0.3	0.3	0.2	0.3	0.3	0.0
10th Grade	0.6	0.6	0.5	0.6	0.6	0.5	0.7	0.6	0.9	1.0	0.9	1.0	0.8	0.8	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.0
12th Grade	0.8	0.6	0.7	0.9	0.7	0.7	1.0	1.1	0.9	0.8	1.3	1.4	1.3	1.6	0.9	1.1	1.0	1.0	1.0	1.1	0.7	0.9	1.0	0.9	1.0	0.7	-0.3
Previously surveyed drugs that have been dropped.																											
Nitrites [e]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	0.4	0.3	0.6	0.4	0.4	0.7	0.7	1.0	0.4	0.3	0.5	0.6	0.7	0.7	0.5	0.3	0.5	0.3	0.6	—	—	—	—	—	—	—	—
PCP [e]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	0.5	0.6	1.0	0.7	0.6	1.3	0.7	1.0	0.8	0.9	0.5	0.4	0.6	0.4	0.7	0.4	0.5	0.6	0.5	0.8	0.8	0.5	0.4	—	—	—	—
Methaqualone [e,k]																											
8th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th Grade	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12th Grade	0.2	0.4	0.1	0.4	0.4	0.6	0.3	0.6	0.4	0.2	0.5	0.3	0.4	0.5	0.5	0.4	0.4	0.2	0.3	0.2	0.2	0.3	—	—	—	—	—

Source. The Monitoring the Future study, the University of Michigan.

Note: See footnotes following Table 8.

TABLE 8
Trends in 30-Day Prevalence of Daily Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Marijuana/Hashish																											
Daily [aa]																											
8th Grade	0.2	0.2	0.4	0.7	0.8	1.5	1.1	1.1	1.4	1.3	1.3	1.2	1.0	0.8	1.0	1.0	0.8	0.9	1.0	1.2	1.3	1.1	1.1	1.0	1.1	0.7	-0.3 s
10th Grade	0.8	0.8	1.0	2.2	2.8	3.5	3.7	3.6	3.8	3.8	4.5	3.9	3.6	3.2	3.1	2.8	2.8	2.7	2.8	3.3	3.6	3.5	4.0	3.4	3.0	2.5	-0.5
12th Grade	2.0	1.9	2.4	3.6	4.6	4.9	5.8	5.6	6.0	6.0	5.8	6.0	6.0	5.6	5.0	5.0	5.1	5.4	5.2	6.1	6.6	6.5	6.5	5.8	6.0	6.0	0.0
Alcohol [s,aa]																											
Any Daily Use																											
8th Grade	0.5	0.6‡	1.0	1.0	0.7	1.0	0.8	0.9	1.0	0.8	0.9	0.7	0.8	0.6	0.5	0.5	0.6	0.7	0.5	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.0
10th Grade	1.3	1.2‡	1.8	1.7	1.7	1.6	1.7	1.9	1.9	1.8	1.9	1.8	1.5	1.3	1.3	1.4	1.4	1.0	1.1	1.1	0.8	1.0	0.9	0.8	0.5	0.5	+0.1
12th Grade	3.6	3.4‡	3.4	2.9	3.5	3.7	3.9	3.9	3.4	2.9	3.6	3.5	3.2	2.8	3.1	3.0	3.1	2.8	2.5	2.7	2.1	2.5	2.2	1.9	1.9	1.3	-0.5 s
Been Drunk																											
Daily [o,aa]																											
8th Grade	0.1	0.1	0.2	0.3	0.2	0.2	0.2	0.3	0.4	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0
10th Grade	0.2	0.3	0.4	0.4	0.6	0.4	0.6	0.6	0.7	0.5	0.6	0.5	0.5	0.4	0.4	0.5	0.5	0.3	0.4	0.3	0.2	0.4	0.3	0.3	0.1	0.1	0.0
12th Grade	0.9	0.8	0.9	1.2	1.3	1.6	2.0	1.5	1.9	1.7	1.4	1.2	1.6	1.8	1.5	1.6	1.3	1.4	1.1	1.6	1.3	1.5	1.3	1.1	0.8	0.8	+0.1
5+ Drinks in a Row																											
in Last 2 Weeks																											
8th Grade	10.9	11.3	11.3	12.1	12.3	13.3	12.3	11.5	13.1	11.7	11.0	10.3	9.8	9.4	8.4	8.7	8.3	8.1	7.8	7.2	6.4	5.1	5.1	4.1	4.6	3.4	-1.2 sss
10th Grade	21.0	19.1	21.0	21.9	22.0	22.8	23.1	22.4	23.5	24.1	22.8	20.3	20.0	19.9	19.0	19.9	19.6	16.0	17.5	16.3	14.7	15.6	13.7	12.6	10.9	9.7	-1.2
12th Grade	29.8	27.9	27.5	28.2	29.8	30.2	31.3	31.5	30.8	30.0	29.7	28.6	27.9	29.2	27.1	25.4	25.9	24.6	25.2	23.2	21.6	23.7	22.1	19.4	17.2	15.5	-1.7
Cigarettes																											
Any Daily Use																											
8th Grade	7.2	7.0	8.3	8.8	9.3	10.4	9.0	8.8	8.1	7.4	5.5	5.1	4.5	4.4	4.0	4.0	3.0	3.1	2.7	2.9	2.4	1.9	1.8	1.4	1.3	0.9	-0.4 s
10th Grade	12.6	12.3	14.2	14.6	16.3	18.3	18.0	15.8	15.9	14.0	12.2	10.1	8.9	8.3	7.5	7.6	7.2	5.9	6.3	6.6	5.5	5.0	4.4	3.2	3.0	1.9	-1.1 sss
12th Grade	18.5	17.2	19.0	19.4	21.6	22.2	24.6	22.4	23.1	20.6	19.0	16.9	15.8	15.6	13.6	12.2	12.3	11.4	11.2	10.7	10.3	9.3	8.5	6.7	5.5	4.8	-0.7

(Table continued on next page.)

TABLE 8 (cont.)
Trends in 30-Day Prevalence of Daily Use of Various Drugs in Grades 8, 10, and 12

(Entries are percentages.)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
1/2 Pack+/Day																											
8th Grade	3.1	2.9	3.5	3.6	3.4	4.3	3.5	3.6	3.3	2.8	2.3	2.1	1.8	1.7	1.7	1.5	1.1	1.2	1.0	0.9	0.7	0.6	0.7	0.5	0.4	0.3	-0.1
10th Grade	6.5	6.0	7.0	7.6	8.3	9.4	8.6	7.9	7.6	6.2	5.5	4.4	4.1	3.3	3.1	3.3	2.7	2.0	2.4	2.4	1.9	1.5	1.5	1.2	1.0	0.6	-0.4 s
12th Grade	10.7	10.0	10.9	11.2	12.4	13.0	14.3	12.6	13.2	11.3	10.3	9.1	8.4	8.0	6.9	5.9	5.7	5.4	5.0	4.7	4.3	4.0	3.4	2.6	2.1	1.8	-0.3
Smokeless Tobacco Daily [t]																											
8th Grade	1.6	1.8	1.5	1.9	1.2	1.5	1.0	1.0	0.9	0.9	1.2	0.8	0.8	1.0	0.7	0.7	0.8	0.8	0.8	0.9	0.8	0.5	0.5	0.5	0.8	0.6	-0.1
10th Grade	3.3	3.0	3.3	3.0	2.7	2.2	2.2	2.2	1.5	1.9	2.2	1.7	1.8	1.6	1.9	1.7	1.6	1.4	1.9	2.5	1.7	2.0	1.9	1.8	1.6	1.0	-0.6 s
12th Grade	—	4.3	3.3	3.9	3.6	3.3	4.4	3.2	2.9	3.2	2.8	2.0	2.2	2.8	2.5	2.2	2.8	2.7	2.9	3.1	3.1	3.2	3.0	3.4	2.9	2.7	-0.2

Source. The Monitoring the Future study, the University of Michigan.

Note. See footnotes following Table 8.

Footnotes for Tables 5 through 8

Approximate Weighted *N*s	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
8th Graders	17,500	18,600	18,300	17,300	17,500	17,800	18,600	18,100	16,700	16,700	16,200	15,100	16,500
10th Graders	14,800	14,800	15,300	15,800	17,000	15,600	15,500	15,000	13,600	14,300	14,000	14,300	15,800
12th Graders	15,000	15,800	16,300	15,400	15,400	14,300	15,400	15,200	13,600	12,800	12,800	12,900	14,600

Approximate Weighted *N*s	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
8th Graders	17,000	16,800	16,500	16,100	15,700	15,000	15,300	16,000	15,100	14,600	14,600	14,400	16,900
10th Graders	16,400	16,200	16,200	16,100	15,100	15,900	15,200	14,900	15,000	12,900	13,000	15,600	14,700
12th Graders	14,600	14,700	14,200	14,500	14,000	13,700	14,400	14,100	13,700	12,600	12,400	12,900	11,800

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. ' ‡ ' indicates that the question changed in the following year. See relevant footnote for that drug. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]For 12th graders only: Use of any illicit drug includes any use of marijuana, LSD, other hallucinogens, crack, other cocaine, or heroin; or any use of narcotics other than heroin, amphetamines, sedatives (barbiturates), or tranquilizers not under a doctor's orders. For 8th and 10th graders only: The use of narcotics other than heroin and sedatives (barbiturates) has been excluded because these younger respondents appear to overreport use (perhaps because they include the use of nonprescription drugs in their answers). Due to changes in the amphetamines questions 2013 data for all grades for any illicit drug use, any illicit drug use other than marijuana and 8th and 10th grade any illicit drug use including inhalants are based on one half of the *N* indicated. 12th grade any illicit drug use including inhalants data are based on one form; *N* is one sixth of *N* indicated. 2014 data are based on all forms. See the amphetamine note for details.

[b]In 2001 the question text was changed on half of the questionnaire forms for each age group. Other psychedelics was changed to other hallucinogens and shrooms was added to the list of examples. For the tranquilizer list of examples, Miltown was replaced with Xanax. For 8th, 10th, and 12th graders: The 2001 data presented here are based on the changed forms only; *N* is one half of *N* indicated. In 2002 the remaining forms were changed to the new wording. The data are based on all forms beginning in 2002. Data for any illicit drug other than marijuana and data for hallucinogens are also affected by these changes and have been handled in a parallel manner. Hallucinogens, LSD, and hallucinogens other than LSD are based on five of six forms beginning in 2014; *N* is five sixths of *N* indicated.

[c]For 12th graders only: Data based on five of six forms in 1991–1998; *N* is five sixths of *N* indicated. Data based on three of six forms beginning in 1999; *N* is three sixths of *N* indicated. For 8th and 10th graders only, beginning in 2014 data based on two thirds of *N* indicated.

[d]Inhalants are unadjusted for underreporting of amyl and butyl nitrites.

[e]For 12th graders only: Data based on one of six forms; *N* is one sixth of *N* indicated. In 2011 for flavored alcoholic beverages Skyy Blue and Zima were dropped from the list of examples. An examination of the data did not show any effect from the wording change. In 2014 the PCP use questions were dropped; annual PCP use was moved to another form. In 2016 a question on use of tobacco using a hookah was added to two additional forms; *N* is three sixths of *N* indicated.

[f]Hallucinogens are unadjusted for underreporting of PCP.

[g]For 8th and 10th graders only: Data based on one of two forms in 1996; *N* is one half of *N* indicated. Data based on one third of *N* indicated in 1997–2001 due to changes in the questionnaire forms. Data based on two of four forms beginning in 2002; *N* is one half of *N* indicated. In 2014 a revised question on use of ecstasy (MDMA) including "Molly" was added to one form. The 2013 and 2014 "Original wording" data reported here are for only the questionnaires using the original question wording; *N* is one half of *N* indicated. Beginning in 2014 data

(Footnote continued on next page.)

Footnotes for Tables 5 through 8 (cont.)

reported here for the "Revised wording" are for only the questionnaires which include "Molly;" *N* is two sixths of *N* indicated in 2014 and five sixths of the *N* indicated in 2015. For 12th graders only: Data based on one of six forms in 1996–2001; *N* is one sixth of *N* indicated Data based on two of six forms beginning in 2002; *N* is two sixths of N indicated. In 2014 a revised question on use of ecxtasy (MDMA) including "Molly" was added to one form. The 2013 and 2014 "Original wording" data reported here are for only the questionnaires using the original question wording; *N* is two sixths of *N* indicated. Beginning in 2014 data reported for the "Revised wording" are for only the questionnaires which include "Molly."; *N* is one sixth of the *N* indicated in 2014 and three sixths of the *N* indicated in 2015.

[h]For 12th graders only: Data based on four of six forms; *N* is four sixths of *N* indicated.

[i]In 1995 the heroin question was changed in one of two forms for 8th and 10th graders and in three of six forms for 12th graders. Separate questions were asked for use with and without injection. In 1996, the heroin question was changed in the remaining 8th- and 10th-grade forms. Data presented here represent the combined data from all forms.

[j]For 8th and 10th graders only: Data based on one of two forms in 1995; *N* is one half of *N* indicated. Data based on all forms in 1996 through 2014. In 2015 the question was dropped from 1 form; *N* is four sixths of *N* indicated. For 12th graders only: Data based on three of six forms; *N* is three sixths of N indicated.

[k]Only drug use not under a doctor's orders is included here.

[l]In 2002 the question text was changed in half of the questionnaire forms. The list of examples of narcotics other than heroin was updated: Talwin, laudanum, and paregoric—all of which had negligible rates of use by 2001—were replaced with Vicodin, OxyContin, and Percocet. The 2002 data presented here are based on the changed forms only; *N* is one half of *N* indicated. In 2003, the remaining forms were changed to the new wording. The data are based on all forms beginning in 2003. In 2013 the list of examples was changed on one form: MS Contin, Roxycodone, Hydrocodone (Lortab, Lorcet, Norco), Suboxone, Tylox, and Tramadol were added to the list. An examination of the data did not show any effect from the wording change.

[m]For 8th, 10th, and 12th graders: In 2009, the question text was changed slightly in half of the forms. An examination of the data did not show any effect from the wording change. In 2010 the remaining forms were changed in a like manner. In 2011 the question text was changed slightly in one form; bennies, Benzedrine and Methadrine were dropped from the list of examples. An examination of the data did not show any effect from the wording change. In 2013 the question wording was changed slightly in two of the 8th and 10th grade questionnaires and in three of the 12th grade questionnaires. The new wording in 2013 asked "On how many occasions (if any) have taken amphetamines or other prescription stimulant drugs…" In contrast, the old wording did not include the text highlighted in red. Results in 2013 indicated higher prevalence in questionnaires with the new wording as compared to the old wording; it was proportionally 61% higher in 8th grade, 34% higher in 10th grade, and 21% higher in 12th grade. 2013 data are based on the changed forms only; for 8th, 10th, and 12th graders N is one half of N indicated. Beginning in 2014 all questionnaires included the new, updated wording.

[n]For 8th and 10th graders only: Data based on one of four forms; *N* is one third of *N* indicated. See text for detailed explanation. In 2011 for flavored alcoholic beverages: Skyy Blue and Zima were dropped from the list of examples. An examination of the data did not show any effect from the wording change. Annual synthetic marijuana use questions asked of one third of *N* indicated.

[o]For 12th graders only: Data based on two of six forms; N is two sixths of N indicated. Bidis and kreteks based on one of six forms beginning in 2009; *N* is one sixth *N* indicated.

