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Prevalence of non-medical amphetamine use among men with diagnosed HIV infection who have sex with men in the United States, 2015–2016

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Abstract

Amphetamine use is higher among men who have sex with men (MSM) compared with other men, and is associated with sexual behavior linked to HIV transmission. No national estimates of amphetamine use among MSM with HIV have been published. We used data from the Medical Monitoring Project, a nationally representative sample of persons with diagnosed HIV, to describe patterns in amphetamine use in the past 12 months among MSM during 2015–2016 (N = 3, 796). Prevalence of amphetamine use in this population was 9.6% (95% CI: 7.6–11.6%) in the past 12 months. MSM who used amphetamines were more likely to have condomless sex with partners without HIV or of unknown serostatus (PR = 1.87; 95% CI: 1.62–2.16) and less likely to be durably virally suppressed (PR = 0.81; 0.71, 0.91). Interventions to address amphetamine use and associated transmission risk behaviors among MSM living with HIV may decrease transmission.

Keywords

HIV; amphetamines; methamphetamine; substance use; men who have sex with men

INTRODUCTION

Men who have sex with men (MSM) are at elevated risk for HIV, as approximately two-thirds of new infections each year in the United States are attributable to male-to-male sexual contact (1). In the 2015 National Survey on Drug Use and Health, 3.4% of MSM reported using amphetamines in the past year, almost four times the prevalence among other men (0.9%) (2). Amphetamine use is a strong risk factor for HIV acquisition (3–5). Prior studies of MSM with HIV have shown prevalence estimates ranging from 10% to 28%, with wide variation based on study geography and year (6–11).

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Amphetamines, a highly addictive class of psychostimulants that includes methamphetamine, can be smoked, snorted, ingested, injected, or taken rectally (12). Amphetamines can cause feelings of euphoria and social connectedness, which in turn enhances sexual pleasure and lowers inhibition (13–15). As a result, amphetamine use by MSM often occurs in social or party settings and precedes or is concurrent with sexual activity (13–16). MSM who use amphetamines report more sexual partners (3,4), are more likely to engage in condomless sex (3,4,17) and are more likely to have a history of bacterial sexually transmitted infections (3,5).

In addition to sexual behavior, amphetamine use may increase the risk for HIV transmission through the sharing of injection equipment (5,12). *Nerlander et al* recently suggested that sexual behavior, rather than injection related risk behavior, is the primary cause of increased HIV risk among MSM who inject amphetamines compared with MSM who inject other drugs (5). However, it is likely that both sharing injection equipment and sexual risk behaviors contribute to HIV transmission in this population, as MSM who use amphetamines may report both behaviors (3,5,12).

Among heterosexual men and women, amphetamine use is also associated with HIV risk behaviors, including sharing injection equipment, having multiple partners and condomless sex (18). Despite these indications of HIV risk, the prevalence of HIV remains low in this population (19), perhaps due to a lower overall risk for HIV among heterosexuals in the US. Given that both the prevalence of amphetamine use and the risk for HIV are greater among MSM than other groups (1,2), we have restricted our sample in the present study to MSM.

Amphetamine use is associated with an array of negative HIV clinical outcomes, including unsuppressed viral load and accelerated progression of HIV disease (20–23). Viral suppression is important for both the health of persons living with HIV as well as preventing transmission (24). These outcomes are likely attributed to poor adherence to antiretroviral medications (ART) (23,25,26), although there is some evidence that frequent stimulant use could biologically promote HIV disease progression (27). There is less consensus about how amphetamine use affects CD4 count, with some studies showing a negative association (22,28) and others finding no association (21).

Although amphetamine use is strongly associated with HIV transmission, a recent nationally representative estimate of the prevalence of amphetamine use among MSM with HIV has not been published. We used nationally representative data on adults with diagnosed HIV to describe patterns in amphetamine use overall and by sociodemographic factors, sexual and other drug use behaviors, and HIV care outcomes among MSM with diagnosed HIV.

