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Trends in characteristics of individuals who use methamphetamine in the United States, 2015-2018

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ABSTRACT

Background: Prevalence of self-reported methamphetamine use has remained relatively stable over the past decade; however, deaths and seizures involving methamphetamine have been increasing. Research is needed to determine if select subgroups in the US are at increased risk for use.

Methods: We examined data from individuals ages ≥12 from the 2015–2018 National Survey on Drug Use and Health (n = 226,632), an annual nationally representative cross-sectional survey of non-institutionalized individuals in the US. Log-linear trends in past-year methamphetamine use were examined, stratified by demographic and drug use characteristics.

Results: Methamphetamine use increased in the US from 2015 to 2018, including among those reporting past-year use of ecstasy/MDMA (6.1 % to 10.8 % [p = .018], a 78.2 % increase), cocaine (8.4 % to 11.8 % [p = .013], a 40.1 % increase), and among those reporting past-year prescription opioid misuse (5.4 % to 8.0 % [p = .019], a 49.2 % increase). Increases were particularly pronounced among those reporting past-year use of heroin (22.5 % to 37.4 % [p = .032], a 66.2 % increase) and LSD (5.1 %–= to 10.3 % [p = .002], a 100.4 % increase). Small increases were also detected among heterosexuals (0.6 % to 0.7 % [p = .044], a 16.2 % increase), those with a high school diploma or less (1.0 % to 1.2 % [p = .020], a 22.0 % increase), and among those receiving government assistance (1.4 % to 1.8 % [p = .046], a 26.2 % increase).

Conclusions: Methamphetamine use is increasing among people who use other drugs with sharp increases among people who use heroin or LSD in particular, and this could have serious public health consequences. Results may signal that methamphetamine use may continue to increase in the general population.

1. Introduction

Death rates involving psychostimulants including methamphetamine have increased in the US from < 0.5 per 100,000 in 2003–2008 to 3.9 per 100,000 in 2018 (Hedegaard et al., 2020), with the number of related deaths increasing to 10,333 in 2017, a 33.3 % increase from 2016 (Kariisa et al., 2019). Positivity rates of methamphetamine have increased among patient urine specimens collected during routine care in the US between 2013 and 2019, from 1.4 % to 8.4 %, a 487 % increase (Twillman et al., 2020), and there have also been increases in methamphetamine seizures in the US, increasing from 147,450 in 2008 to 386,272 in 2018 (U.S. Drug Enforcement Administration, 2019a, 2019b). However, despite the recent spike in deaths, detection of use in biospecimens, and in seizures, prevalence of self-reported use on national surveys has remained low and stable. For example, among high school seniors in the US, past-year self-reported use has been ≤1% since 2008 (Johnston et al., 2020). Given that prevalence based on self-report has remained stable, it is important to determine if prevalence has been increasing in select subgroups of the population, which can inform prevention, intervention, and harm reduction efforts.

The recent spikes in deaths related to psychostimulant use may be driven by those who use heroin or use other opioids nonmedically. For example, nearly one half of psychostimulant-related deaths in 2016 and 2017 involved an opioid (Kariisa et al., 2019). Similarly, among specimens collected during routine care in the US, of those testing positive for fentanyl, positivity for co-exposure to methamphetamine increased

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from 2013 to 2019, from 2.2 % to 30.4 %, a 1,281 % increase (Twillman et al., 2020). A recent nationally representative survey of non-institutionalized individuals in the US estimated that past-month methamphetamine use increased among those reporting past-month heroin use and among those with past-year opioid use disorder between 2015 and 2017 (Strickland et al., 2019). These associations were specific to methamphetamine without substantial change among use of other drugs (among those who use opioids). Thus, increases in methamphetamine use and associated adverse outcomes appear to be increasingly associated with co-use of opioids. However, while Strickland et al. (2019) estimated trends in past-month co-use of opioids and methamphetamine, we believe examining trends in past-year methamphetamine use would allow us to determine trends in use among people who have used less recently—people who likely use less frequently but are still at risk for continued use. Further, while additional focus is still needed on concurrent use of cocaine, heroin, and scheduled prescription drugs with methamphetamine, more information is needed on trends in co-use of common "party" drugs such as ecstasy and LSD. Focusing on a wider range of drugs within a wider window period would allow us to detect more unique drug-related trends that may be present among people who have used methamphetamine less recently.