[p]For 12th graders only: In 2004 the barbiturate question text was changed on half of the questionnaire forms. Barbiturates was changed to sedatives including barbiturates, and "have you taken barbiturates . . . " was changed to "have you taken sedatives . . . " In the list of examples downs, downers, goofballs, yellow, reds, blues, rainbows were changed to downs, or downers, and include Phenobarbital, Tuinal, Nembutal, and Seconal. An examination of the data did not show any effect from the wording change. In 2005 the remaining forms were changed in a like manner. In 2013 the question text was changed in all forms: Tuinal, Nembutal, and Seconal were replaced with Ambien, Lunesta, and Sonata. In one form the list of examples was also changed: Tuinal was dropped from the list and Dalmane, Restoril, Halcion, Intermezzo, and Zolpimist were added. An examination of the data did not show any effect from the wording change.

(Footnote continued on next page.)

Footnotes for Tables 5 through 8 (cont.)

[q]The use of any prescription drug includes use of any of the following: amphetamines, sedatives (barbiturates), narcotics other than heroin, or tranquilizers "…without a doctor telling you to use them."

[r]For 8th and 10th graders only: Data based on one of two forms in 1996; *N* is one half of *N* indicated. Data based on three of four forms in 1997–1998; *N* is two thirds of *N* indicated. Data based on two of four forms in 1999–2001; *N* is one third of *N* indicated. Data based on one of four forms beginning in 2002; *N* is one sixth of *N* indicated. See text for detailed explanation. For 12th graders only: Data based on one of six forms in 1996–2001; *N* is one sixth of *N* indicated. Data based on two of six forms in 2002–2009; *N* is two sixths of *N* indicated. Data for 2001 and 2002 are not comparable due to changes in the questionnaire forms. Data based on one of six forms beginning in 2010; N is one sixth of N indicated.

[s]For 8th, 10th, and 12th graders: In 1993, the question text was changed slightly in half of the forms to indicate that a drink meant more than just a few sips. The 1993 data are based on the changed forms only; *N* is one half of *N* indicated for these groups. In 1994 the remaining forms were changed to the new wording. The data are based on all forms beginning in 1994. In 2004, the question text was changed slightly in half of the forms. An examination of the data did not show any effect from the wording change. The remaining forms were changed in 2005.

[t]For 8th and 10th graders only: Data based on one of two forms for 1991–1996 and on two of four forms beginning in 1997; *N* is one half of *N* indicated. For 12th graders only: Data based on one of six forms; *N* is one sixth of *N* indicated. For all grades in 2011: snus and dissolvable tobacco were added to the list of examples. An examination of the data did not show any effect from the wording change.

[u]For 8th and 10th graders only: In 2006, the question text was changed slightly in half of the questionnaire forms. An examination of the data did not show any effect from the wording change. In 2007 the remaining forms were changed in a like manner. In 2008 the question text was changed slightly in half of the questionnaire forms. An examination of the data did not show any effect from the wording change. In 2009 the remaining forms were changed in a like manner. For 12th graders only: Data based on two of six forms in 1991–2005; N is two sixths of *N* indicated. Data based on three of six forms beginning in 2006; *N* is three sixths of *N* indicated. In 2006 a slightly altered version of the question was added to a third form. An examination of the data did not show any effect from the wording change. In 2007 the remaining forms were changed in a like manner. In 2008 the question text was changed slightly in two of the questionnaire forms. An examination of the data did not show any effect from the wording change. In 2009 the remaining form was changed in a like manner.

[v]For 12th graders only: Data based on two of six forms in 2002–2005; *N* is two sixths of *N* indicated. Data based on three of six forms beginning in 2006; *N* is three sixths of *N* indicated.

[w]For 12th graders only: Data based on two of six forms in 2000; *N* is two sixths of *N* indicated. Data based on three of six forms in 2001; *N* is three sixths of *N* indicated. Data based on one of six forms beginning in 2002; *N* is one sixth of *N* indicated.

[x]For 12th graders only: Data based on two of six forms in 2000; *N* is two sixths of *N* indicated. Data based on three of six forms in 2001–2009; *N* is three sixths of *N* indicated. Data based on two of six forms beginning in 2010; *N* is two sixths of *N* indicated.

[y]The 2003 flavored alcoholic beverage data were created by adjusting the 2004 data to reflect the change in the 2003 and 2004 alcopops data.

[z]For 8th and 10th graders only: Data based on one of four forms; *N* is one third of *N* indicated. See text for detailed explanation. For 12th graders only: Data based on two of six forms; *N* is two sixths of *N* indicated. For all grades: In 2011 the question text was "…had an alcoholic beverage containing caffeine (like Four Loko or Joose)." In 2012 the question text was changed to "…had an alcoholic beverage mixed with an energy drink (like Red Bull)." An examination of the data did not show any effect from the wording changes.

[aa]Daily use is defined as use on 20 or more occasions in the past 30 days except for cigarettes and smokeless tobacco, for which actual daily use is measured, and for 5+ drinks, for which the prevalence of having five or more drinks in a row in the last two weeks is measured.

[bb]8th and 10th grade data based on one third of *N* indicated. 12th grade data based on two of six forms; *N* is two sixths of *N* indicated.

TABLE 9
Trends in Harmfulness of Drugs as Perceived by 8th Graders

How much do you think people risk harming themselves (physically or in other ways), if they . . .	Percentage saying great risk [a]														
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Try marijuana once or twice [b]	40.4	39.1	36.2	31.6	28.9	27.9	25.3	28.1	28.0	29.0	27.7	28.2	30.2	31.9	31.4
Smoke marijuana occasionally [b]	57.9	56.3	53.8	48.6	45.9	44.3	43.1	45.0	45.7	47.4	46.3	46.0	48.6	50.5	48.9
Smoke marijuana regularly [b]	83.8	82.0	79.6	74.3	73.0	70.9	72.7	73.0	73.3	74.8	72.2	71.7	74.2	76.2	73.9
Try synthetic marijuana once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take synthetic marijuana occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try inhalants once or twice [d]	35.9	37.0	36.5	37.9	36.4	40.8	40.1	38.9	40.8	41.2	45.6	42.8	40.3	38.7	37.5
Take inhalants regularly [d]	65.6	64.4	64.6	65.5	64.8	68.2	68.7	67.2	68.8	69.9	71.6	69.9	67.4	66.4	64.1
Take LSD once or twice [e]	—	—	42.1	38.3	36.7	36.5	37.0	34.9	34.1	34.0	31.6	29.6	27.9	26.8	25.8
Take LSD regularly [e]	—	—	68.3	65.8	64.4	63.6	64.1	59.6	58.8	57.5	52.9	49.3	48.2	45.2	44.0
Try ecstasy (MDMA) once or twice [f]	—	—	—	—	—	—	—	—	—	—	35.8	38.9	41.9	42.5	40.0
Take ecstasy (MDMA) occasionally [f]	—	—	—	—	—	—	—	—	—	—	55.5	61.8	65.8	65.1	60.8
Try salvia once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take salvia occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try crack once or twice [d]	62.8	61.2	57.2	54.4	50.8	51.0	49.9	49.3	48.7	48.5	48.6	47.4	48.7	49.0	49.6
Take crack occasionally [d]	82.2	79.6	76.8	74.4	72.1	71.6	71.2	70.6	70.6	70.1	70.0	69.7	70.3	70.4	69.4
Try cocaine powder once or twice [d]	55.5	54.1	50.7	48.4	44.9	45.2	45.0	44.0	43.3	43.3	43.9	43.2	43.7	44.4	44.2
Take cocaine powder occasionally [d]	77.0	74.3	71.8	69.1	66.4	65.7	65.8	65.2	65.4	65.5	65.8	64.9	65.8	66.0	65.3
Try heroin once or twice without using a needle [e]	—	—	—	—	60.1	61.3	63.0	62.8	63.0	62.0	61.1	62.6	62.7	61.6	61.4
Take heroin occasionally without using a needle [e]	—	—	—	—	76.8	76.6	79.2	79.0	78.9	78.6	78.5	78.5	77.8	77.5	76.8
Try OxyContin once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take OxyContin occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try Vicodin once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take Vicodin occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try Adderall once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take Adderall occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try bath salts (synthetic stimulants) once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take bath salts (synthetic stimulants) occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try cough/cold medicine once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take cough/cold medicine occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	11.0	12.1	12.4	11.6	11.6	11.8	10.4	12.1	11.6	11.9	12.2	12.5	12.6	13.7	13.9
Take one or two drinks nearly every day [b]	31.8	32.4	32.6	29.9	30.5	28.6	29.1	30.3	29.7	30.4	30.0	29.6	29.9	31.0	31.4
Have five or more drinks once or twice each weekend [b]	59.1	58.0	57.7	54.7	54.1	51.8	55.6	56.0	55.3	55.9	56.1	56.4	56.5	56.9	57.2
Smoke one to five cigarettes per day [c]	—	—	—	—	—	—	—	—	26.9	28.9	30.5	32.8	33.4	37.0	37.5
Smoke one or more packs of cigarettes per day [g]	51.6	50.8	52.7	50.8	49.8	50.4	52.6	54.3	54.8	58.8	57.1	57.5	57.7	62.4	61.5
Use electronic cigarettes (e-cigarettes) regularly [h]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Smoke little cigars or cigarillos regularly [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Use smokeless tobacco regularly	35.1	35.1	36.9	35.5	33.5	34.0	35.2	36.5	37.1	39.0	38.2	39.4	39.7	41.3	40.8
Take dissolvable tobacco regularly [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take snus regularly [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take steroids [i]	64.2	69.5	70.2	67.6	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*17,400*	*18,700*	*18,400*	*17,400*	*17,500*	*17,900*	*18,800*	*18,100*	*16,700*	*16,700*	*16,200*	*15,100*	*16,500*	*17,000*	*16,800*

Table continued on next page.

TABLE 9 (cont.)
Trends in Harmfulness of Drugs as Perceived by 8th Graders

How much do you think people risk harming themselves (physically or in other ways), if they . . .	Percentage saying great risk [a]											2015–2016 change
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Try marijuana once or twice [b]	32.2	32.8	31.1	29.5	29.5	28.2	26.0	24.1	23.0	23.0	22.8	-0.2
Smoke marijuana occasionally [b]	48.9	50.2	48.1	44.8	44.1	43.4	41.7	37.2	36.7	36.8	36.8	+0.1
Smoke marijuana regularly [b]	73.2	74.3	72.0	69.8	68.0	68.3	66.9	61.0	58.9	58.0	57.5	-0.4
Try synthetic marijuana once or twice [c]	—	—	—	—	—	—	24.4	24.2	23.9	26.0	27.5	+1.5
Take synthetic marijuana occasionally [c]	—	—	—	—	—	—	36.8	36.2	32.4	33.5	35.4	+1.9
Try inhalants once or twice [d]	35.8	35.9	33.9	34.1	35.5	34.7	34.2	33.7	34.5	33.7	32.0	-1.8
Take inhalants regularly [d]	62.1	61.9	59.2	58.1	60.6	59.0	59.0	56.7	55.3	54.1	52.1	-1.9
Take LSD once or twice [e]	23.8	22.8	21.9	21.4	23.6	21.7	19.9	19.6	20.0	22.2	22.6	+0.4
Take LSD regularly [e]	40.0	38.5	36.9	37.0	38.6	37.8	35.0	34.5	33.7	37.0	36.8	-0.2
Try ecstasy (MDMA) once or twice [f]	32.8	30.4	28.6	26.0	27.0	25.4	23.6	24.1‡	46.1	45.5	42.5	-3.0
Take ecstasy (MDMA) occasionally [f]	52.0	48.6	46.8	43.9	45.0	43.7	41.0	42.1‡	59.7	58.5	54.0	-4.5 ss
Try salvia once or twice [c]	—	—	—	—	—	—	9.5	8.5	—	—	—	—
Take salvia occasionally [c]	—	—	—	—	—	—	16.1	14.6	—	—	—	—
Try crack once or twice [d]	47.6	47.3	47.1	46.6	49.6	48.1	47.0	47.1	48.3	49.6	48.9	-0.7
Take crack occasionally [d]	68.7	68.3	67.9	66.6	68.4	67.7	67.8	66.5	65.5	65.7	65.7	+0.1
Try cocaine powder once or twice [d]	43.5	43.5	42.7	42.3	45.7	43.3	42.8	43.5	43.9	44.3	44.3	-0.1
Take cocaine powder occasionally [d]	64.0	64.2	62.7	62.3	64.2	63.5	63.3	62.7	61.8	61.6	62.4	+0.8
Try heroin once or twice without using a needle [e]	60.4	60.3	60.8	60.0	62.3	61.7	59.1	59.8	60.9	61.4	59.2	-2.2
Take heroin occasionally without using a needle [e]	75.3	76.4	75.5	74.0	76.7	75.9	75.1	73.4	73.2	72.7	70.3	-2.4
Try OxyContin once or twice [c]	—	—	—	—	—	—	21.9	19.9	22.1	20.2	21.3	+1.1
Take OxyContin occasionally [c]	—	—	—	—	—	—	35.3	32.6	34.4	32.5	33.5	+0.9
Try Vicodin once or twice [c]	—	—	—	—	—	—	17.5	15.0	18.4	16.9	18.3	+1.4
Take Vicodin occasionally [c]	—	—	—	—	—	—	29.4	26.2	28.2	26.7	28.8	+2.1
Try Adderall once or twice [c]	—	—	—	—	—	—	17.6	16.5	20.7	19.2	21.4	+2.2 s
Take Adderall occasionally [c]	—	—	—	—	—	—	29.9	28.3	32.5	32.0	35.9	+3.9 ss
Try bath salts (synthetic stimulants) once or twice [c]	—	—	—	—	—	—	24.9	39.3	36.8	33.9	31.8	-2.1
Take bath salts (synthetic stimulants) occasionally [c]	—	—	—	—	—	—	38.8	51.9	49.1	45.5	42.5	-3.0 s
Try cough/cold medicine once or twice [c]	—	—	—	—	—	—	21.2	20.1	22.9	20.9	23.5	+2.6 ss
Take cough/cold medicine occasionally [c]	—	—	—	—	—	—	38.8	37.3	37.9	37.3	38.6	+1.3
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	14.2	14.9	13.5	14.4	14.9	14.5	13.9	13.7	14.8	15.3	14.7	-0.6
Take one or two drinks nearly every day [b]	31.3	32.6	31.5	31.5	32.3	31.8	31.4	30.6	31.0	30.9	30.7	-0.2
Have five or more drinks once or twice each weekend [b]	56.4	57.9	57.0	55.8	57.2	58.4	58.2	55.7	54.3	53.9	53.4	-0.5
Smoke one to five cigarettes per day [c]	37.0	38.6	38.6	38.6	38.2	37.4	40.4	42.8	41.9	41.7	43.2	+1.5
Smoke one or more packs of cigarettes per day [g]	59.4	61.1	59.8	59.1	60.9	62.5	62.6	62.4	62.1	63.0	61.2	-1.7
Use electronic cigarettes (e-cigarettes) regularly [h]	—	—	—	—	—	—	—	—	14.5	18.5	21.3	+2.8 ss
Smoke little cigars or cigarillos regularly [c]	—	—	—	—	—	—	—	—	28.8	31.0	32.5	+1.5
Use smokeless tobacco regularly	39.5	41.8	41.0	40.8	41.8	40.8	37.8	36.2	34.5	36.6	35.1	-1.5
Take dissolvable tobacco regularly [c]	—	—	—	—	—	—	34.8	32.2	33.5	33.0	34.3	+1.3
Take snus regularly [c]	—	—	—	—	—	—	42.2	38.9	38.3	37.7	37.9	+0.2
Take steroids [i]	—	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*16,500*	*16,100*	*15,700*	*15,000*	*15,300*	*16,000*	*15,100*	*14,600*	*14,600*	*14,400*	*16,900*	

Table continued on next page.