METHODS:

Data Source

The Medical Monitoring Project (MMP) is an annual cross-sectional survey that is designed to produce nationally representative estimates of behavioral and clinical characteristics, including care and other services received, of adults with diagnosed HIV in the United States. Briefly, the MMP used a two-stage sampling method, in which during the first

stage, 23 areas were sampled from all states in the U.S., the District of Columbia, and Puerto Rico, using stratified random sampling with probabilities proportional to size. All sampled jurisdictions participated in the MMP, and included California (including the separately funded jurisdictions of Los Angeles County and San Francisco), Delaware, Florida, Georgia, Illinois (including Chicago), Indiana, Michigan, Mississippi, New Jersey, New York (including New York City), North Carolina, Oregon, Pennsylvania (including Philadelphia), Puerto Rico, Texas (including Houston), Virginia, and Washington. During the second stage, for each participating jurisdiction, simple random samples of persons with diagnosed HIV aged 18 years and older were drawn from the National HIV Surveillance System (NHSS), a census of persons with diagnosed HIV in the US. A detailed protocol for the MMP has been published, with more information about the sampling strategy (29).

We analyzed combined data from the 2015 and 2016 MMP cycles. Data were collected via phone or face-to-face interviews and medical record abstractions during June 2015-May 2017. Response rates were 100% at the state/territory level and ranged from 40%-44% at the person level. MMP data collection is a part of routine public health surveillance, and thus, determined to be nonresearch (30). Participating jurisdictions obtained local institutional review board approval to collect data, when required. Informed consent was obtained from all participants. All enrolled participants consented to both interviewing and medical records abstraction. Medical records were abstracted for the facility where participants reported receiving the most HIV care.

A total of 7,692 persons were interviewed in the 2015 and 2016 MMP cycles, including 5,570 men. We restricted analyses to MSM (N = 3,796), defined as men who reported anal sex with a man in the past 12 months and men who self-identify as gay or bisexual (regardless of sexual activity). We excluded 52 men (1.2%) missing information on sexual behavior and identity.

Measures

All study variables were assessed for the 12 months preceding the date of interview, except where otherwise specified. Included measures were selected *a priori* based on a review of the literature.

Sociodemographics—Poverty was determined based on yearly household income and number of dependents according to US Department of Health and Human Services guidelines (31). We categorized age groups based on the participants' age on the date of the interview. All other sociodemographic measures are reported based on participant self-report.

Amphetamines—The frequency of non-medical injection and non-injection drug use was ascertained in participant interviews for an array of different types of drugs based on a self-reported scale with the following categories: daily, weekly, monthly, less than monthly, and never. We combined injection and non-injection drug use frequency scales and dichotomized responses to indicate any use (daily, weekly, monthly, less than monthly) or nonuse (never) for each drug. We defined amphetamine use to include the use of methamphetamine, including "crystal meth, tina, crank, or ice," or other amphetamines, including "speed,

bennies, or uppers." We also reported the prevalence of disaggregated methamphetamine usage and other amphetamine usage.

We reported the prevalence of injecting amphetamines among all who used amphetamines. Among those who injected amphetamines, frequency scales for injection and non-injection use of amphetamines were used to determine the primary mode of use (injection, non-injection, equal frequency for non-injection and injection). The frequency of amphetamine use was compared with the use of other classes of recreational drugs (other stimulants, club drugs, opioids, tranquilizers, and marijuana) to determine the primary drug class used (amphetamines, other drug(s), or amphetamines and other drugs equally).

Other drugs and binge drinking—As with amphetamines, we dichotomized drug use to indicate any use or nonuse, based on the frequency scales for non-medical injection and non-injection drug use. We combined other drugs to create broad drug class categories, including: other stimulants (cocaine, crack, and cocaine-heroin mixtures or "speedballs"); club drugs (derived from a single interview question inclusive of ecstasy, ketamine, and gamma-hydroxybutyrate or "GHB"); opioids (painkillers, heroin, and cocaine-heroin mixtures or "speedballs"); tranquilizers (derived from a single interview question inclusive of prescription benzodiazepines); marijuana; nitrate inhalants or "poppers"; and erectile dysfunction medications. Binge drinking was defined as consuming 5 or more alcoholic beverages in one sitting within the past 30 days based on a single dichotomous question.

Clinical outcomes—Current depression (major or other) was identified based on responses to the Patient Health Questionnaire (PHQ-8), criteria from the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (DSM-IV), and an algorithm described by Kroenke et al (32). Briefly, individuals were categorized as having current depression if at least 2 of the depression symptoms, including either depressed mood or anhedonia, were reported to be present on more than half the days in the past 2 weeks (32).