Until recently, the opioid and methamphetamine crises were considered distinct, affecting different populations, but these crises have begun to overlap (The Lancet, 2018). A second "wave" of methamphetamine may be beginning (The Lancet, 2018); therefore, more research is needed to examine trends in methamphetamine use in the general US population and to determine whether individuals with specific demographic or drug use characteristics are becoming at increased risk for use. This study examines recent trends in methamphetamine use in the general US population to determine if select subgroups are at increased risk for use.

2. Methods

2.1. Procedure

The National Survey on Drug Use and Health (NSDUH) is a nationally representative annual cross-sectional survey of non-institutionalized individuals ages $\geq$12 in the 50 US states and the District of Columbia (Center for Behavioral Health Statistics and Quality, 2019). The sampling frame is obtained through four stages. Surveys are administered via computer-assisted interviewing conducted by an interviewer and audio computer-assisted self-interviewing. We performed a secondary analysis of individuals age $\geq$12 from the 2015–2018 cohorts (n = 226,632). We could not include earlier years because NSDUH was redesigned in 2015 and questions about use of methamphetamine and various other drugs changed (Substance Abuse Mental Health Services Administration, 2015).

2.2. Measures

Participants were asked about demographic characteristics including age, sex, race/ethnicity, education, household income, sexual identity, and past-year receipt of governmental program assistance (i.e., food stamps, supplemental security income, cash assistance, non-cash assistance). With regard to past-year drug use, the survey asks participants whether they smoked, swallowed, snorted or injected methamphetamine (also known as crank, ice, crystal meth, speed, or glass). Participants are also asked whether they have used cannabis, lysergic acid diethylamide (LSD), ecstasy (MDMA, Molly), cocaine, and heroin, and they are also asked about misuse of prescription opioids, tranquilizers, and stimulants. Misuse is defined by NSDUH as using a drug in any way not directed by a doctor, including use without a prescription, more often, in greater amounts, or longer than directed to use them, or use in any other way not directed to use.

2.3. Analysis

We first estimated prevalence of past-year methamphetamine use across cohorts and then estimated prevalence stratified by demographic characteristics and according to past-year use of other drugs. We then calculated absolute and relative changes in prevalence between 2015 and 2018. We also estimated whether there were log-linear associations between methamphetamine use and time by determining whether there were linear, quadratic, or cubic trends using logistic regression. A sensitivity analysis was conducted in which overall trends in methamphetamine use and trends among those reporting past-year use of each drug were then repeated, focusing only on those reporting no past-year heroin use. This was done to determine whether any drug-related trends are independent of past-year heroin use. In addition, when prevalence of use of another drug significantly changed among people reporting methamphetamine use, using similar models, we then estimated whether trends in use of other drugs also shifted among people reporting use of these drugs. For example, if LSD use significantly shifted among people reporting methamphetamine use, we also determined whether people who use other drugs also experienced shifting trends in LSD use. Sample weights (provided by NSDUH) were used to account for the complex survey design, selection probability, non-response, and population distribution, and weights were divided by four to account for pooling of data from four cohorts. Stata 13 SE (StataCorp, 2013) was used to analyze all data and we used Taylor series estimation methods to provide accurate standard errors (Heeringa et al., 2010). This secondary analysis was exempt from review by New York University Langone Medical Center's institutional review board.