TABLE 9 (cont.)
Trends in Harmfulness of Drugs as Perceived by 8th Graders

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding. "‡' indicates that the question changed the following year.

[a]Answer alternatives were: (1) No risk, (2) Slight risk, (3) Moderate risk, (4) Great risk, and (5) Can't say, drug unfamiliar.

[b]Beginning in 2012 data based on two thirds of *N* indicated.

[c]Data based on one third of *N* indicated.

[d]Beginning in 1997, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[e]Data based on one of two forms in 1993–1996; *N* is one half of *N* indicated. Beginning in 1997, data based on one third of *N* indicated due to changes in questionnaire forms.

[f]Beginning in 2014 data are based on the revised question which included "Molly," *N* is one third of *N* indicated in 2014 and two thirds of *N* indicated in 2015. 2014 and 2015 data are not comparable to earlier years due to the revision of the question text.

[g]Beginning in 1999, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[h]E-cigarette data based on two thirds of *N* indicated. Little cigars or cigarillos data based on one third *N* indicated.

[i]Data based on two forms in 1991 and 1992. Data based on one of two forms in 1993 and 1994; *N* is one half of *N* indicated.

TABLE 10
Trends in Harmfulness of Drugs as Perceived by 10th Graders

How much do you think people risk harming themselves (physically or in other ways), if they . . .	Percentage saying great risk [a]														
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Try marijuana once or twice [b]	30.0	31.9	29.7	24.4	21.5	20.0	18.8	19.6	19.2	18.5	17.9	19.9	21.1	22.0	22.3
Smoke marijuana occasionally [b]	48.6	48.9	46.1	38.9	35.4	32.8	31.9	32.5	33.5	32.4	31.2	32.0	34.9	36.2	36.6
Smoke marijuana regularly [b]	82.1	81.1	78.5	71.3	67.9	65.9	65.9	65.8	65.9	64.7	62.8	60.8	63.9	65.6	65.5
Try synthetic marijuana once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take synthetic marijuana occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try inhalants once or twice [d]	37.8	38.7	40.9	42.7	41.6	47.2	47.5	45.8	48.2	46.6	49.9	48.7	47.7	46.7	45.7
Take inhalants regularly [d]	69.8	67.9	69.6	71.5	71.8	75.8	74.5	73.3	76.3	75.0	76.4	73.4	72.2	73.0	71.2
Take LSD once or twice [e]	—	—	48.7	46.5	44.7	45.1	44.5	43.5	45.0	43.0	41.3	40.1	40.8	40.6	40.3
Take LSD regularly [e]	—	—	78.9	75.9	75.5	75.3	73.8	72.3	73.9	72.0	68.8	64.9	63.0	63.1	60.8
Try ecstasy (MDMA) once or twice [f]	—	—	—	—	—	—	—	—	—	—	39.4	43.5	49.7	52.0	51.4
Take ecstasy (MDMA) occasionally [f]	—	—	—	—	—	—	—	—	—	—	64.8	67.3	71.7	74.6	72.8
Try salvia once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take salvia occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try crack once or twice [d]	70.4	69.6	66.6	64.7	60.9	60.9	59.2	58.0	57.8	56.1	57.1	57.4	57.6	56.7	57.0
Take crack occasionally [d]	87.4	86.4	84.4	83.1	81.2	80.3	78.7	77.5	79.1	76.9	77.3	75.7	76.4	76.7	76.9
Try cocaine powder once or twice [d]	59.1	59.2	57.5	56.4	53.5	53.6	52.2	50.9	51.6	48.8	50.6	51.3	51.8	50.7	51.3
Take cocaine powder occasionally [d]	82.2	80.1	79.1	77.8	75.6	75.0	73.9	71.8	73.6	70.9	72.3	71.0	71.4	72.2	72.4
Try heroin once or twice without using a needle [e]	—	—	—	—	70.7	72.1	73.1	71.7	73.7	71.7	72.0	72.2	70.6	72.0	72.4
Take heroin occasionally without using a needle [e]	—	—	—	—	85.1	85.8	86.5	84.9	86.5	85.2	85.4	83.4	83.5	85.4	85.2
Try OxyContin once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take OxyContin occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try Vicodin once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take Vicodin occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try Adderall once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take Adderall occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try bath salts (synthetic stimulants) once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take bath salts (synthetic stimulants) occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try cough/cold medicine once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take cough/cold medicine occasionally [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	9.0	10.1	10.9	9.4	9.3	8.9	9.0	10.1	10.5	9.6	9.8	11.5	11.5	10.8	11.5
Take one or two drinks nearly every day [b]	36.1	36.8	35.9	32.5	31.7	31.2	31.8	31.9	32.9	32.3	31.5	31.0	30.9	31.3	32.6
Have five or more drinks once or twice each weekend [u]	54.7	55.9	54.9	52.9	52.0	50.9	51.8	52.5	51.9	51.0	50.7	51.7	51.6	51.7	53.3
Smoke one to five cigarettes per day [c]	—	—	—	—	—	—	—	—	28.4	30.2	32.4	35.1	38.1	39.7	41.0
Smoke one or more packs of cigarettes per day [g]	60.3	59.3	60.7	59.0	57.0	57.9	59.9	61.9	62.7	65.9	64.7	64.3	65.7	68.4	68.1
Use electronic cigarettes (e-cigarettes) regularly [h]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Smoke little cigars or cigarillos regularly [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Use smokeless tobacco regularly	40.3	39.6	44.2	42.2	38.2	41.0	42.2	42.8	44.2	46.7	46.2	46.9	48.0	47.8	46.1
Take dissolvable tobacco regularly [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take snus regularly [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take steroids [i]	67.1	72.7	73.4	72.5	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*14,700*	*14,800*	*15,300*	*15,900*	*17,000*	*15,700*	*15,600*	*15,000*	*13,600*	*14,300*	*14,000*	*14,300*	*15,800*	*16,400*	*16,200*

Table continued on next page.

TABLE 10 (cont.)
Trends in Harmfulness of Drugs as Perceived by 10th Graders

How much do you think people risk harming themselves (physically or in other ways), if they . . .	Percentage saying great risk [a]											2015–2016 change
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Try marijuana once or twice [b]	22.2	22.2	23.1	20.5	19.9	19.3	17.2	15.7	15.2	15.8	16.4	+0.6
Smoke marijuana occasionally [b]	35.6	36.0	37.0	32.9	30.9	30.1	26.8	25.1	23.9	24.7	24.4	-0.3
Smoke marijuana regularly [b]	64.9	64.5	64.8	59.5	57.2	55.2	50.9	46.5	45.4	43.2	44.0	+0.8
Try synthetic marijuana once or twice [c]	—	—	—	—	—	—	24.6	24.1	25.0	26.3	26.8	+0.5
Take synthetic marijuana occasionally [c]	—	—	—	—	—	—	34.9	32.8	30.7	31.7	31.8	+0.1
Try inhalants once or twice [d]	43.9	43.0	41.2	42.0	42.5	42.4	42.4	43.0	43.1	43.1	40.7	-2.4 s
Take inhalants regularly [d]	70.2	68.6	66.8	66.8	67.1	66.2	66.1	65.9	64.7	63.1	59.7	-3.4 ss
Take LSD once or twice [e]	38.8	35.4	34.6	34.9	33.9	34.2	34.7	34.7	34.5	36.4	34.4	-2.0
Take LSD regularly [e]	60.7	56.8	55.7	56.7	56.1	54.9	56.4	55.9	54.8	58.3	55.2	-3.0
Try ecstasy (MDMA) once or twice [f]	48.4	45.3	43.2	38.9	36.3	37.2	36.2	36.0‡	53.2	54.8	54.2	-0.6
Take ecstasy (MDMA) occasionally [f]	71.3	68.2	66.4	62.1	59.2	60.8	59.8	58.6‡	69.0	70.1	69.3	-0.8
Try salvia once or twice [c]	—	—	—	—	—	—	12.2	10.7	—	—	—	—
Take salvia occasionally [c]	—	—	—	—	—	—	20.3	17.1	—	—	—	—
Try crack once or twice [d]	56.6	56.4	56.5	57.7	58.1	59.5	59.0	60.2	61.4	62.5	61.3	-1.2
Take crack occasionally [d]	76.2	76.0	76.5	75.9	76.2	76.5	76.7	77.8	76.4	77.5	75.2	-2.3 s
Try cocaine powder once or twice [d]	50.2	49.5	49.8	50.8	52.9	53.0	53.4	54.5	54.1	54.8	54.6	-0.2
Take cocaine powder occasionally [d]	71.3	70.9	71.1	71.0	72.2	72.0	72.6	72.8	71.7	72.6	70.9	-1.7
Try heroin once or twice without using a needle [e]	70.0	70.5	70.8	72.2	73.0	72.9	72.6	73.2	72.6	74.1	73.3	-0.9
Take heroin occasionally without using a needle [e]	83.6	84.2	83.1	83.3	84.8	83.4	84.4	84.0	82.5	83.3	82.2	-1.1
Try OxyContin once or twice [c]	—	—	—	—	—	—	30.9	29.4	29.7	29.9	28.7	-1.2
Take OxyContin occasionally [c]	—	—	—	—	—	—	48.3	44.7	44.4	43.7	41.4	-2.3
Try Vicodin once or twice [c]	—	—	—	—	—	—	23.2	21.0	22.5	24.1	21.8	-2.3 s
Take Vicodin occasionally [c]	—	—	—	—	—	—	40.3	36.0	36.4	35.4	32.6	-2.8 s
Try Adderall once or twice [c]	—	—	—	—	—	—	19.7	17.6	22.2	22.9	22.5	-0.3
Take Adderall occasionally [c]	—	—	—	—	—	—	34.3	30.5	37.0	37.0	35.8	-1.2
Try bath salts (synthetic stimulants) once or twice [c]	—	—	—	—	—	—	32.3	50.1	49.6	49.1	42.7	-6.4 sss
Take bath salts (synthetic stimulants) occasionally [c]	—	—	—	—	—	—	44.9	61.8	61.1	60.4	53.0	-7.3 sss
Try cough/cold medicine once or twice [c]	—	—	—	—	—	—	23.6	21.6	22.9	24.0	24.0	+0.1
Take cough/cold medicine occasionally [c]	—	—	—	—	—	—	40.4	37.3	38.3	38.2	37.6	-0.7
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	11.1	11.6	12.6	11.9	11.9	12.3	11.3	11.3	11.6	12.4	13.3	+0.8
Take one or two drinks nearly every day [b]	31.7	33.3	35.0	33.8	33.1	32.9	31.8	30.6	31.3	31.2	32.2	+1.0
Have five or more drinks once or twice each weekend [b]	52.4	54.1	56.6	54.2	54.6	55.5	52.8	52.3	54.0	54.5	54.5	0.0
Smoke one to five cigarettes per day [c]	41.3	41.7	43.5	42.8	41.4	44.8	49.1	47.7	52.0	52.9	53.0	+0.2
Smoke one or more packs of cigarettes per day [g]	67.7	68.2	69.1	67.3	67.2	69.8	71.6	70.8	72.0	72.9	71.5	-1.4
Use electronic cigarettes (e-cigarettes) regularly [h]	—	—	—	—	—	—	—	—	14.1	17.0	19.1	+2.1 s
Smoke little cigars or cigarillos regularly [c]	—	—	—	—	—	—	—	—	31.0	34.9	35.3	+0.4
Use smokeless tobacco regularly	45.9	46.7	48.0	44.7	43.7	45.7	42.9	40.0	39.9	42.5	43.0	+0.4
Take dissolvable tobacco regularly [c]	—	—	—	—	—	—	33.3	31.3	32.0	35.6	34.2	-1.4
Take snus regularly [c]	—	—	—	—	—	—	41.0	38.9	38.8	41.8	39.9	-1.9
Take steroids [i]	—	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*16,200*	*16,100*	*15,100*	*15,900*	*15,200*	*14,900*	*15,000*	*12,900*	*13,000*	*15,600*	*14,700*	

Table continued on next page.

TABLE 10 (cont.)
Trends in Harmfulness of Drugs as Perceived by 10th Graders

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding. '‡' indicates that the question changed the following year.

[a]Answer alternatives were: (1) No risk, (2) Slight risk, (3) Moderate risk, (4) Great risk, and (5) Can't say, drug unfamiliar.

[b]Beginning in 2012 data based on two thirds of *N* indicated.

[c]Data based on one third of *N* indicated.

[d]Beginning in 1997, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[e]Data based on one of two forms in 1993–1996; *N* is one half of *N* indicated. Beginning in 1997, data based on one third of *N* indicated due to changes in questionnaire forms.

[f]Beginning in 2014 data are based on the revised question which included "Molly," *N* is one third of *N* indicated in 2014 and two thirds of *N* indicated in 2015. 2014 and 2015 data are not comparable to earlier years due to the revision of the question text.

[g]Beginning in 1999, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[h]E-cigarette data based on two thirds of *N* indicated. Little cigars or cigarillos data based on one third *N* indicated.

[i]Data based on two forms in 1991 and 1992. Data based on one of two forms in 1993 and 1994; *N* is one half of *N* indicated.