HIV care engagement was defined as having received at least two elements of outpatient HIV care at least 90 days apart. Receipt of outpatient HIV care was measured through medical record abstraction and defined as any documentation of the following: encounter with an HIV care provider (could also be self-reported), viral load test result, CD4 test result, HIV resistance test or tropism assay, ART prescription, PCP prophylaxis, or MAC prophylaxis. Participants reporting current ART use were asked about adherence on 3 domains (number of days of missed doses per month, frequency of taking medication, and a self-rated adherence scale). Self-reported adherence can be unreliable and we were unable to verify responses with a gold standard method (e.g., electronic drug monitoring device). Therefore, we scaled and combined the 3 adherence questions to create a single adherence score which can indicate imperfect adherence without relying on a single self-reported measure (33). The score ranges from 0 to 100 (higher score indicates better adherence) and has good internal consistency and external construct validity when compared to a gold standard method (33). We dichotomized the score to indicate perfect adherence (100) or less than perfect (0–99). We designated a high threshold for adherence in order to increase the sensitivity to detect problems with adherence, which in clinical practice may indicate the need for follow-up by a provider. CD4 count and viral load data were abstracted from

medical records. We dichotomized geometric mean of CD4 count as less than 350 cells/mm^3 or greater than or equal to 350 cells/mm^3. We defined durable viral suppression as having all viral load results over the past 12 months <200 copies/mL based on the cutoff used in other reports from the CDC (34,35).

Sexual behavior—We defined sexually active as having any vaginal or anal sex. We created a dichotomous variable (1–9 partners or ≥ 10 partners) from the total number of sexual partners. We created a dichotomous measure for high-risk sex associated with HIV transmission, which was defined as having any condomless anal or vaginal sex with a partner without HIV or of unknown serostatus and not known to be using HIV pre-exposure prophylaxis (PrEP), while not being durably virally suppressed.

Analytical Methods

Among MSM with diagnosed HIV, we estimated amphetamine use overall and by demographic characteristics. We described overall patterns of use, including frequency, injection use, and frequency with respect to other drug use. We examined HIV care outcomes, including engagement in care, ART adherence, CD4 count, and viral suppression, and selected factors, including housing stability, depression, binge drinking, and use of other drugs, by amphetamine use. Among sexually active MSM, we described selected sexual behaviors, including having 10 or more partners, condomless sex, condomless sex with partners without HIV or of unknown serostatus, sex in exchange for money, drugs, shelter or other goods, non-medical use of erectile dysfunction medications, use of poppers, and the combined measure for high-risk sex, by amphetamine use.

We estimated weighted percentages with corresponding 95% confidence intervals (CIs). All prevalence estimates were weighted on the basis of known probabilities of selection at state or territory and person levels (36). In addition, data were weighted to adjust for person nonresponse and post-stratified to NHSS population totals (37). To quantify associations with amphetamine use, we determined bivariate prevalence ratios (PRs) and corresponding 95% CIs using logistic regression with predicted marginal means (38). All PRs were evaluated at alpha = 0.05.

RESULTS

Sociodemographics

The majority of MSM with diagnosed HIV were over 40–49 years of age (25.5%; 95% CI: 23.4, 27.7) or 50 years and older (43.8%; 95% CI: 41.3, 46.3) (Table I). This population was 43.0% (95% CI: 38.2, 47.7) non-Hispanic white, 27.1% (95% CI: 21.5, 32.8) non-Hispanic black, 23.3% (95% CI: 19.0, 27.7) Hispanic or Latino, and 6.6% (95% CI: 5.2, 7.9) other race/ethnicity groups including American Indian/Alaska Native, Asian, Native Hawaiian/ Other Pacific Islander, or multiple races. A majority of the population (87.8%; 95% CI: 86.6, 89.1) was born in the U.S. or Puerto Rico. Most MSM with diagnosed HIV had more than a high school education (73%; 95% CI: 71.1, 74.8), were above the poverty level (71.0%; 95% CI: 68.7, 73.4), and had not experienced homelessness within the past 12 months (93.8%; 95% CI: 92.9, 94.7).