3. Results

There was a small increase in prevalence of past-year methamphetamine use from 0.62 % to 0.70 % (p = .039), a 13.2 % relative increase. As shown in Table 1, there were significant linear increases among those with a high school diploma or less (a 22.0 % increase, p = 0.020), among those identifying as heterosexual (a 16.2 % increase, p = 0.044), and among those who have received government assistance in the past year (a 26.2 % increase, p = 0.046). There was also a quadratic increase among those ages 26 − 34 (a 33.3 % increase, p = .031). With regard to other drug use, there were significant linear increases in use among those reporting past-year use of ecstasy/MDMA (from 6.1% to 10.8% [p = .018], a 78.2 % increase), cocaine (from 8.4 % to 11.8 % [p = .013], a 40.1 % increase), and among those reporting past-year prescription opioid misuse (from 5.4% to 8% [p = .019], a 49.2 % increase). Increases were particularly pronounced among those reporting past-year use of heroin (from 22.5 % to 37.4 % [p = .032], a 66.2 % relative and 14.9 % absolute increase) and LSD (from 5.1 % to 10.3 % [p = .002], a 100.4 % increase) (Fig. 1).

In our sensitivity tests examining trends in methamphetamine use among participants who did not report past-year heroin use (Supplemental Table 1), among those reporting LSD use there was a significant linear increase in methamphetamine use (with use increasing from 4.3 % to 8.1 %, an 86.6 % relative increase; p = .019). We also detected smaller, quadratic increases among those reporting misuse of prescription opioids (from 4.4 % to 6.1 %, p = .046) and/or tranquilizers (from 7.1 % to 8.3 %, p = .012). In addition, when focusing on drugs that increased in prevalence among people who used methamphetamine (Supplemental Table 2), we did not detect such increases in use among people reporting use of other drugs. The only increase we detected was that LSD use also increased among people reporting cocaine use (with use increasing from 12.8 % to 17.9 %, a 39.8 % increase; p = .004).

4. Discussion

Although methamphetamine use has only slightly increased in the

Table 1
Trends in Prevalence of Self-Reported Past-Year Methamphetamine Use by Sociodemographic and Drug Use Characteristics in the United States, 2015-2018.