TABLE 11
Trends in Harmfulness of Drugs as Perceived by 12th Graders

How much do you think people risk harming themselves (physically or in other ways), if they . . .	Percentage saying great risk [a]															
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Try marijuana once or twice	15.1	11.4	9.5	8.1	9.4	10.0	13.0	11.5	12.7	14.7	14.8	15.1	18.4	19.0	23.6	23.1
Smoke marijuana occasionally	18.1	15.0	13.4	12.4	13.5	14.7	19.1	18.3	20.6	22.6	24.5	25.0	30.4	31.7	36.5	36.9
Smoke marijuana regularly	43.3	38.6	36.4	34.9	42.0	50.4	57.6	60.4	62.8	66.9	70.4	71.3	73.5	77.0	77.5	77.8
Try synthetic marijuana once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take synthetic marijuana occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try LSD once or twice	49.4	45.7	43.2	42.7	41.6	43.9	45.5	44.9	44.7	45.4	43.5	42.0	44.9	45.7	46.0	44.7
Take LSD regularly	81.4	80.8	79.1	81.1	82.4	83.0	83.5	83.5	83.2	83.8	82.9	82.6	83.8	84.2	84.3	84.5
Try PCP once or twice	—	—	—	—	—	—	—	—	—	—	—	—	55.6	58.8	56.6	55.2
Try ecstasy (MDMA) once or twice [b]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try salvia once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take salvia occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try cocaine once or twice	42.6	39.1	35.6	33.2	31.5	31.3	32.1	32.8	33.0	35.7	34.0	33.5	47.9	51.2	54.9	59.4
Take cocaine occasionally	—	—	—	—	—	—	—	—	—	—	—	54.2	66.8	69.2	71.8	73.9
Take cocaine regularly	73.1	72.3	68.2	68.2	69.5	69.2	71.2	73.0	74.3	78.8	79.0	82.2	88.5	89.2	90.2	91.1
Try crack once or twice	—	—	—	—	—	—	—	—	—	—	—	—	57.0	62.1	62.9	64.3
Take crack occasionally	—	—	—	—	—	—	—	—	—	—	—	—	70.4	73.2	75.3	80.4
Take crack regularly	—	—	—	—	—	—	—	—	—	—	—	—	84.6	84.8	85.6	91.6
Try cocaine powder once or twice	—	—	—	—	—	—	—	—	—	—	—	—	45.3	51.7	53.8	53.9
Take cocaine powder occasionally	—	—	—	—	—	—	—	—	—	—	—	—	56.8	61.9	65.8	71.1
Take cocaine powder regularly	—	—	—	—	—	—	—	—	—	—	—	—	81.4	82.9	83.9	90.2
Try heroin once or twice	60.1	58.9	55.8	52.9	50.4	52.1	52.9	51.1	50.8	49.8	47.3	45.8	53.6	54.0	53.8	55.4
Take heroin occasionally	75.6	75.6	71.9	71.4	70.9	70.9	72.2	69.8	71.8	70.7	69.8	68.2	74.6	73.8	75.5	76.6
Take heroin regularly	87.2	88.6	86.1	86.6	87.5	86.2	87.5	86.0	86.1	87.2	86.0	87.1	88.7	88.8	89.5	90.2
Try heroin once or twice without using a needle	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take heroin occasionally without using a needle	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try any narcotic other than heroin (codeine, Vicodin, OxyContin, Percocet, etc.) once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take any narcotic other than heroin occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take any narcotic other than heroin regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try amphetamines once or twice [d]	35.4	33.4	30.8	29.9	29.7	29.7	26.4	25.3	24.7	25.4	25.2	25.1	29.1	29.6	32.8	32.2
Take amphetamines regularly [d]	69.0	67.3	66.6	67.1	69.9	69.1	66.1	64.7	64.8	67.1	67.2	67.3	69.4	69.8	71.2	71.2
Try Adderall once or twice [e]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try Adderall occasionally [e]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try crystal methamphetamine (ice) once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try bath salts (synthetic stimulants) once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take bath salts (synthetic stimulants) occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try sedatives (barbiturates) once or twice [f]	34.8	32.5	31.2	31.3	30.7	30.9	28.4	27.5	27.0	27.4	26.1	25.4	30.9	29.7	32.2	32.4
Take sedatives (barbiturates) regularly [f]	69.1	67.7	68.6	68.4	71.6	72.2	69.9	67.6	67.7	68.5	68.3	67.2	69.4	69.6	70.5	70.2
Try one or two drinks of an alcoholic beverage (beer, wine, liquor)	5.3	4.8	4.1	3.4	4.1	3.8	4.6	3.5	4.2	4.6	5.0	4.6	6.2	6.0	6.0	8.3
Take one or two drinks nearly every day	21.5	21.2	18.5	19.6	22.6	20.3	21.6	21.6	21.6	23.0	24.4	25.1	26.2	27.3	28.5	31.3
Take four or five drinks nearly every day	63.5	61.0	62.9	63.1	66.2	65.7	64.5	65.5	66.8	68.4	69.8	66.5	69.7	68.5	69.8	70.9
Have five or more drinks once or twice each weekend	37.8	37.0	34.7	34.5	34.9	35.9	36.3	36.0	38.6	41.7	43.0	39.1	41.9	42.6	44.0	47.1
Smoke one or more packs of cigarettes per day	51.3	56.4	58.4	59.0	63.0	63.7	63.3	60.5	61.2	63.8	66.5	66.0	68.6	68.0	67.2	68.2
Use electronic cigarettes (e-cigarettes) regularly [g]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Smoke little cigars or cigarillos regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Use smokeless tobacco regularly	—	—	—	—	—	—	—	—	—	—	—	25.8	30.0	33.2	32.9	34.2
Take steroids	—	—	—	—	—	—	—	—	—	—	—	—	—	—	63.8	69.9
Approximate weighted N =	*2,804*	*2,918*	*3,052*	*3,770*	*3,250*	*3,234*	*3,604*	*3,557*	*3,305*	*3,262*	*3,250*	*3,020*	*3,315*	*3,276*	*2,796*	*2,553*

Table continued on n

(Table continued on next page.)

TABLE 11 (cont.)
Trends in Harmfulness of Drugs as Perceived by 12th Graders

	Percentage saying great risk [a]														
How much do you think people risk harming themselves (physically or in other ways), if they . . .	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Try marijuana once or twice	27.1	24.5	21.9	19.5	16.3	15.6	14.9	16.7	15.7	13.7	15.3	16.1	16.1	15.9	16.1
Smoke marijuana occasionally	40.6	39.6	35.6	30.1	25.6	25.9	24.7	24.4	23.9	23.4	23.5	23.2	26.6	25.4	25.8
Smoke marijuana regularly	78.6	76.5	72.5	65.0	60.8	59.9	58.1	58.5	57.4	58.3	57.4	53.0	54.9	54.6	58.0
Try synthetic marijuana once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take synthetic marijuana occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try LSD once or twice	46.6	42.3	39.5	38.8	36.4	36.2	34.7	37.4	34.9	34.3	33.2	36.7	36.2	36.2	36.5
Take LSD regularly	84.3	81.8	79.4	79.1	78.1	77.8	76.6	76.5	76.1	75.9	74.1	73.9	72.3	70.2	69.9
Try PCP once or twice	51.7	54.8	50.8	51.5	49.1	51.0	48.8	46.8	44.8	45.0	46.2	48.3	45.2	47.1	46.6
Try ecstasy (MDMA) once or twice [b]	—	—	—	—	—	—	33.8	34.5	35.0	37.9	45.7	52.2	56.3	57.7	60.1
Try salvia once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take salvia occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try cocaine once or twice	59.4	56.8	57.6	57.2	53.7	54.2	53.6	54.6	52.1	51.1	50.7	51.2	51.0	50.7	50.5
Take cocaine occasionally	75.5	75.1	73.3	73.7	70.8	72.1	72.4	70.1	70.1	69.5	69.9	68.3	69.1	67.2	66.7
Take cocaine regularly	90.4	90.2	90.1	89.3	87.9	88.3	87.1	86.3	85.8	86.2	84.1	84.5	83.0	82.2	82.8
Try crack once or twice	60.6	62.4	57.6	58.4	54.6	56.0	54.0	52.2	48.2	48.4	49.4	50.8	47.3	47.8	48.4
Take crack occasionally	76.5	76.3	73.9	73.8	72.8	71.4	70.3	68.7	67.3	65.8	65.4	65.6	64.0	64.5	63.8
Take crack regularly	90.1	89.3	87.5	89.6	88.6	88.0	86.2	85.3	85.4	85.3	85.8	84.1	83.2	83.5	83.3
Try cocaine powder once or twice	53.6	57.1	53.2	55.4	52.0	53.2	51.4	48.5	46.1	47.0	49.0	49.5	46.2	45.4	46.2
Take cocaine powder occasionally	69.8	70.8	68.6	70.6	69.1	68.8	67.7	65.4	64.2	64.7	63.2	64.4	61.4	61.6	60.8
Take cocaine powder regularly	88.9	88.4	87.0	88.6	87.8	86.8	86.0	84.1	84.6	85.5	84.4	84.2	82.3	81.7	82.7
Try heroin once or twice	55.2	50.9	50.7	52.8	50.9	52.5	56.7	57.8	56.0	54.2	55.6	56.0	58.0	56.6	55.2
Take heroin occasionally	74.9	74.2	72.0	72.1	71.0	74.8	76.3	76.9	77.3	74.6	75.9	76.6	78.5	75.7	76.0
Take heroin regularly	89.6	89.2	88.3	88.0	87.2	89.5	88.9	89.1	89.9	89.2	88.3	88.5	89.3	86.8	87.5
Try heroin once or twice without using a needle	—	—	—	—	55.6	58.6	60.5	59.6	58.5	61.6	60.7	60.6	58.9	61.2	60.5
Take heroin occasionally without using a needle	—	—	—	—	71.2	71.0	74.3	73.4	73.6	74.7	74.4	74.7	73.0	76.1	73.3
Try any narcotic other than heroin (codeine, Vicodin, OxyContin, Percocet, etc.) once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take any narcotic other than heroin occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take any narcotic other than heroin regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try amphetamines once or twice [d]	36.3	32.6	31.3	31.4	28.8	30.8	31.0	35.3	32.2	32.6	34.7	34.4	36.8	35.7	37.7
Take amphetamines regularly [d]	74.1	72.4	69.9	67.0	65.9	66.8	66.0	67.7	66.4	66.3	67.1	64.8	65.6	63.9	67.1
Try Adderall once or twice [e]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try Adderall occasionally [e]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try crystal methamphetamine (ice) once or twice	61.6	61.9	57.5	58.3	54.4	55.3	54.4	52.7	51.2	51.3	52.7	53.8	51.2	52.4	54.6
Try bath salts (synthetic stimulants) once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Take bath salts (synthetic stimulants) occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Try sedatives (barbiturates) once or twice [f]	35.1	32.2	29.2	29.9	26.3	29.1	26.9	29.0	26.1	25.0	25.7	26.2	27.9‡	24.9	24.7
Take sedatives (barbiturates) regularly [f]	70.5	70.2	66.1	63.3	61.6	60.4	56.8	56.3	54.1	52.3	50.3	49.3	49.6‡	54.0	54.1
Try one or two drinks of an alcoholic beverage (beer, wine, liquor)	9.1	8.6	8.2	7.6	5.9	7.3	6.7	8.0	8.3	6.4	8.7	7.6	8.4	8.6	8.5
Take one or two drinks nearly every day	32.7	30.6	28.2	27.0	24.8	25.1	24.8	24.3	21.8	21.7	23.4	21.0	20.1	23.0	23.7
Take four or five drinks nearly every day	69.5	70.5	67.8	66.2	62.8	65.6	63.0	62.1	61.1	59.9	60.7	58.8	57.8	59.2	61.8
Have five or more drinks once or twice each weekend	48.6	49.0	48.3	46.5	45.2	49.5	43.0	42.8	43.1	42.7	43.6	42.2	43.5	43.6	45.0
Smoke one or more packs of cigarettes per day	69.4	69.2	69.5	67.6	65.6	68.2	68.7	70.8	70.8	73.1	73.3	74.2	72.1	74.0	76.5
Use electronic cigarettes (e-cigarettes) regularly [g]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Smoke little cigars or cigarillos regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Use smokeless tobacco regularly	37.4	35.5	38.9	36.6	33.2	37.4	38.6	40.9	41.1	42.2	45.4	42.6	43.3	45.0	43.6
Take steroids	65.6	70.7	69.1	66.1	66.4	67.6	67.2	68.1	62.1	57.9	58.9	57.1	55.0	55.7	56.8
Approximate weighted N =	*2,549*	*2,684*	*2,759*	*2,591*	*2,603*	*2,449*	*2,579*	*2,564*	*2,306*	*2,130*	*2,173*	*2,198*	*2,466*	*2,491*	*2,512*

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TABLE 11 (cont.)
Trends in Harmfulness of Drugs as Perceived by 12th Graders

How much do you think people risk harming themselves (physically or in other ways), if they . . .	Percentage saying great risk [a]											2015– 2016 change
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Try marijuana once or twice	17.8	18.6	17.4	18.5	17.1	15.6	14.8	14.5	12.5	12.3	12.9	+0.7
Smoke marijuana occasionally	25.9	27.1	25.8	27.4	24.5	22.7	20.6	19.5	16.4	15.8	17.1	+1.3
Smoke marijuana regularly	57.9	54.8	51.7	52.4	46.8	45.7	44.1	39.5	36.1	31.9	31.1	-0.8
Try synthetic marijuana once or twice	—	—	—	—	—	—	23.5	25.9	32.5	33.0	35.6	+2.6
Take synthetic marijuana occasionally	—	—	—	—	—	—	32.7	36.2	39.4	40.9	43.9	+3.0
Try LSD once or twice	36.1	37.0	33.9	37.1	35.6	34.7	33.1	34.9	35.5	33.2	31.7	-1.5
Take LSD regularly	69.3	67.3	63.6	67.8	65.3	65.5	66.8	66.8	62.7	60.7	58.2	-2.5
Try PCP once or twice	47.0	48.0	47.4	49.7	52.4	53.9	51.6	53.9	53.8	54.4	55.1	+0.7
Try ecstasy (MDMA) once or twice [b]	59.3	58.1	57.0	53.3	50.6	49.0	49.4	47.5‡	47.8	49.5	48.8	-0.7
Try salvia once or twice [c]	—	—	—	—	39.8	36.7‡	13.8	12.9	14.1	13.1	13.0	-0.1
Take salvia occasionally	—	—	—	—	—	—	23.1	21.3	20.0	17.6	16.3	-1.3
Try cocaine once or twice	52.5	51.3	50.3	53.1	52.8	54.0	51.6	54.4	53.7	51.1	52.7	+1.5
Take cocaine occasionally	69.8	68.8	67.1	71.4	67.8	69.7	69.0	70.2	68.1	66.3	68.6	+2.3
Take cocaine regularly	84.6	83.3	80.7	84.4	81.7	83.8	82.6	83.3	80.6	79.1	78.3	-0.7
Try crack once or twice	47.8	47.3	47.5	48.4	50.2	51.7	52.0	55.6	54.5	53.6	53.9	+0.3
Take crack occasionally	64.8	63.6	65.2	64.7	64.3	66.2	66.5	69.5	68.5	67.8	66.2	-1.6
Take crack regularly	82.8	82.6	83.4	84.0	83.8	83.9	84.0	85.4	82.0	81.2	81.9	+0.7
Try cocaine powder once or twice	45.8	45.1	45.1	46.5	48.2	48.0	48.1	49.9	49.9	49.0	49.3	+0.2
Take cocaine powder occasionally	61.9	59.9	61.6	62.6	62.6	64.2	62.6	65.4	64.8	62.8	62.9	+0.1
Take cocaine powder regularly	82.1	81.5	82.5	83.4	81.8	83.3	83.3	83.9	81.5	80.1	80.7	+0.6
Try heroin once or twice	59.1	58.4	55.5	59.3	58.3	59.1	59.4	61.7	62.8	64.0	64.5	+0.5
Take heroin occasionally	79.1	76.2	75.3	79.7	74.8	77.2	78.0	78.2	77.9	78.0	78.7	+0.7
Take heroin regularly	89.7	87.8	86.4	89.9	85.5	87.9	88.6	87.6	85.7	84.8	85.4	+0.6
Try heroin once or twice without using a needle	62.6	60.2	60.8	61.5	63.8	61.1	63.3	64.5	65.3	62.5	66.1	+3.5
Take heroin occasionally without using a needle	76.2	73.9	73.2	74.8	76.2	74.7	76.1	76.4	73.6	71.1	74.6	+3.5
Try any narcotic other than heroin (codeine, Vicodin, OxyContin, Percocet, etc.) once or twice	—	—	—	—	40.4	39.9	38.4	43.1	42.7	44.1	43.6	-0.5
Take any narcotic other than heroin occasionally	—	—	—	—	54.3	54.8	53.8	57.3	59.0	58.5	55.7	-2.8
Take any narcotic other than heroin regularly	—	—	—	—	74.9	75.5	73.9	75.8	72.7	73.9	72.4	-1.5
Try amphetamines once or twice [d]	39.5	41.3	39.2	41.9	40.6‡	34.8	34.3	36.3	34.1	34.0	31.1	-2.9
Take amphetamines regularly [d]	68.1	68.1	65.4	69.0	63.6‡	58.7	60.0	59.5	55.1	54.3	51.3	-3.0
Try Adderall once or twice [e]	—	—	—	—	33.3	31.2	27.2	31.8	33.6	34.3	32.5	-1.8
Try Adderall occasionally [e]	—	—	—	—	41.6	40.8	35.3	38.8	41.5	41.6	40.9	-0.8
Try crystal methamphetamine (ice) once or twice	59.1	60.2	62.2	63.4	64.9	66.5	67.8	72.2	70.2	70.0	70.0	0.0
Try bath salts (synthetic stimulants) once or twice	—	—	—	—	—	—	33.2	59.5	59.2	57.5	54.9	-2.6
Take bath salts (synthetic stimulants) occasionally	—	—	—	—	—	—	45.0	69.9	68.8	67.4	64.2	-3.3
Try sedatives (barbiturates) once or twice [f]	28.0	27.9	25.9	29.6	28.0	27.8	27.8	29.4	29.6	28.9	27.4	-1.5
Take sedatives (barbiturates) regularly [f]	56.8	55.1	50.2	54.7	52.1	52.4	53.9	53.3	50.5	50.6	47.0	-3.6
Try one or two drinks of an alcoholic beverage (beer, wine, liquor)	9.3	10.5	10.0	9.4	10.8	9.4	8.7	9.9	8.6	10.3	9.5	-0.8
Take one or two drinks nearly every day	25.3	25.1	24.2	23.7	25.4	24.6	23.7	23.1	21.1	21.5	21.6	+0.1
Take four or five drinks nearly every day	63.4	61.8	60.8	62.4	61.1	62.3	63.6	62.4	61.2	59.1	59.1	0.0
Have five or more drinks once or twice each weekend	47.6	45.8	46.3	48.0	46.3	47.6	48.8	45.8	45.4	46.9	48.4	+1.4
Smoke one or more packs of cigarettes per day	77.6	77.3	74.0	74.9	75.0	77.7	78.2	78.2	78.0	75.9	76.5	+0.6
Use electronic cigarettes (e-cigarettes) regularly [g]	—	—	—	—	—	—	—	—	14.2	16.2	18.2	+2.1
Smoke little cigars or cigarillos regularly	—	—	—	—	—	—	—	—	38.3	39.7	39.5	-0.2
Use smokeless tobacco regularly	45.9	44.0	42.9	40.8	41.2	42.6	44.3	41.6	40.7	38.5	38.1	-0.4
Take steroids	60.2	57.4	60.8	60.2	59.2	61.1	58.6	54.2	54.6	54.4	54.5	+0.1
Approximate weighted N =	*2,407*	*2,450*	*2,389*	*2,290*	*2,440*	*2,408*	*2,331*	*2,098*	*2,067*	*2,174*	*1,988*	