Patterns of amphetamine use

The weighted prevalence of amphetamine use in the past 12 months among MSM with diagnosed HIV infection was 9.6% (95% confidence interval [CI]: 7.6, 11.6) (Table I). The prevalence of amphetamine use varied significantly based on sociodemographic indicators (Table II). Prevalence was lowest among MSM 50 years of age and older and, compared to those, higher among MSM 30–39 years of age (PR = 1.92; 95% CI: 1.38, 2.68) and 40–49 years of age (PR = 1.45; 95% CI: 1.11, 1.90); although not statistically different, the prevalence of amphetamine use may also be higher among those aged 18–29 (PR = 1.48; 95% CI: 0.93, 2.36). Compared with non-Hispanic black MSM, prevalence of amphetamine use was higher among non-Hispanic white MSM (PR = 3.01; 95% CI: 2.07, 4.38), Hispanic or Latino MSM (PR = 2.52; 95% CI: 1.53, 4.15), and MSM in other race/ethnicity groups (PR = 3.11; 1.86, 5.19). The prevalence of amphetamine use was higher among MSM with a high school diploma or equivalent (PR = 1.76; 95% CI: 1.02, 3.05) and among those with a degree beyond high school (PR = 1.74; 95% CI: 1.05, 2.88) compared with those who did not finish high school. Although amphetamine use did not vary by poverty level, MSM experiencing homelessness were more likely to use amphetamines (PR = 3.17; 95% CI: 2.47, 4.07).

Methamphetamine was used by 96.7% (95% CI: 94.7, 98.6) of all MSM who use amphetamines; 22.9% (95% CI: 16.1, 29.7) used other amphetamines (Table III). Among those reporting amphetamine use, 45.9% (95% CI: 40.0, 51.9) used them less than monthly, 24.8% (95% CI: 18.2, 31.4) used them on a monthly basis, 16.4% (95% CI: 12.7, 20.1) used them weekly and 12.8% (95% CI: 9.4, 16.3) used them daily. Amphetamines were the primary drug used by 39.2% (95% CI: 33.5, 44.9) of MSM who use amphetamines, while 32.8% (95% CI: 26.2, 39.4) used another drug with greater frequency, and 28.1% (95% CI: 22.4, 33.7) used amphetamines and other drugs with equal frequency. Among the 38.6% (95% CI: 32.1, 45.1) of all MSM who used amphetamines and reported injection usage, 50.2% (95% CI: 40.9, 59.5) injected amphetamines less than monthly, and 19.6% (95% CI: 12.0, 27.2), 10.7% (95% CI: 5.9, 15.6), and 19.5% (95% CI: 12.2, 26.8) injected monthly, weekly, or daily, respectively. Among MSM who reported injection amphetamine usage, 18.5% (95% CI: 10.8, 26.2) reported more frequent use by injection, while 28.3% (95% CI: 16.2, 40.3) used non-injection methods most frequently; the remaining 53.2% (95% CI: 40.7, 65.7) used injection and non-injection methods with equal frequency. Among sexually active MSM who used amphetamines, 81.2% (95% CI: 75.2, 87.3) used amphetamines before or during sex.

Sexual behavior

There were substantial differences in sexual behavior based on amphetamine usage (Table IV). Among all MSM, 91.0% (95% CI: 87.6, 94.3) of persons who used amphetamines were sexually active in the past year, compared with 63.2% (95% CI: 61.2, 65.2) of those who did not use amphetamines (PR = 1.44; 95% CI: 1.38, 1.51). Among all sexually active MSM, persons who used amphetamines were 3.60 (95% CI: 2.76, 4.69) times as likely to report 10 or more sexual partners in the past year and 1.87 (95% CI: 1.62, 2.16) times as likely to report condomless sex with a partner without HIV or of unknown serostatus, compared to persons who did not use amphetamines. High-risk sex was 3.17 (95% CI: 2.27, 4.43)

times as high among sexually active MSM who used amphetamines compared with sexually active MSM who did not use amphetamines. Among sexually active MSM, non-medical use of erectile dysfunction medications (PR = 5.61; 95% CI: 4.37, 7.20) and poppers (PR = 5.38; 4.24, 6.83) were more likely to be reported among persons who used amphetamines compared to those who did not use amphetamines. More than 14% (95% CI: 9.1, 19.6) of sexually active MSM who used amphetamines reported exchanging sex for money, drugs, shelter or other goods, which was nearly 6 (95% CI: 3.62, 9.81) times as high compared with sexually active MSM who did not use amphetamines.