	Weighted % (95 % CI)				% change from 2015 to 2018		
	2015	2016	2017	2018	Absolute change	Relative change	Linear trend *P*-value
Past-year methamphetamine use	0.6 (0.5 – 0.7)	0.5 (0.5 – 0.6)	0.6 (0.6 – 0.7)	0.7 (0.6 – 0.8)	0.1	13.2	.039
Age, years							
12 – 17	0.2 (0.1 – 0.3)	0.1 (0.1 – 0.2)	0.2 (0.1 – 0.3)	0.2 (0.1 – 0.3)	0.0	−19.5	.825
18 – 25	1.0 (0.8 – 1.2)	0.8 (0.6 – 1.0)	1.1 (0.9 – 1.4)	0.8 (0.7 – 1.1)	−0.1	−15.0	.005 [a]
26 – 34	1.1 (0.8 – 1.5)	0.9 (0.7 – 1.2)	1.0 (0.8 – 1.2)	1.4 (1.1 – 1.9)	0.4	33.3	.031 [b]
35 – 49	0.9 (0.7 – 1.2)	0.7 (0.5 – 0.9)	0.8 (0.6 – 1.1)	1.0 (0.8 – 1.2)	0.1	9.2	.433
≥ 50	0.3 (0.2 – 0.4)	0.3 (0.2 – 0.5)	0.3 (0.2 – 0.5)	0.4 (0.3 – 0.6)	0.1	30.2	.249
Sex							
Male	0.9 (0.7 – 1.1)	0.6 (0.5 – 0.7)	0.9 (0.7 – 1.0)	0.9 (0.7 – 1.1)	0.0	0.9	.356
Female	0.4 (0.3 – 0.5)	0.4 (0.4 – 0.5)	0.4 (0.3 – 0.5)	0.5 (0.4 – 0.7)	0.2	39.2	.063
Race/ethnicity							
Non-Hispanic White	0.7 (0.6 – 0.8)	0.6 (0.5 – 0.8)	0.7 (0.6 – 0.8)	0.8 (0.7 – 1.0)	0.1	19.2	.066
Non-Hispanic Black	0.4 (0.2 – 0.6)	0.1 (0.1 – 0.3)	0.2 (0.1 – 0.4)	0.2 (0.1 – 0.4)	−0.2	−44.0	.263
Hispanic	0.6 (0.4 – 0.8)	0.4 (0.3 – 0.6)	0.6 (0.4 – 0.9)	0.7 (0.5 – 1.0)	0.1	23.9	.071
Other or Mixed	0.6 (0.4 – 0.9)	0.4 (0.2 – 0.6)	0.6 (0.4 – 1.0)	0.6 (0.4 – 0.8)	0.0	−3.4	.651
Education							
High school diploma or less	1.0 (0.8 – 1.2)	0.8 (0.7 – 1.0)	1.1 (0.9 – 1.3)	1.2 (1.0 – 1.5)	0.2	22.0	.020
Some college	0.7 (0.6 – 0.9)	0.6 (0.4 – 0.7)	0.7 (0.6 – 0.9)	0.8 (0.6 – 1.0)	0.0	6.2	.428
College degree	0.2 (0.1 – 0.3)	0.2 (0.1 – 0.3)	0.1 (0.1 – 0.3)	0.2 (0.1 – 0.4)	0.1	33.9	.568
Annual Family Income							
< $20,000	1.3 (1.0 – 1.7)	1.2 (0.9 – 1.5)	1.7 (1.4 – 2.1)	1.6 (1.3 – 2.0)	0.2	17.2	.103
$20,000-$49,999	0.7 (0.6 – 0.9)	0.7 (0.5 – 0.8)	0.7 (0.6 – 0.8)	0.8 (0.6 – 1.0)	0.0	5.0	.615
$50,000-$74,999	0.3 (0.2 – 0.5)	0.4 (0.3 – 0.6)	0.3 (0.2 – 0.5)	0.6 (0.3 – 1.0)	0.3	88.3	.110
> $75,000	0.3 (0.2 – 0.4)	0.2 (0.1 – 0.3)	0.2 (0.2 – 0.3)	0.4 (0.3 – 0.5)	0.0	14.6	.012 [b]
Sexual Identity							
Heterosexual	0.6 (0.5 – 0.7)	0.5 (0.4 – 0.6)	0.6 (0.5 – 0.7)	0.7 (0.6 – 0.8)	0.1	16.2	.044
Gay/Lesbian	2.7 (1.3 – 5.4)	1.1 (0.6 – 2.1)	1.2 (0.5 – 2.9)	2.3 (1.3 – 4.3)	−0.4	−13.0	.819
Bisexual	2.2 (1.4 – 3.3)	1.9 (1.4 – 2.6)	1.5 (0.9 – 2.5)	2.3 (1.7 – 3.3)	0.2	8.3	.838
Government Assistance	1.4 (1.1 – 1.8)	1.3 (1.1 – 1.6)	1.7 (1.4 – 2.0)	1.8 (1.4 – 2.2)	0.4	26.2	.046
Past-Year Drug Use							
Cannabis	3.2 (2.7 – 3.8)	2.4 (2.0 – 2.8)	2.9 (2.5 – 3.5)	3.1 (2.6 – 3.8)	−0.1	−2.5	.036 [a]
LSD	5.1 (3.4 – 7.7)	6.6 (4.5 – 9.6)	10.2 (7.4 – 13.9)	10.3 (7.3 – 14.3)	5.2	100.4	.002
Ecstasy	6.1 (4.1 – 8.8)	5.6 (3.3 – 9.4)	8.3 (6.0 – 11.3)	10.8 (7.9 – 14.7)	4.7	78.2	.018
Cocaine	8.4 (6.8 – 10.4)	8.4 (6.4 – 10.9)	9.3 (7.3 – 11.8)	11.8 (9.2 – 14.9)	3.4	40.1	.013
Heroin	22.5 (16.4 – 30.0)	30.0 (21.7 – 39.9)	35.5 (26.6 – 45.5)	37.4 (26.2 – 50.2)	14.9	66.2	.032
Prescription opioids	5.4 (4.4 – 6.6)	5.2 (4.2 – 6.4)	6.0 (4.9 – 7.2)	8.0 (6.3 – 10.1)	2.7	49.2	.019
Prescription tranquilizers	7.8 (6.3 – 9.6)	7.0 (5.5 – 8.8)	7.9 (6.3 – 9.9)	10.3 (8.2 – 12.8)	2.5	32.1	.094
Prescription stimulants	6.8 (5.1 – 8.9)	5.9 (4.3 – 8.1)	8.2 (6.4 – 10.4)	6.1 (4.7 – 8.0)	−0.6	−9.2	.848