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TABLE 11 (cont.)
Trends in Harmfulness of Drugs as Perceived by 12th Graders

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. ' ‡ ' indicates that the question changed the following year. See relevant footnote for that drug. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]Answer alternatives were: (1) No risk, (2) Slight risk, (3) Moderate risk, (4) Great risk, and (5) Can't say, drug unfamiliar.

[b] Beginning in 2014 data are based on the revised question which included "Molly." 2014 and 2015 data are not comparable to earlier years due to the revision of the question text.

[c]In 2011 the question on perceived risk of using salvia once or twice appeared at the end of a form. In 2012 the question was moved to an earlier section of the same form. A question on perceived risk of using salvia occasionally was also added following the question on perceived risk of trying salvia once or twice. These changes likely explain the discontinuity in the 2012 results.

[d]In 2011 the list of examples was changed from uppers, pep pills, bennies, speed to uppers, speed, Adderall, Ritalin, etc. These changes likely explain the discontinuity in the 2011 results.

[e]In 2014 "(without a doctor's orders)" added to the questions on perceived risk of using Adderall.

[f]In 2004 the question text was changed from barbiturates to sedatives/barbiturates and the list of examples was changed from downers, goofballs, reds, yellows, etc. to just downers. These changes likely explain the discontinuity in the 2004 results.

[g]Based on two of six forms; N is two times the N indicated.

TABLE 12
Trends in Disapproval of Drug Use in Grade 8

Do you disapprove of people who . . .	Percentage who disapprove or strongly disapprove [a]														
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Try marijuana once or twice [b]	84.6	82.1	79.2	72.9	70.7	67.5	67.6	69.0	70.7	72.5	72.4	73.3	73.8	75.9	75.3
Smoke marijuana occasionally [b]	89.5	88.1	85.7	80.9	79.7	76.5	78.1	78.4	79.3	80.6	80.6	80.9	81.5	83.1	82.4
Smoke marijuana regularly [b]	92.1	90.8	88.9	85.3	85.1	82.8	84.6	84.5	84.5	85.3	84.5	85.3	85.7	86.8	86.3
Try inhalants once or twice [c]	84.9	84.0	82.5	81.6	81.8	82.9	84.1	83.0	85.2	85.4	86.6	86.1	85.1	85.1	84.6
Take inhalants regularly [c]	90.6	90.0	88.9	88.1	88.8	89.3	90.3	89.5	90.3	90.2	90.5	90.4	89.8	90.1	89.8
Take LSD once or twice [d]	—	—	77.1	75.2	71.6	70.9	72.1	69.1	69.4	66.7	64.6	62.6	61.0	58.1	58.5
Take LSD regularly [d]	—	—	79.8	78.4	75.8	75.3	76.3	72.5	72.5	69.3	67.0	65.5	63.5	60.5	60.7
Try ecstasy (MDMA) once or twice [e]	—	—	—	—	—	—	—	—	—	—	69.0	74.3	77.7	76.3	75.0
Take ecstasy (MDMA) occasionally [e]	—	—	—	—	—	—	—	—	—	—	73.6	78.6	81.3	79.4	77.9
Try crack once or twice [c]	91.7	90.7	89.1	86.9	85.9	85.0	85.7	85.4	86.0	85.4	86.0	86.2	86.4	87.4	87.6
Take crack occasionally [c]	93.3	92.5	91.7	89.9	89.8	89.3	90.3	89.5	89.9	88.8	89.8	89.6	89.8	90.3	90.5
Try cocaine powder once or twice [c]	91.2	89.6	88.5	86.1	85.3	83.9	85.1	84.5	85.2	84.8	85.6	85.8	85.6	86.8	87.0
Take cocaine powder occasionally [c]	93.1	92.4	91.6	89.7	89.7	88.7	90.1	89.3	89.9	88.8	89.6	89.9	89.8	90.3	90.7
Try heroin once or twice without using a needle [d]	—	—	—	—	85.8	85.0	87.7	87.3	88.0	87.2	87.2	87.8	86.9	86.6	86.9
Take heroin occasionally without using a needle [d]	—	—	—	—	88.5	87.7	90.1	89.7	90.2	88.9	88.9	89.6	89.0	88.6	88.5
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	51.7	52.2	50.9	47.8	48.0	45.5	45.7	47.5	48.3	48.7	49.8	51.1	49.7	51.1	51.2
Take one or two drinks nearly every day [b]	82.2	81.0	79.6	76.7	75.9	74.1	76.6	76.9	77.0	77.8	77.4	78.3	77.1	78.6	78.7
Have five or more drinks once or twice each weekend [b]	85.2	83.9	83.3	80.7	80.7	79.1	81.3	81.0	80.3	81.2	81.6	81.9	81.9	82.3	82.9
Smoke one to five cigarettes per day [e]	—	—	—	—	—	—	—	—	75.1	79.1	80.4	81.1	81.4	83.1	82.9
Smoke one or more packs of cigarettes per day [f]	82.8	82.3	80.6	78.4	78.6	77.3	80.3	80.0	81.4	81.9	83.5	84.6	84.6	85.7	85.3
Use electronic cigarettes (e-cigarettes) regularly [e]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Use smokeless tobacco regularly [b]	79.1	77.2	77.1	75.1	74.0	74.1	76.5	76.3	78.0	79.2	79.4	80.6	80.7	81.0	82.0
Take steroids [g]	89.8	90.3	89.9	87.9	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*17,400*	*18,500*	*18,400*	*17,400*	*17,600*	*18,000*	*18,800*	*18,100*	*16,700*	*16,700*	*16,200*	*15,100*	*16,500*	*17,000*	*16,800*

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TABLE 12 (cont.)
Trends in Disapproval of Drug Use in Grade 8

Do you disapprove of people who . . .	Percentage who disapprove or strongly disapprove [a]											
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Try marijuana once or twice [b]	76.0	78.7	76.6	75.3	73.5	74.4	75.1	72.0	70.5	70.3	70.1	-0.2
Smoke marijuana occasionally [b]	82.2	84.5	82.6	81.9	79.9	81.1	81.6	78.8	77.7	77.5	77.5	0.0
Smoke marijuana regularly [b]	86.1	87.7	86.8	85.9	84.3	85.7	85.6	83.8	82.2	82.2	82.3	+0.1
Try inhalants once or twice [c]	83.4	84.1	82.3	83.1	83.1	82.9	83.1	81.6	80.7	80.6	78.3	-2.4 s
Take inhalants regularly [c]	89.0	89.5	88.5	88.4	88.9	88.5	88.6	86.8	85.5	85.4	83.3	-2.1 s
Take LSD once or twice [d]	53.9	53.5	52.6	53.2	53.7	55.4	51.8	52.0	52.8	56.0	55.2	-0.8
Take LSD regularly [d]	55.8	55.6	54.7	55.7	55.8	57.6	54.1	53.6	54.8	58.1	57.6	-0.5
Try ecstasy (MDMA) once or twice [e]	66.7	65.7	63.5	62.3	62.4	64.2	60.2	60.9	61.0‡	68.2	64.8	-3.4 s
Take ecstasy (MDMA) occasionally [e]	69.8	68.3	66.5	65.7	65.9	67.5	63.2	63.4	64.1‡	71.7	67.5	-4.1 ss
Try crack once or twice [c]	87.2	88.6	87.2	88.4	89.1	88.5	89.0	88.1	88.0	87.5	87.0	-0.5
Take crack occasionally [c]	90.0	91.2	90.3	91.0	91.5	91.0	91.2	90.3	89.8	89.8	88.8	-1.0
Try cocaine powder once or twice [c]	86.5	88.2	86.8	88.1	88.4	88.3	88.6	88.0	87.7	87.5	86.8	-0.7
Take cocaine powder occasionally [c]	90.2	91.0	90.1	90.7	91.4	91.3	91.5	90.6	90.1	90.1	89.3	-0.7
Try heroin once or twice without using a needle [d]	87.2	88.4	86.9	88.6	89.5	87.5	86.8	87.2	87.1	87.1	85.6	-1.5
Take heroin occasionally without using a needle [d]	88.5	89.7	88.2	90.1	90.6	89.0	87.7	88.2	88.1	88.0	86.7	-1.3
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	51.3	54.0	52.5	52.7	54.2	54.0	54.1	53.3	53.3	53.7	52.6	-1.2
Take one or two drinks nearly every day [b]	78.7	80.4	79.2	78.5	79.5	80.7	81.3	80.2	79.6	79.7	79.1	-0.5
Have five or more drinks once or twice each weekend [b]	82.0	83.8	83.2	83.2	83.6	84.8	86.0	85.0	84.9	85.4	84.9	-0.5
Smoke one to five cigarettes per day [e]	83.5	85.3	85.0	83.6	84.7	86.8	—	—	—	—	—	—
Smoke one or more packs of cigarettes per day [f]	85.6	87.0	86.7	87.1	87.0	88.0	88.8	88.0	87.5	88.8	88.1	-0.7
Use electronic cigarettes (e-cigarettes) regularly [e]	—	—	—	—	—	—	—	—	58.4	65.0	66.6	+1.6
Use smokeless tobacco regularly [b]	81.0	82.3	82.1	81.5	81.2	82.6	82.7	81.5	80.2	82.5	81.1	-1.5
Take steroids [g]	—	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*16,500*	*16,100*	*15,700*	*15,000*	*15,300*	*16,000*	*15,100*	*14,600*	*14,600*	*14,400*	*16,900*	

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TABLE 12 (cont.)
Trends in Disapproval of Drug Use in Grade 8

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding. ' ‡ ' indicates that the question changed the following year.

[a]Answer alternatives were: (1) Don't disapprove, (2) Disapprove, (3) Strongly disapprove, and (4) Can't say, drug unfamiliar. Percentages are shown for categories (2) and (3) combined.

[b]Beginning in 2012, data based on two thirds of *N* indicated.

[c]Beginning in 1997, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[d]Data based on one of two forms in 1993–1996; *N* is one half of *N* indicated. Beginning in 1997, data based on one third of *N* indicated due to changes in questionnaire forms.

[e]Data based on one third of *N* indicated. For MDMA "Molly" was added to the question text in 2015; 2014 and 2015 data are not comparable due to this change.

[f]Beginning in 1999, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[g]Data based on two forms in 1991 and 1992. Data based on one of two forms in 1993 and 1994; *N* is one half of *N* indicated.