Other substance use and binge drinking

Usage of all other drug classes was higher among MSM who used amphetamines than those who did not, especially club drugs (PR = 17.15; 95% CI: 12.60, 23.34) and tranquilizers (PR = 12.79; 95% CI: 8.48, 19.28). Binge drinking was reported by 24.1% (95% CI: 18.5, 29.7) of MSM who used amphetamines and, although not statistically significant, this was 1.25 (95% CI: 0.97, 1.61) times as high compared with MSM who did not use amphetamines.

Clinical outcomes

MSM who used amphetamines were slightly less likely to be engaged in care (PR = 0.90; 95% CI: 0.82, 0.99) or currently taking ART (PR = 0.93; 95% CI: 0.87, 0.99) (Table IV). Among MSM taking ART, persons who used amphetamines were less likely to have a perfect adherence score (PR = 0.47; 95% CI: 0.38, 0.59). Consequently, MSM who used amphetamines were also less likely to be durably virally suppressed (PR = 0.81; 95% CI: 0.71, 0.91). We did not observe a difference in CD4 count by amphetamine use. Depression was more common among MSM who used amphetamines (PR = 1.72; 95% CI: 1.41, 2.08).

DISCUSSION

This analysis provides the first national estimates of amphetamine use among MSM with diagnosed HIV. Prevalence of amphetamine use in the past 12 months in this population was 9.6%. Compared with other MSM with diagnosed HIV, those who used amphetamines were more likely to report sexual behavior associated with HIV transmission and less likely to be durably virally suppressed. Consequently, amphetamine use may facilitate HIV transmission among MSM.

Our estimate for the prevalence of amphetamine use among MSM with diagnosed HIV is similar to the results reported by *Sanchez et al* (12.9% in 2015 and 11.5% in 2016) which is based on a large, national convenience sample of MSM (6). However, our findings are substantially lower than most other estimates reported in the literature (8–11), which are based on samples from large coastal cities. Amphetamine use among MSM in the U.S. is thought to vary by geography, with research and corresponding publications focused on the areas with the highest use. This publication bias makes it difficult to determine the overall burden of the epidemic in the U.S., and to characterize the epidemic with respect to other factors which may vary by geography, including sociodemographic factors, patterns of amphetamine use, and HIV care outcomes. Our study adds to the literature by supporting the

findings of *Sanchez et al* (6) with nationally representative data and providing further detail on patterns of use.

We found substantial differences in the prevalence of amphetamine use based on sociodemographic factors. Notably, we found that 26.9% of those who experienced homelessness had used amphetamines in the past year. Given that these data are cross-sectional, we cannot establish temporality. However, it is plausible that amphetamine use increases the risk for homelessness, which is a major barrier to engagement in HIV care and viral suppression (39). MSM who use amphetamines are therefore an important target for programs to reduce homelessness.

Methamphetamine was the predominant drug reported by MSM who use amphetamines. This is notable because methamphetamine is more addictive than other forms of amphetamines (40). For most of these MSM, amphetamine usage was monthly or less than monthly, but a large minority (29%) reported daily or weekly use. Interventions for the treatment of amphetamine dependence in this population could help address this problem. Interventions that are culturally competent and tailored to address the unique social factors which lead some MSM to use amphetamines may be most effective (41). A number of intervention strategies, including pharmacological treatments, behavioral interventions and contingency management, have been tested (42,43). However, no pharmacological agent has been shown to be effective and few of the behavioral interventions have focused on MSM living with HIV (42,43).

We found that MSM with diagnosed HIV who used amphetamines were less likely to be engaged in care or currently taking ART. In addition, among those who were currently taking ART, amphetamine use was associated with lower adherence. As a likely consequence of lower use of and adherence to ART, MSM who used amphetamines were also more likely to have a detectable viral load. Our choice of threshold for viral suppression (<200 copies/mL) is lower than the level found in some studies to be associated with protection against heterosexual transmission of HIV (up to 1700 copies/mL) (44–46). However, few studies of viral load and sexual transmission of HIV have included MSM. The strongest evidence among MSM comes from the PARTNER2 study, which used 200 copies/mL as the threshold to show that no transmissions occurred between sero-different MSM if the partner living with HIV was virally suppressed (47). If the true threshold for transmission potential between MSM is indeed higher than 200 copies/mL, then our study may overestimate the 12 month prevalence of individuals in this population with a viral load high enough for sexual transmission of HIV. Conversely, by using 200 cells/mL as the threshold for viral suppression, our definition is more sensitive to identify potential HIV care issues. The decreased prevalence of durable viral suppression among MSM who used amphetamines is an indication that this population may need additional care support, including ART adherence. However, we did not find a lower CD4 count among MSM who used amphetamines. *Ellis et al* found that amphetamine usage was only associated with decreased CD4 among MSM with recent amphetamine use (confirmed with urine toxicology screening at the time of immunological testing) (22), suggesting that the impact on CD4 may be acute. We were unable to verify and match the timing of amphetamine usage with