Note. Misuse is defined by NSDUH as using a drug in any way not directed by a doctor, including use without a prescription, more often, in greater amounts, or longer than directed to use them, or use in any other way not directed to use. *P*-values for trends are for linear trends. We also tested quadratic and cubic trends. If a quadratic or cubic trend was present, then the *p*-value is for the that trend. [a] cubic trend, [b] quadratic trend.

general population between 2015 and 2018, use is increasing among people reporting other past-year drug use. Those reporting use of ecstasy, LSD, cocaine, heroin, or prescription opioid misuse are increasingly reporting methamphetamine use. However, it appears that increases in methamphetamine use are driven primarily by people who report past-year heroin use. Methamphetamine use increased 66 % among those reporting past-year heroin use and we believe these findings partially corroborate the recent spike in deaths related to co-use of psychostimulants and opioids (Kariisa et al., 2019). Further, there has been an increase in methamphetamine use among people entering heroin treatment (Jones et al., 2019), a combination of which can have serious risks.

Although methamphetamine use increased among people reporting past-year use of various drugs, our sensitivity analysis focusing only on those not reporting past-year heroin use suggests that only people who have used LSD in the past year consistently increased methamphetamine use (with methamphetamine use doubling among past-year LSD users). Although, it should be noted that there were in fact smaller, quadratic increases in methamphetamine use among those reporting misuse of opioids and/or tranquilizers. LSD is a common "party drug" or "club drug" (Parsons et al., 2007) which is increasingly prevalent among adolescents and young adults in the US (Johnston et al., 2020; Schulenberg et al., 2019) and use is also increasingly prevalent among electronic dance music (EDM) party attendees (Palamar and Keyes, 2020). It appears that methamphetamine is being added to drug repertoires of people who use psychedelics such as LSD, recreationally. We believe that this may signal that methamphetamine use may continue to increase in the general population, along with the popularity of LSD.

With regard to demographic characteristics, we detected increases in prevalence among those with a high school diploma or less and among those who report having received government program assistance (e.g., food stamps) in the past year. Thus, we believe use is possibly increasing among individuals of lower socioeconomic status. In addition, although sexual minority individuals (particularly gay men and men who have sex with men [MSM]) are known to be at higher risk for methamphetamine use than their heterosexual counterparts (Duncan et al., 2019; Griffin et al., 2019), we determined that those identifying as heterosexual are increasingly reporting methamphetamine use. However, the actual increase in prevalence was small. MSM in particular are at risk for using methamphetamine for sexual purposes (e.g., "chemsex") (Daskalopoulou et al., 2014; Palamar et al., 2014; Sewell et al., 2019). Although those identifying as heterosexual are still at low risk for use compared to sexual minority individuals, results do corroborate recent findings suggesting that among those diagnosed with syphilis in the US, self-reported past-year use of methamphetamine among heterosexuals has been increasing (Kidd et al., 2019).

Historically, methamphetamine use has been particularly prevalent among people who attend EDM parties at nightclubs—especially gay males (Griffin et al., 2019; Kelly et al., 2013). Although