TABLE 13
Trends in Disapproval of Drug Use in Grade 10

Do you disapprove of people who . . .	Percentage who disapprove or strongly disapprove [a]														
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Try marijuana once or twice [b]	74.6	74.8	70.3	62.4	59.8	55.5	54.1	56.0	56.2	54.9	54.8	57.8	58.1	60.4	61.3
Smoke marijuana occasionally [b]	83.7	83.6	79.4	72.3	70.0	66.9	66.2	67.3	68.2	67.2	66.2	68.3	68.4	70.8	71.9
Smoke marijuana regularly [b]	90.4	90.0	87.4	82.2	81.1	79.7	79.7	80.1	79.8	79.1	78.0	78.6	78.8	81.3	82.0
Try inhalants once or twice [c]	85.2	85.6	84.8	84.9	84.5	86.0	86.9	85.6	88.4	87.5	87.8	88.6	87.7	88.5	88.1
Take inhalants regularly [c]	91.0	91.5	90.9	91.0	90.9	91.7	91.7	91.1	92.4	91.8	91.3	91.8	91.0	92.3	91.9
Take LSD once or twice [d]	—	—	82.1	79.3	77.9	76.8	76.6	76.7	77.8	77.0	75.4	74.6	74.4	72.4	71.8
Take LSD regularly [d]	—	—	86.8	85.6	84.8	84.5	83.4	82.9	84.3	82.1	80.8	79.4	77.6	75.9	75.0
Try ecstasy (MDMA) once or twice [e]	—	—	—	—	—	—	—	—	—	—	72.6	77.4	81.0	83.7	83.1
Take ecstasy (MDMA) occasionally [e]	—	—	—	—	—	—	—	—	—	—	81.0	84.6	86.3	88.0	87.4
Try crack once or twice [c]	92.5	92.5	91.4	89.9	88.7	88.2	87.4	87.1	87.8	87.1	86.9	88.0	87.6	88.6	88.8
Take crack occasionally [c]	94.3	94.4	93.6	92.5	91.7	91.9	91.0	90.6	91.5	90.9	90.6	91.0	91.0	91.8	91.8
Try cocaine powder once or twice [c]	90.8	91.1	90.0	88.1	86.8	86.1	85.1	84.9	86.0	84.8	85.3	86.4	85.9	86.8	86.9
Take cocaine powder occasionally [c]	94.0	94.0	93.2	92.1	91.4	91.1	90.4	89.7	90.7	89.9	90.2	89.9	90.4	91.2	91.2
Try heroin once or twice without using a needle [d]	—	—	—	—	89.7	89.5	89.1	88.6	90.1	90.1	89.1	89.2	89.3	90.1	90.3
Take heroin occasionally without using a needle [d]	—	—	—	—	91.6	91.7	91.4	90.5	91.8	92.3	90.8	90.7	90.6	91.8	92.0
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	37.6	39.9	38.5	36.5	36.1	34.2	33.7	34.7	35.1	33.4	34.7	37.7	36.8	37.6	38.5
Take one or two drinks nearly every day [b]	81.7	81.7	78.6	75.2	75.4	73.8	75.4	74.6	75.4	73.8	73.8	74.9	74.2	75.1	76.9
Have five or more drinks once or twice each weekend [b]	76.7	77.6	74.7	72.3	72.2	70.7	70.2	70.5	69.9	68.2	69.2	71.5	71.6	71.8	73.7
Smoke one to five cigarettes per day [e]	—	—	—	—	—	—	—	—	67.8	69.1	71.2	74.3	76.2	77.5	79.3
Smoke one or more packs of cigarettes per day [f]	79.4	77.8	76.5	73.9	73.2	71.6	73.8	75.3	76.1	76.7	78.2	80.6	81.4	82.7	84.3
Use electronic cigarettes (e-cigarettes) regularly [e]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Use smokeless tobacco regularly [b]	75.4	74.6	73.8	71.2	71.0	71.0	72.3	73.2	75.1	75.8	76.1	78.7	79.4	80.2	80.5
Take steroids [g]	90.0	91.0	91.2	90.8	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*14,800*	*14,800*	*15,300*	*15,900*	*17,000*	*15,700*	*15,600*	*15,000*	*13,600*	*14,300*	*14,000*	*14,300*	*15,800*	*16,400*	*16,200*

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TABLE 13 (cont.)
Trends in Disapproval of Drug Use in Grade 10

Do you disapprove of people who . . .	Percentage who disapprove or strongly disapprove [a]											2015–2016
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	change
Try marijuana once or twice [b]	62.5	63.9	64.5	60.1	59.2	58.5	56.2	53.2	53.8	52.7	52.6	0.0
Smoke marijuana occasionally [b]	72.6	73.3	73.6	69.2	68.0	67.9	65.7	62.1	62.9	62.6	61.9	-0.7
Smoke marijuana regularly [b]	82.5	82.4	83.0	79.9	78.7	78.8	77.3	73.8	74.6	74.3	73.5	-0.8
Try inhalants once or twice [c]	88.1	87.6	87.1	87.0	86.5	86.9	85.7	86.1	85.9	84.1	83.3	-0.8
Take inhalants regularly [c]	92.2	91.8	91.6	91.1	90.8	90.9	90.0	89.7	89.7	88.3	87.1	-1.2
Take LSD once or twice [d]	71.2	67.7	66.3	67.8	68.2	68.5	68.3	69.1	67.8	70.3	69.5	-0.7
Take LSD regularly [d]	74.9	71.5	69.8	72.2	72.9	72.5	73.0	74.2	73.3	76.5	74.9	-1.7
Try ecstasy (MDMA) once or twice [e]	81.6	80.0	78.1	76.5	75.5	76.1	75.3	75.4	74.4‡	78.0	76.8	-1.2
Take ecstasy (MDMA) occasionally [e]	86.0	84.3	83.0	81.3	81.3	82.2	81.2	81.3	80.4‡	84.0	81.7	-2.3 s
Try crack once or twice [c]	89.5	89.5	90.8	90.4	90.3	90.9	91.0	90.6	90.6	90.1	89.7	-0.4
Take crack occasionally [c]	92.0	92.7	92.9	92.8	92.4	93.0	93.0	92.4	92.4	92.1	91.1	-1.1
Try cocaine powder once or twice [c]	87.3	87.7	88.6	88.4	89.0	89.4	89.3	88.7	88.9	87.9	87.9	0.0
Take cocaine powder occasionally [c]	91.4	92.0	92.1	92.1	92.2	92.5	92.4	91.8	91.9	91.8	90.8	-1.1
Try heroin once or twice without using a needle [d]	91.1	90.7	91.4	91.6	91.4	91.6	91.9	91.3	91.9	91.7	90.2	-1.5
Take heroin occasionally without using a needle [d]	92.5	92.5	92.5	93.0	92.4	92.4	92.9	92.3	92.7	92.7	90.9	-1.8 s
Try one or two drinks of an alcoholic beverage (beer, wine, liquor) [b]	37.8	39.5	41.8	39.7	40.3	41.5	39.6	38.5	40.7	40.0	41.8	+1.8
Take one or two drinks nearly every day [b]	76.4	77.1	79.1	77.6	77.6	80.0	78.0	77.1	77.9	78.2	78.6	+0.4
Have five or more drinks once or twice each weekend [b]	72.9	74.1	77.2	75.1	75.9	77.3	77.5	77.8	79.5	79.6	80.8	+1.2
Smoke one to five cigarettes per day [e]	80.2	79.7	82.5	80.0	80.6	82.1	—	—	—	—	—	—
Smoke one or more packs of cigarettes per day [f]	83.2	84.7	85.2	84.5	83.9	85.8	86.0	86.1	88.0	88.3	88.5	+0.3
Use electronic cigarettes (e-cigarettes) regularly [e]	—	—	—	—	—	—	—	—	54.6	59.9	65.0	+5.1 sss
Use smokeless tobacco regularly [b]	80.5	80.9	81.8	79.5	78.5	79.5	79.5	77.7	78.7	80.1	81.2	+1.1
Take steroids [g]	—	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*16,200*	*16,100*	*15,100*	*15,900*	*15,200*	*14,900*	*15,000*	*12,900*	*13,000*	*15,600*	*14,700*	

Table continued on next page.

TABLE 13 (cont.)
Trends in Disapproval of Drug Use in Grade 10

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding. ' ‡ ' indicates that the question changed the following year.

[a]Answer alternatives were: (1) Don't disapprove, (2) Disapprove, (3) Strongly disapprove, and (4) Can't say, drug unfamiliar. Percentages are shown for categories (2) and (3) combined.

[b]Beginning in 2012, data based on two thirds of *N* indicated.

[c]Beginning in 1997, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[d]Data based on one of two forms in 1993–1996; *N* is one half of *N* indicated. Beginning in 1997, data based on one third of *N* indicated due to changes in questionnaire forms.

[e]Data based on one third of *N* indicated. For MDMA "Molly" was added to the question text in 2015; 2014 and 2015 data are not comparable due to this change.

[f]Beginning in 1999, data based on two thirds of *N* indicated due to changes in questionnaire forms.

[g]Data based on two forms in 1991 and 1992. Data based on one of two forms in 1993 and 1994; *N* is one half of *N* indicated.

TABLE 14
Trends in Disapproval of Drug Use in Grade 12

Do you disapprove of people (who are 18 or older) doing each of the following? [a]	Percentage who disapprove or strongly disapprove [b]															
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Trying marijuana once or twice	47.0	38.4	33.4	33.4	34.2	39.0	40.0	45.5	46.3	49.3	51.4	54.6	56.6	60.8	64.6	67.8
Smoking marijuana occasionally	54.8	47.8	44.3	43.5	45.3	49.7	52.6	59.1	60.7	63.5	65.8	69.0	71.6	74.0	77.2	80.5
Smoking marijuana regularly	71.9	69.5	65.5	67.5	69.2	74.6	77.4	80.6	82.5	84.7	85.5	86.6	89.2	89.3	89.8	91.0
Trying LSD once or twice	82.8	84.6	83.9	85.4	86.6	87.3	86.4	88.8	89.1	88.9	89.5	89.2	91.6	89.8	89.7	89.8
Taking LSD regularly	94.1	95.3	95.8	96.4	96.9	96.7	96.8	96.7	97.0	96.8	97.0	96.6	97.8	96.4	96.4	96.3
Trying ecstasy (MDMA) once or twice [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Trying cocaine once or twice	81.3	82.4	79.1	77.0	74.7	76.3	74.6	76.6	77.0	79.7	79.3	80.2	87.3	89.1	90.5	91.5
Taking cocaine regularly	93.3	93.9	92.1	91.9	90.8	91.1	90.7	91.5	93.2	94.5	93.8	94.3	96.7	96.2	96.4	96.7
Trying crack once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	92.3
Taking crack occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	94.3
Taking crack regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	94.9
Trying cocaine powder once or twice	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	87.9
Taking cocaine powder occasionally	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	92.1
Taking cocaine powder regularly	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	93.7
Trying heroin once or twice	91.5	92.6	92.5	92.0	93.4	93.5	93.5	94.6	94.3	94.0	94.0	93.3	96.2	95.0	95.4	95.1
Taking heroin occasionally	94.8	96.0	96.0	96.4	96.8	96.7	97.2	96.9	96.9	97.1	96.8	96.6	97.9	96.9	97.2	96.7
Taking heroin regularly	96.7	97.5	97.2	97.8	97.9	97.6	97.8	97.5	97.7	98.0	97.6	97.6	98.1	97.2	97.4	97.5
Trying heroin once or twice without using a needle	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Taking heroin occasionally without using a needle	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Trying amphetamines once or twice [d]	74.8	75.1	74.2	74.8	75.1	75.4	71.1	72.6	72.3	72.8	74.9	76.5	80.7	82.5	83.3	85.3
Taking amphetamines regularly [d]	92.1	92.8	92.5	93.5	94.4	93.0	91.7	92.0	92.6	93.6	93.3	93.5	95.4	94.2	94.2	95.5
Trying sedatives (barbiturates) once or twice [e]	77.7	81.3	81.1	82.4	84.0	83.9	82.4	84.4	83.1	84.1	84.9	86.8	89.6	89.4	89.3	90.5
Taking sedatives (barbiturates) regularly [e]	93.3	93.6	93.0	94.3	95.2	95.4	94.2	94.4	95.1	95.1	95.5	94.9	96.4	95.3	95.3	96.4
Trying one or two drinks of an alcoholic beverage (beer, wine, liquor)	21.6	18.2	15.6	15.6	15.8	16.0	17.2	18.2	18.4	17.4	20.3	20.9	21.4	22.6	27.3	29.4
Taking one or two drinks nearly every day	67.6	68.9	66.8	67.7	68.3	69.0	69.1	69.9	68.9	72.9	70.9	72.8	74.2	75.0	76.5	77.9
Taking four or five drinks nearly every day	88.7	90.7	88.4	90.2	91.7	90.8	91.8	90.9	90.0	91.0	92.0	91.4	92.2	92.8	91.6	91.9
Having five or more drinks once or twice each weekend	60.3	58.6	57.4	56.2	56.7	55.6	55.5	58.8	56.6	59.6	60.4	62.4	62.0	65.3	66.5	68.9
Smoking one or more packs of cigarettes per day	67.5	65.9	66.4	67.0	70.3	70.8	69.9	69.4	70.8	73.0	72.3	75.4	74.3	73.1	72.4	72.8
Taking steroids	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	90.8
Approximate weighted N =	*2,677*	*2,957*	*3,085*	*3,686*	*3,221*	*3,261*	*3,610*	*3,651*	*3,341*	*3,254*	*3,265*	*3,113*	*3,302*	*3,311*	*2,799*	*2,566*

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TABLE 14 (cont.)
Trends in Disapproval of Drug Use in Grade 12

	Percentage who disapprove or strongly disapprove [b]														
Do you disapprove of people (who are 18 or older) doing each of the following? [a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Trying marijuana once or twice	68.7	69.9	63.3	57.6	56.7	52.5	51.0	51.6	48.8	52.5	49.1	51.6	53.4	52.7	55.0
Smoking marijuana occasionally	79.4	79.7	75.5	68.9	66.7	62.9	63.2	64.4	62.5	65.8	63.2	63.4	64.2	65.4	67.8
Smoking marijuana regularly	89.3	90.1	87.6	82.3	81.9	80.0	78.8	81.2	78.6	79.7	79.3	78.3	78.7	80.7	82.0
Trying LSD once or twice	90.1	88.1	85.9	82.5	81.1	79.6	80.5	82.1	83.0	82.4	81.8	84.6	85.5	87.9	87.9
Taking LSD regularly	96.4	95.5	95.8	94.3	92.5	93.2	92.9	93.5	94.3	94.2	94.0	94.0	94.4	94.6	95.6
Trying ecstasy (MDMA) once or twice [c]	—	—	—	—	—	—	82.2	82.5	82.1	81.0	79.5	83.6	84.7	87.7	88.4
Trying cocaine once or twice	93.6	93.0	92.7	91.6	90.3	90.0	88.0	89.5	89.1	88.2	88.1	89.0	89.3	88.6	88.9
Taking cocaine regularly	97.3	96.9	97.5	96.6	96.1	95.6	96.0	95.6	94.9	95.5	94.9	95.0	95.8	95.4	96.0
Trying crack once or twice	92.1	93.1	89.9	89.5	91.4	87.4	87.0	86.7	87.6	87.5	87.0	87.8	86.6	86.9	86.7
Taking crack occasionally	94.2	95.0	92.8	92.8	94.0	91.2	91.3	90.9	92.3	91.9	91.6	91.5	90.8	92.1	91.9
Taking crack regularly	95.0	95.5	93.4	93.1	94.1	93.0	92.3	91.9	93.2	92.8	92.2	92.4	91.2	93.1	92.1
Trying cocaine powder once or twice	88.0	89.4	86.6	87.1	88.3	83.1	83.0	83.1	84.3	84.1	83.3	83.8	83.6	82.2	83.2
Taking cocaine powder occasionally	93.0	93.4	91.2	91.0	92.7	89.7	89.3	88.7	90.0	90.3	89.8	90.2	88.9	90.0	89.4
Taking cocaine powder regularly	94.4	94.3	93.0	92.5	93.8	92.9	91.5	91.1	92.3	92.6	92.5	92.2	90.7	92.6	92.0
Trying heroin once or twice	96.0	94.9	94.4	93.2	92.8	92.1	92.3	93.7	93.5	93.0	93.1	94.1	94.1	94.2	94.3
Taking heroin occasionally	97.3	96.8	97.0	96.2	95.7	95.0	95.4	96.1	95.7	96.0	95.4	95.6	95.9	96.4	96.3
Taking heroin regularly	97.8	97.2	97.5	97.1	96.4	96.3	96.4	96.6	96.4	96.6	96.2	96.2	97.1	97.1	96.7
Trying heroin once or twice without using a needle	—	—	—	—	92.9	90.8	92.3	93.0	92.6	94.0	91.7	93.1	92.2	93.1	93.2
Taking heroin occasionally without using a needle	—	—	—	—	94.7	93.2	94.4	94.3	93.8	95.2	93.5	94.4	93.5	94.4	95.0
Trying amphetamines once or twice [d]	86.5	86.9	84.2	81.3	82.2	79.9	81.3	82.5	81.9	82.1	82.3	83.8	85.8	84.1	86.1
Taking amphetamines regularly [d]	96.0	95.6	96.0	94.1	94.3	93.5	94.3	94.0	93.7	94.1	93.4	93.5	94.0	93.9	94.8
Trying sedatives (barbiturates) once or twice [e]	90.6	90.3	89.7	87.5	87.3	84.9	86.4	86.0	86.6	85.9	85.9	86.6	87.8‡	83.7	85.4
Taking sedatives (barbiturates) regularly [e]	97.1	96.5	97.0	96.1	95.2	94.8	95.3	94.6	94.7	95.2	94.5	94.7	94.4‡	94.2	95.2
Trying one or two drinks of an alcoholic beverage (beer, wine, liquor)	29.8	33.0	30.1	28.4	27.3	26.5	26.1	24.5	24.6	25.2	26.6	26.3	27.2	26.0	26.4
Taking one or two drinks nearly every day	76.5	75.9	77.8	73.1	73.3	70.8	70.0	69.4	67.2	70.0	69.2	69.1	68.9	69.5	70.8
Taking four or five drinks nearly every day	90.6	90.8	90.6	89.8	88.8	89.4	88.6	86.7	86.9	88.4	86.4	87.5	86.3	87.8	89.4
Having five or more drinks once or twice each weekend	67.4	70.7	70.1	65.1	66.7	64.7	65.0	63.8	62.7	65.2	62.9	64.7	64.2	65.7	66.5
Smoking one or more packs of cigarettes per day	71.4	73.5	70.6	69.8	68.2	67.2	67.1	68.8	69.5	70.1	71.6	73.6	74.8	76.2	79.8
Taking steroids	90.5	92.1	92.1	91.9	91.0	91.7	91.4	90.8	88.9	88.8	86.4	86.8	86.0	87.9	88.8
Approximate weighted N =	*2,547*	*2,645*	*2,723*	*2,588*	*2,603*	*2,399*	*2,601*	*2,545*	*2,310*	*2,150*	*2,144*	*2,160*	*2,442*	*2,455*	*2,460*

Table continued on next page.