immunological testing, but this provides a potential explanation for our results and mixed findings in the literature (21,22,28).

Amphetamine usage was also highly associated with sexual activity. Notably, more than 80% of sexually active MSM who used amphetamines reported usage before or during sex, which can disinhibit risk taking behavior. Among sexually active MSM, amphetamine usage was associated with reporting more sexual partners, and a greater likelihood of not being durably virally suppressed and having condomless sex with HIV-negative and HIV-unknown partners not known to be taking PrEP. The use of amphetamines during sex, which may be shared with sexual partners (14,15), and the associated transmission risk behaviors could explain the elevated rate of seroconversion among MSM who use amphetamines (3–5). Overall, 25.9% of sexually active MSM who used amphetamines engaged in high-risk sex, compared with just 8.2% of those without prevalent use. Although we were unable to assess polysubstance use (concurrent use of 3 or more substances) during sex, MSM who use amphetamines also reported a higher prevalence of other drug use, including other stimulants, club drugs and poppers, which may contribute to sexual risk behaviors (50). We estimate that 1 in 10 MSM with diagnosed HIV use amphetamines and therefore this population may be an important subgroup disproportionately contributing to HIV transmission. Interventions for ART adherence and reduction of high-risk sexual behaviors may be needed for persons unable or unwilling to discontinue amphetamine use. While interventions to reduce amphetamine use have had limited success, strategies to reduce sexual risk behaviors, including condomless sex, have had more success (42).

Future research will need to further describe patterns of amphetamine usage and associated HIV care outcomes and sexual risk behaviors. For example, we did not determine whether there is a dose response between frequency of amphetamine use and viral suppression or if all MSM who use amphetamines are at increased risk for poor health and sexual risk outcomes. Additional research is also needed to understand patterns of amphetamine use and concurrent use of other drugs in this population. Our results may not be generalizable to other populations living with HIV (e.g., heterosexuals). Further research is needed to describe patterns of amphetamine use in other populations, which may differ in terms of prevalence, frequency, route of administration, and the frequency of other behaviors such as condomless sex.

This analysis has a number of limitations. Due to small cell sizes in stratified analysis, which resulted in unstable weighted estimates, we were unable to stratify our findings based on frequency of amphetamine use and other potential confounders or effect modifiers. The observed associations are cross-sectional and should not be interpreted as causal. We were unable to verify self-reported behavioral data, including event-level information about sexual partners. Therefore, some measures, such as our dichotomous variable for high-risk sex, may be biased due to misclassification. We only abstracted medical records from the facility where patients reported receiving the most HIV care, so we may have incomplete data on patients receiving care at more than one facility. We were also unable to assess regional variability in our data, because the MMP was designed to be representative on the national and local jurisdictional level. We were unable to report stable estimates on the jurisdictional level. If we were to stratify our data based on region, we would break the study

design and the data would no longer be representative or appropriate to use with the sample weights. While these data present an overall estimate of prevalence in this population, prior research has identified regions, including some large and coastal metropolitan areas, with a prevalence of amphetamine usage much higher than our current national estimate (8–11). Similarly, amphetamine use may be relatively less common among MSM in other regions, which has important implications for distribution of resources and targeting interventions.

CONCLUSIONS

Non-medical amphetamine use was relatively common among MSM with diagnosed HIV in the US. Amphetamines were commonly used by this population before and during sex and were associated with sexual transmission risk behaviors including condomless sex and having more sexual partners. At the same time, MSM who used amphetamines were less likely to be virally suppressed. Consequently, amphetamine usage may facilitate transmission of HIV to sexual partners of MSM. Interventions to address the use of amphetamines, and to improve ART adherence and decrease sexual risk behavior among MSM who use amphetamines, could help prevent the transmission of HIV and improve health. For those unwilling or unable to decrease amphetamine use, interventions to address HIV care needs could be an important bridge to maintain health.