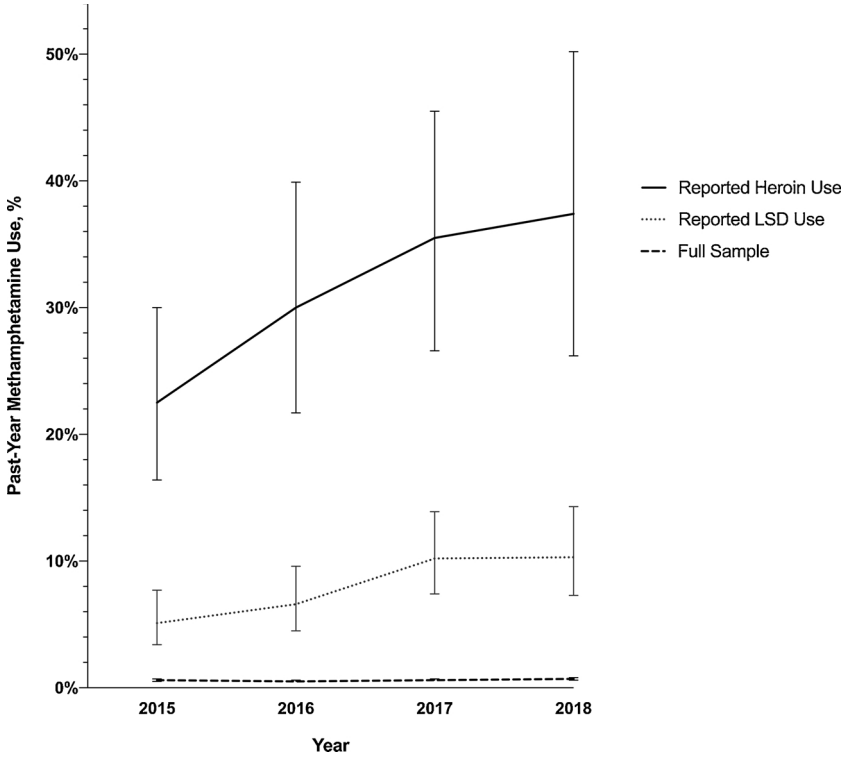

Fig. 1. Trends in prevalence of past-year methamphetamine use in the general population in the United States and among those reporting past-year use of heroin or LSD, 2015-2018.

methamphetamine use in these scenes appears to have diminished since the early 2000s, similar to the national decrease in use (Johnston et al., 2020), a recent study estimated that past-year methamphetamine use may again be increasing among EDM party attendees as use among such party attendees in NYC increased from 1.5 % to 5.2 % between 2016 and 2019, a 242 % increase (Palamar and Keyes, 2020). More research is needed to determine the contexts of this methamphetamine use, and whether it is more "recreational" in nature.

4.1. Limitations

People who use methamphetamine and/or heroin may be underrepresented in this national survey and thus, our prevalence estimates may be underestimates. Methamphetamine use is also often underreported, especially in national samples. Although some individuals who use may intentionally underreport use, others are unwittingly exposed to methamphetamine as an adulterant in drugs such as ecstasy and never become aware they have used the drug (Palamar et al., 2017). Results are also limited because we could not examine region or state of participant residence, and we could not examine trends including years prior to 2015 due to the recent NSDUH redesign. However, it should be noted that annual prevalence in 2013 and 2014 (of ~0.5 %) (Substance Abuse and Mental Health Services Administration, 2015) was comparable to our estimated 2015 prevalence (of 0.6 %). Finally, response rates have been slowly declining in recent years and this may impact generalizability of findings.

4.2. Conclusion

The sharp increase in methamphetamine use among people who report use of drugs such as heroin or LSD is concerning and has important public health implications. Methamphetamine is a highly potent stimulant which can lead to addiction and risky sexual behavior (Centers for Disease Control and Prevention, 2006; Courtney and Ray, 2014), and use is often highly stigmatized which can prevent individuals who use from receiving information or treatment (Semple et al., 2012; Vosburgh et al., 2012). Alarmingly, methamphetamine can now also be adulterated with fentanyl (Tupper et al., 2018). Indeed, we have confirmed that increases in methamphetamine use are associated with heroin/opioid use, and these individuals, as well as those who use party drugs such as LSD, appear to be driving increases in use. Results should be used to inform prevention approaches for people at risk for using methamphetamine.

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Contributors

All authors are responsible for this reported research. J. Palamar and B. Han conceptualized and designed the study, and J. Palamar conducted the statistical analyses. K. Keyes advised regarding statistical analyses. All authors drafted the manuscript, and all authors interpreted results, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted.

Declaration of Competing Interest

No conflict declared.

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Appendix A. Supplementary data

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