TABLE 14 (cont.)
Trends in Disapproval of Drug Use in Grade 12

Do you disapprove of people (who are 18 or older) doing each of the following? [a]	Percentage who disapprove or strongly disapprove [b]											2015–2016 change
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Trying marijuana once or twice	55.6	58.6	55.5	54.8	51.6	51.3	48.8	49.1	48.0	45.5	43.1	-2.4
Smoking marijuana occasionally	69.3	70.2	67.3	65.6	62.0	60.9	59.1	58.9	56.7	52.9	50.5	-2.4
Smoking marijuana regularly	82.2	83.3	79.6	80.3	77.7	77.5	77.8	74.5	73.4	70.7	68.5	-2.2
Trying LSD once or twice	88.0	87.8	85.5	88.2	86.5	86.3	87.2	86.6	85.0	81.7	82.4	+0.7
Taking LSD regularly	95.9	94.9	93.5	95.3	94.3	94.9	95.2	95.3	94.7	92.5	92.4	-0.2
Trying ecstasy (MDMA) once or twice [c]	89.0	87.8	88.2	88.2	86.3	83.9	87.1	84.9‡	83.1	84.5	84.0	-0.5
Trying cocaine once or twice	89.1	89.6	89.2	90.8	90.5	91.1	91.0	92.3	90.0	89.0	88.4	-0.6
Taking cocaine regularly	96.1	96.2	94.8	96.5	96.0	96.0	96.8	96.7	96.3	95.2	94.8	-0.3
Trying crack once or twice	88.8	88.8	89.6	90.9	89.8	91.4	92.8	91.4	89.3	90.2	90.1	0.0
Taking crack occasionally	92.9	92.4	93.3	94.0	92.6	93.9	95.0	93.6	91.9	92.5	92.0	-0.6
Taking crack regularly	93.8	93.6	93.5	94.3	93.1	94.4	95.4	94.1	92.4	92.8	92.6	-0.2
Trying cocaine powder once or twice	84.1	83.5	85.7	87.3	87.0	88.1	88.7	88.2	85.5	86.4	86.6	+0.3
Taking cocaine powder occasionally	90.4	90.6	91.7	92.3	91.0	92.2	93.0	91.7	90.4	91.3	90.6	-0.7
Taking cocaine powder regularly	93.2	92.6	92.8	93.9	92.6	93.8	95.0	94.1	91.7	92.4	92.0	-0.4
Trying heroin once or twice	93.8	94.8	93.3	94.7	93.9	94.3	95.8	95.6	94.7	94.2	94.1	-0.1
Taking heroin occasionally	96.2	96.8	95.3	96.9	96.2	96.3	97.0	96.9	96.6	95.3	95.5	+0.2
Taking heroin regularly	96.9	97.1	95.9	97.4	96.4	96.7	97.4	97.4	97.1	96.4	95.7	-0.6
Trying heroin once or twice without using a needle	93.7	93.6	94.2	94.7	93.2	92.6	95.2	93.7	92.5	92.6	93.8	+1.2
Taking heroin occasionally without using a needle	94.5	94.9	95.3	95.5	94.5	94.1	95.9	94.6	93.5	92.8	94.0	+1.1
Trying amphetamines once or twice [d]	86.3	87.3	87.2	88.2	88.1‡	84.1	83.9	84.9	83.1	81.4	82.1	+0.7
Taking amphetamines regularly [d]	95.3	95.4	94.2	95.6	94.9‡	92.9	93.9	93.2	93.0	92.2	92.2	0.0
Trying sedatives (barbiturates) once or twice [e]	85.3	86.5	86.1	87.7	87.6	87.3	88.2	88.9	88.5	87.4	86.5	-0.9
Taking sedatives (barbiturates) regularly [e]	95.1	94.6	94.3	95.8	94.7	95.1	96.1	95.8	95.0	94.7	94.8	+0.1
Trying one or two drinks of an alcoholic beverage (beer, wine, liquor)	29.0	31.0	29.8	30.6	30.7	28.7	25.4	27.3	29.2	28.9	28.8	-0.2
Taking one or two drinks nearly every day	72.8	73.3	74.5	70.5	71.5	72.8	70.8	71.9	71.7	71.1	71.8	+0.7
Taking four or five drinks nearly every day	90.6	90.5	89.8	89.7	88.8	90.8	90.1	90.6	91.9	89.7	91.1	+1.3
Having five or more drinks once or twice each weekend	68.5	68.8	68.9	67.6	68.8	70.0	70.1	71.6	72.6	71.9	74.2	+2.3
Smoking one or more packs of cigarettes per day	81.5	80.7	80.5	81.8	81.0	83.0	83.7	82.6	85.0	84.1	85.3	+1.3
Taking steroids	89.4	89.2	90.9	90.3	89.8	89.7	90.4	88.2	87.5	87.8	86.7	-1.1
Approximate weighted N =	*2,377*	*2,450*	*2,314*	*2,233*	*2,449*	*2,384*	*2,301*	*2,147*	*2,078*	*2,193*	*2,000*	

Table continued on next page.

TABLE 14 (cont.)
Trends in Disapproval of Drug Use in Grade 12

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' —' indicates data not available. ' ‡ ' indicates that the question changed the following year. See relevant footnote for that drug. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]The 1975 question asked about people who are 20 or older.

[b]Answer alternatives were: (1) Don't disapprove, (2) Disapprove, and (3) Strongly disapprove. Percentages are shown for categories (2) and (3) combined.

[c]Beginning in 2014 "molly" was added to the question on disapproval of using MDMA once or twice. 2014 and 2015 data are not comparable to earlier years due to this change.

[d]In 2011 the list of examples was changed from upper, pep pill, bennie, speed to upper, speed, Adderall, Ritalin, etc. These changes likely explain the discontinuity in the 2011 results.

[e]In 2004 the question text was changed from barbiturates to sedatives/barbiturates and the list of examples was changed from downers, goofballs, reds, yellows, etc. to just downers. These changes likely explain the discontinuity in the 2004 results.

TABLE 15
Trends in Availability of Drugs as Perceived by 8th Graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percentage saying fairly easy or very easy to get [a]													
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Marijuana	—	42.3	43.8	49.9	52.4	54.8	54.2	50.6	48.4	47.0	48.1	46.6	44.8	41.0	41.1
LSD	—	21.5	21.8	21.8	23.5	23.6	22.7	19.3	18.3	17.0	17.6	15.2	14.0	12.3	11.5
PCP [b]	—	18.0	18.5	17.7	19.0	19.6	19.2	17.5	17.1	16.0	15.4	14.1	13.7	11.4	11.0
Ecstasy (MDMA) [b]	—	—	—	—	—	—	—	—	—	—	23.8	22.8	21.6	16.6	15.6
Crack	—	25.6	25.9	26.9	28.7	27.9	27.5	26.5	25.9	24.9	24.4	23.7	22.5	20.6	20.8
Cocaine powder	—	25.7	25.9	26.4	27.8	27.2	26.9	25.7	25.0	23.9	23.9	22.5	21.6	19.4	19.9
Heroin	—	19.7	19.8	19.4	21.1	20.6	19.8	18.0	17.5	16.5	16.9	16.0	15.6	14.1	13.2
Narcotics other than Heroin [b,c]	—	19.8	19.0	18.3	20.3	20.0	20.6	17.1	16.2	15.6	15.0	14.7	15.0	12.4	12.9
Amphetamines [d]	—	32.2	31.4	31.0	33.4	32.6	30.6	27.3	25.9	25.5	26.2	24.4	24.4	21.9	21.0
Crystal methamphetamine (ice) [b]	—	16.0	15.1	14.1	16.0	16.3	15.7	16.0	14.7	14.9	13.9	13.3	14.1	11.9	13.5
Sedatives (barbiturates)	—	27.4	26.1	25.3	26.5	25.6	24.4	21.1	20.8	19.7	20.7	19.4	19.3	18.0	17.6
Tranquilizers	—	22.9	21.4	20.4	21.3	20.4	19.6	18.1	17.3	16.2	17.8	16.9	17.3	15.8	14.8
Alcohol	—	76.2	73.9	74.5	74.9	75.3	74.9	73.1	72.3	70.6	70.6	67.9	67.0	64.9	64.2
Cigarettes	—	77.8	75.5	76.1	76.4	76.9	76.0	73.6	71.5	68.7	67.7	64.3	63.1	60.3	59.1
Steroids	—	24.0	22.7	23.1	23.8	24.1	23.6	22.3	22.6	22.3	23.1	22.0	21.7	19.7	18.1
Approximate weighted N =		*8,355*	*16,775*	*16,119*	*15,496*	*16,318*	*16,482*	*16,208*	*15,397*	*15,180*	*14,804*	*13,972*	*15,583*	*15,944*	*15,730*

Table continued on next page.

TABLE 15 (cont.)
Trends in Availability of Drugs as Perceived by 8th Graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percentage saying fairly easy or very easy to get [a]											2015–2016 change
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Marijuana	39.6	37.4	39.3	39.8	41.4	37.9	36.9	39.1	36.9	37.0	34.6	-2.4 s
LSD	10.8	10.5	10.9	10.0	10.0	9.3	7.5	7.4	6.9	6.6	6.9	+0.3
PCP [b]	10.5	9.5	10.1	9.1	8.0	7.9	6.7	5.8	5.5	5.1	4.8	-0.4
Ecstasy (MDMA) [b]	14.5	13.4	14.1	13.1	12.9	12.0	9.6	9.5	10.1	9.6	8.7	-0.9
Crack	20.9	19.7	20.2	18.6	17.9	15.7	14.4	13.7	12.0	11.3	11.1	-0.2
Cocaine powder	20.2	19.0	19.5	17.8	16.6	14.9	14.1	13.5	11.9	11.6	11.0	-0.6
Heroin	13.0	12.6	13.3	12.0	11.6	9.9	9.4	10.0	8.6	7.8	8.9	+1.0 s
Narcotics other than Heroin [b,c]	13.0	11.7	12.1	11.8‡	14.6	12.3	10.6	9.7	9.2	8.8	8.9	+0.1
Amphetamines [d]	20.7	19.9	21.3	20.2	19.6‡	15.0	13.4	12.8	12.1	11.8	12.1	+0.3
Crystal methamphetamine (ice) [b]	14.5	12.1	12.8	11.9	10.9	9.6	8.8	8.5	7.7	6.9	6.6	-0.3
Sedatives (barbiturates)	17.3	16.8	17.5	15.9	15.3	12.6	11.1	10.6	10.0	9.0	9.3	+0.3
Tranquilizers	14.4	14.4	15.4	14.1	13.7	12.0	10.5	10.4	9.8	9.8	11.4	+1.6 ss
Alcohol	63.0	62.0	64.1	61.8	61.1	59.0	57.5	56.1	54.4	53.6	52.7	-1.0
Cigarettes	58.0	55.6	57.4	55.3	55.5	51.9	50.7	49.9	47.2	47.0	45.6	-1.4
Steroids	17.1	17.0	16.8	15.2	14.2	13.3	12.5	12.9	11.8	11.6	12.6	+1.0
Approximate weighted N =	*15,502*	*15,043*	*14,482*	*13,989*	*14,485*	*15,233*	*14,235*	*13,605*	*13,208*	*13,494*	*15,628*	

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. ' ‡ ' indicates that the question changed the following year. See relevant footnote for that drug. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]Answer alternatives were: (1) Probably impossible, (2) Very difficult, (3) Fairly difficult, (4) Fairly easy, (5) Very easy, and (6) Can't say, drug unfamiliar.

[b]Beginning in 1993, data based on one of two of forms; *N* is one half of *N* indicated. Beginning in 2014 data based on one sixth of *N* indicated. For MDMA only: In 2014 the question text was changed in one form to include "Molly." In 2015 a second from was changed to including "Molly;" data based on one sixth of N indicated in 2014 and on one half of N indicated in 2015. An examination of the data did not show any effect from this wording change.

[c]In 2010 the list of examples for narcotics other than heroin was changed from methadone, opium to Vicodin, OxyContin, Percocet, etc. This change likely explains the discontinuity in the 2010 results.

[d]In 2011 the list of examples for amphetamines was changed from uppers, pep pills, bennies, speed to uppers, speed, Adderall, Ritalin, etc. These changes likely explain the discontinuity in the 2012 results.

TABLE 16
Trends in Availability of Drugs as Perceived by 10th Graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percentage saying fairly easy or very easy to get [a]													
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Marijuana	—	65.2	68.4	75.0	78.1	81.1	80.5	77.9	78.2	77.7	77.4	75.9	73.9	73.3	72.6
LSD	—	33.6	35.8	36.1	39.8	41.0	38.3	34.0	34.3	32.9	31.2	26.8	23.1	21.6	20.7
PCP [b]	—	23.7	23.4	23.8	24.7	26.8	24.8	23.9	24.5	25.0	21.6	20.8	19.4	18.0	18.1
Ecstasy (MDMA) [b]	—	—	—	—	—	—	—	—	—	—	41.4	41.0	36.3	31.2	30.2
Crack	—	33.7	33.0	34.2	34.6	36.4	36.0	36.3	36.5	34.0	30.6	31.3	29.6	30.6	31.0
Cocaine powder	—	35.0	34.1	34.5	35.3	36.9	37.1	36.8	36.7	34.5	31.0	31.8	29.6	31.2	31.5
Heroin	—	24.3	24.3	24.7	24.6	24.8	24.4	23.0	23.7	22.3	20.1	19.9	18.8	18.7	19.3
Narcotics other than Heroin [b,c]	—	26.9	24.9	26.9	27.8	29.4	29.0	26.1	26.6	27.2	25.8	25.4	23.5	23.1	23.6
Amphetamines [d]	—	43.4	46.4	46.6	47.7	47.2	44.6	41.0	41.3	40.9	40.6	39.6	36.1	35.7	35.6
Crystal methamphetamine (ice) [b]	—	18.8	16.4	17.8	20.7	22.6	22.9	22.1	21.8	22.8	19.9	20.5	19.0	19.5	21.6
Sedatives (barbiturates)	—	38.0	38.8	38.3	38.8	38.1	35.6	32.7	33.2	32.4	32.8	32.4	28.8	30.0	29.7
Tranquilizers	—	31.6	30.5	29.8	30.6	30.3	28.7	26.5	26.8	27.6	28.5	28.3	25.6	25.6	25.4
Alcohol	—	88.6	88.9	89.8	89.7	90.4	89.0	88.0	88.2	87.7	87.7	84.8	83.4	84.3	83.7
Cigarettes	—	89.1	89.4	90.3	90.7	91.3	89.6	88.1	88.3	86.8	86.3	83.3	80.7	81.4	81.5
Steroids	—	37.6	33.6	33.6	34.8	34.8	34.2	33.0	35.9	35.4	33.1	33.2	30.6	29.6	29.7
Approximate weighted N =		*7,014*	*14,652*	*15,192*	*16,209*	*14,887*	*14,856*	*14,423*	*13,112*	*13,690*	*13,518*	*13,694*	*15,255*	*15,806*	*15,636*

Table continued on next page.

TABLE 16 (cont.)
Trends in Availability of Drugs as Perceived by 10th Graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percentage saying fairly easy or very easy to get [a]											
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Marijuana	70.7	69.0	67.4	69.3	69.4	68.4	68.8	69.7	66.9	65.6	64.0	-1.6
LSD	19.2	19.0	19.3	17.8	18.3	16.6	14.9	16.3	14.8	15.5	15.2	-0.4
PCP [b]	15.8	15.4	14.4	13.4	12.6	12.0	10.2	9.4	8.3	9.0	7.6	-1.4 s
Ecstasy (MDMA) [b]	27.4	27.7	26.7	25.6	25.7	24.8	21.0	20.7	20.4	19.3	16.3	-3.0 ss
Crack	29.9	29.0	27.2	23.9	22.5	19.7	18.4	17.1	15.1	14.4	13.9	-0.5
Cocaine powder	30.7	30.0	28.2	24.7	22.6	20.6	19.2	18.3	16.4	16.1	14.9	-1.2
Heroin	17.4	17.3	17.2	15.0	14.5	13.2	11.9	11.9	10.9	11.0	10.6	-0.4
Narcotics other than Heroin [b,c]	22.2	21.5	20.3	18.8‡	28.7	25.0	24.3	22.5	18.8	19.2	16.8	-2.4 s
Amphetamines [d]	34.7	33.3	32.0	31.8	32.6‡	28.5	27.3	26.5	25.2	27.3	22.9	-4.5 sss
Crystal methamphetamine (ice) [b]	20.8	18.8	15.8	14.0	13.3	11.8	10.7	10.0	9.8	8.9	8.2	-0.8
Sedatives (barbiturates)	29.9	28.2	26.9	25.5	24.9	22.0	20.2	18.3	16.7	16.6	14.2	-2.4 sss
Tranquilizers	25.1	24.9	24.1	22.3	21.6	20.8	19.7	18.3	17.5	19.4	20.5	+1.1
Alcohol	83.1	82.6	81.1	80.9	80.0	77.9	78.2	77.2	75.3	74.9	71.1	-3.8 sss
Cigarettes	79.5	78.2	76.5	76.1	75.6	73.6	72.9	71.4	69.0	66.6	62.9	-3.6 ss
Steroids	30.2	27.7	24.5	20.8	20.3	18.8	18.0	17.2	16.5	17.0	15.3	-1.7 s
Approximate weighted N =	*15,804*	*15,511*	*14,634*	*15,451*	*14,827*	*14,509*	*14,628*	*12,601*	*12,574*	*15,186*	*14,126*	

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. ' ‡ ' indicates that the question changed the following year. See relevant footnote for that drug. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]Answer alternatives were: (1) Probably impossible, (2) Very difficult, (3) Fairly difficult, (4) Fairly easy, (5) Very easy, and (6) Can't say, drug unfamiliar.

[b]Beginning in 1993, data based on one of two forms; *N* is one half of *N* indicated. Beginning in 2014 data based on one sixth of N indicated.

[b]Beginning in 1993, data based on one of two of forms; *N* is one half of *N* indicated. Beginning in 2014 data based on one sixth of *N* indicated. For MDMA only: In 2014 the question text was changed in one form to include "Molly." In 2015 a second from was changed to including "Molly;" data based on one sixth of N indicated in 2014 and on one half of N indicated in 2015. An examination of the data did not show any effect from this wording change.

[d]In 2011 the list of examples for amphetamines was changed from uppers, pep pills, bennies, speed to uppers, speed, Adderall, Ritalin, etc. These changes likely explain the discontinuity in the 2011 results.

TABLE 17
Trends in Availability of Drugs as Perceived by 12th Graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percentage saying fairly easy or very easy to get [a]															
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Marijuana	87.8	87.4	87.9	87.8	90.1	89.0	89.2	88.5	86.2	84.6	85.5	85.2	84.8	85.0	84.3	84.4
Amyl/butyl nitrites	—	—	—	—	—	—	—	—	—	—	—	—	23.9	25.9	26.8	24.4
LSD	46.2	37.4	34.5	32.2	34.2	35.3	35.0	34.2	30.9	30.6	30.5	28.5	31.4	33.3	38.3	40.7
Some other hallucinogen [b]	47.8	35.7	33.8	33.8	34.6	35.0	32.7	30.6	26.6	26.6	26.1	24.9	25.0	26.2	28.2	28.3
PCP	—	—	—	—	—	—	—	—	—	—	—	—	22.8	24.9	28.9	27.7
Ecstasy (MDMA) [c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21.7	22.0
Cocaine	37.0	34.0	33.0	37.8	45.5	47.9	47.5	47.4	43.1	45.0	48.9	51.5	54.2	55.0	58.7	54.5
Crack	—	—	—	—	—	—	—	—	—	—	—	—	41.1	42.1	47.0	42.4
Cocaine powder	—	—	—	—	—	—	—	—	—	—	—	—	52.9	50.3	53.7	49.0
Heroin	24.2	18.4	17.9	16.4	18.9	21.2	19.2	20.8	19.3	19.9	21.0	22.0	23.7	28.0	31.4	31.9
Some other narcotic (including methadone) [c]	34.5	26.9	27.8	26.1	28.7	29.4	29.6	30.4	30.0	32.1	33.1	32.2	33.0	35.8	38.3	38.1
Amphetamines [d]	67.8	61.8	58.1	58.5	59.9	61.3	69.5	70.8	68.5	68.2	66.4	64.3	64.5	63.9	64.3	59.7
Crystal methamphetamine (ice)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24.1
Sedatives (barbiturates) [e]	60.0	54.4	52.4	50.6	49.8	49.1	54.9	55.2	52.5	51.9	51.3	48.3	48.2	47.8	48.4	45.9
Tranquilizers	71.8	65.5	64.9	64.3	61.4	59.1	60.8	58.9	55.3	54.5	54.7	51.2	48.6	49.1	45.3	44.7
Alcohol	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Steroids	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Approximate weighted N =	*2,627*	*2,865*	*3,065*	*3,598*	*3,172*	*3,240*	*3,578*	*3,602*	*3,385*	*3,269*	*3,274*	*3,077*	*3,271*	*3,231*	*2,806*	*2,549*

Table continued on next page.

TABLE 17 (cont.)
Trends in Availability of Drugs as Perceived by 12th Graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percentage saying fairly easy or very easy to get [a]														
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Marijuana	83.3	82.7	83.0	85.5	88.5	88.7	89.6	90.4	88.9	88.5	88.5	87.2	87.1	85.8	85.6
Amyl/butyl nitrites	22.7	25.9	25.9	26.7	26.0	23.9	23.8	25.1	21.4	23.3	22.5	22.3	19.7	20.0	19.7
LSD	39.5	44.5	49.2	50.8	53.8	51.3	50.7	48.8	44.7	46.9	44.7	39.6	33.6	33.1	28.6
Some other hallucinogen [b]	28.0	29.9	33.5	33.8	35.8	33.9	33.9	35.1	29.5	34.5‡	48.5	47.7	47.2	49.4	45.0
PCP	27.6	31.7	31.7	31.4	31.0	30.5	30.0	30.7	26.7	28.8	27.2	25.8	21.9	24.2	23.2
Ecstasy (MDMA) [c]	22.1	24.2	28.1	31.2	34.2	36.9	38.8	38.2	40.1	51.4	61.5	59.1	57.5	47.9	40.3
Cocaine	51.0	52.7	48.5	46.6	47.7	48.1	48.5	51.3	47.6	47.8	46.2	44.6	43.3	47.8	44.7
Crack	39.9	43.5	43.6	40.5	41.9	40.7	40.6	43.8	41.1	42.6	40.2	38.5	35.3	39.2	39.3
Cocaine powder	46.0	48.0	45.4	43.7	43.8	44.4	43.3	45.7	43.7	44.6	40.7	40.2	37.4	41.7	41.6
Heroin	30.6	34.9	33.7	34.1	35.1	32.2	33.8	35.6	32.1	33.5	32.3	29.0	27.9	29.6	27.3
Some other narcotic (including methadone) [c]	34.6	37.1	37.5	38.0	39.8	40.0	38.9	42.8	40.8	43.9	40.5	44.0	39.3	40.2	39.2
Amphetamines [d]	57.3	58.8	61.5	62.0	62.8	59.4	59.8	60.8	58.1	57.1	57.1	57.4	55.0	55.4	51.2
Crystal methamphetamine (ice)	24.3	26.0	26.6	25.6	27.0	26.9	27.6	29.8	27.6	27.8	28.3	28.3	26.1	26.7	27.2
Sedatives (barbiturates) [e]	42.4	44.0	44.5	43.3	42.3	41.4	40.0	40.7	37.9	37.4	35.7	36.6	35.3‡	46.3	44.4
Tranquilizers	40.8	40.9	41.1	39.2	37.8	36.0	35.4	36.2	32.7	33.8	33.1	32.9	29.8	30.1	25.7
Alcohol	—	—	—	—	—	—	—	—	95.0	94.8	94.3	94.7	94.2	94.2	93.0
Steroids	46.7	46.8	44.8	42.9	45.5	40.3	41.7	44.5	44.6	44.8	44.4	45.5	40.7	42.6	39.7
Approximate weighted N =	*2,476*	*2,586*	*2,670*	*2,526*	*2,552*	*2,340*	*2,517*	*2,520*	*2,215*	*2,095*	*2,120*	*2,138*	*2,391*	*2,169*	*2,161*

Table continued on next page.

TABLE 17 (cont.)
Trends in Availability of Drugs as Perceived by 12th Graders

How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?	Percentage saying "fairly easy" or "very easy" to get [a]											
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2015–2016 change
Marijuana	84.9	83.9	83.9	81.1	82.1	82.2	81.6	81.4	81.3	79.5	81.0	+1.5
Amyl/butyl nitrites	18.4	18.1	16.9	15.7	—	—	—	—	—	—	—	
LSD	29.0	28.7	28.5	26.3	25.1	25.1	27.6	24.5	25.9	26.5	28.0	+1.6
Some other hallucinogen [b]	43.9	43.7	42.8	40.5	39.5	38.3	37.8	36.6	33.6	31.4	32.5	+1.0
PCP	23.1	21.0	20.6	19.2	18.5	17.2	14.2	15.3	11.1	13.8	12.6	-1.2
Ecstasy (MDMA) [c]	40.3	40.9	41.9	35.1	36.4	37.1	35.9	35.1	36.1	37.1	32.5	-4.7 s
Cocaine	46.5	47.1	42.4	39.4	35.5	30.5	29.8	30.5	29.2	29.1	28.6	-0.5
Crack	38.8	37.5	35.2	31.9	26.1	24.0	22.0	24.6	20.1	22.0	19.8	-2.2
Cocaine powder	42.5	41.2	38.9	33.9	29.0	26.4	25.1	28.4	22.3	25.8	22.9	-2.8
Heroin	27.4	29.7	25.4	27.4	24.1	20.8	19.9	22.1	20.2	20.4	20.0	-0.4
Some other narcotic (including methadone) [d]	39.6	37.3	34.9	36.1‡	54.2	50.7	50.4	46.5	42.2	39.0	39.3	+0.3
Amphetamines [e]	52.9	49.6	47.9	47.1	44.1‡	47.0	45.4	42.7	44.5	41.9	41.1	-0.7
Crystal methamphetamine (ice)	26.7	25.1	23.3	22.3	18.3	17.1	14.5	17.2	13.7	15.3	14.5	-0.8
Sedatives (barbiturates) [f]	43.8	41.7	38.8	37.9	36.8	32.4	28.7	27.9	26.3	25.0	25.7	+0.8
Tranquilizers	24.4	23.6	22.4	21.2	18.4	16.8	14.9	15.0	14.4	14.9	15.2	+0.3
Alcohol	92.5	92.2	92.2	92.1	90.4	88.9	90.6	89.7	87.6	86.6	85.4	-1.2
Steroids	41.1	40.1	35.2	30.3	27.3	26.1	25.0	28.5	22.0	23.7	21.3	-2.3
Approximate weighted N =	*2,131*	*2,420*	*2,276*	*2,243*	*2,395*	*2,337*	*2,280*	*2,092*	*2,066*	*2,181*	*1,958*	

Source. The Monitoring the Future study, the University of Michigan.

Notes. Level of significance of difference between the two most recent classes: s = .05, ss = .01, sss = .001. ' — ' indicates data not available. ' ‡ ' indicates that the question changed the following year. See relevant footnote for that drug. Any apparent inconsistency between the change estimate and the prevalence estimates for the two most recent years is due to rounding.

[a]Answer alternatives were: (1) Probably impossible, (2) Very difficult, (3) Fairly difficult, (4) Fairly easy, and (5) Very easy.

[b]In 2001 the question text was changed from other psychedelics to other hallucinogens and shrooms was added to the list of examples. These changes likely explain the discontinuity in the 2001 results.

[c]Beginning in 2014 "molly" was added to the question on availability of Ecstasy (MDMA). An examination of the data did not show any effect from this wording change.

[d]In 2010 the list of examples for narcotics other than heroin was changed from methadone, opium to Vicodin, OxyContin, Percocet, etc. This change likely explains the discontinuity in the 2010 results.

[e]In 2011 the list of examples was changed from uppers, pep pills, bennies, speed to uppers, speed, Adderall, Ritalin, etc. These changes likely explain the discontinuity in the 2011 results.

[f]In 2004 the question text was changed from barbiturates to sedatives/barbiturates and the list of examples was changed from downers, goofballs, reds, yellows, etc. to just downers. These changes likely explain the discontinuity in the 2004 results.

Monitoring the Future website:
http://www.monitoringthefuture.org

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