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Table I:

Characteristics of men with diagnosed HIV infection who have sex with men in the United States, Medical Monitoring Project, 2015–2016

	Sample N	Weighted Column %	95% CI
Total	3,796	100.0	---
Recent amphetamines use [a]			
Yes	397	9.6	7.6, 11.6
No	3,378	90.4	88.4, 92.4
Age (years)			
18–29	398	11.6	10.0, 13.2
30–39	721	19.1	17.5, 20.7
40–49	943	25.5	23.4, 27.7
≥ 50	1,734	43.8	41.3, 46.3
Race & ethnicity			
White, non-Hispanic	1,708	43.0	38.2, 47.7
Black, non-Hispanic	1,045	27.1	21.5, 32.8
Hispanic or Latino	790	23.3	19.0, 27.7
Other[b]	253	6.6	5.2, 7.9
Nativity			
U.S. or Puerto Rico	3,302	87.8	86.6, 89.1
Foreign born	476	12.2	10.9, 13.4
Education			
< High School	269	7.1	6.0, 8.2
High school diploma or equivalent	742	20.0	18.4, 21.5
> High school	2,784	73.0	71.1, 74.8
Poverty [c]			
Above poverty level	2,580	71.0	68.7, 73.4
At or below poverty level	1,032	29.0	26.6, 31.1
Homelessness			
No, not homeless	3,530	93.8	92.9, 94.7

	Sample N	Weighted Column %	95% CI
Yes, was homeless	265	6.2	5.3, 7.1

Notes: All variables measured by self-report within the past 12 months. Abbreviations: HIV = human immunodeficiency virus; CI = confidence interval

[a] Includes methamphetamine and/or other amphetamines use in the past 12 months

[b] Includes American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, or multiple races

[c] Based on yearly household income and number of dependents according to US Department of Health and Human Services guidelines

Table II:

Prevalence of amphetamine use among men with diagnosed HIV infection who have sex with men in the United States, Medical Monitoring Project, 2015–2016

	Amphetamine use [a]		Bivariate analysis		
	Weighted Row %	95% CI	PR	95% CI	p-value
Total	9.6	7.6, 11.6			
Age (years)					
18–29	10.5	6.0, 15.1	1.48	0.93, 2.36	0.147
30–39	13.7	9.9, 17.5	1.92	1.38, 2.68	0.001
40–49	10.4	7.5, 13.2	1.45	1.11, 1.90	0.010
≥ 50	7.1	5.1, 9.1	Reference		
Race & ethnicity					
White, non-Hispanic	12.3	9.6, 14.9	3.01	2.07, 4.38	<0.001
Black, non-Hispanic	4.1	2.6, 5.5	Reference		
Hispanic or Latino	10.3	6.7, 13.8	2.52	1.53, 4.15	0.002
Other[b]	12.7	7.2, 18.1	3.11	1.86, 5.19	0.002
Nativity					
U.S. or Puerto Rico	9.9	7.7, 12.1	1.30	0.92, 1.86	0.124
Foreign born	7.6	5.1, 10.1	Reference		
Education					
< High School	5.7	2.6, 8.7	Reference		
High school diploma or equivalent	10.0	5.7, 14.4	1.76	1.02, 3.05	0.046
> High school	9.9	8.0, 11.7	1.74	1.05, 2.88	0.006
Poverty [c]					
Above poverty level	9.0	6.7, 11.3	Reference		
At or below poverty level	10.7	7.6, 13.8	1.19	0.86, 1.64	0.305
Homelessness					
No, not homeless	8.5	6.5, 10.4	Reference		
Yes, was homeless	26.9	20.1, 33.7	3.17	2.47, 4.07	<0.001

Notes: All variables measured by self-report within the past 12 months. Abbreviations: HIV = human immunodeficiency virus; PR = prevalence ratio; CI = confidence interval

[a]Includes methamphetamine and/or other amphetamines use in the past 12 months

[b]Includes American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, or multiple races

[c]Based on yearly household income and number of dependents according to US Department of Health and Human Services guidelines

Table III:

Patterns of amphetamine use[a] among men with diagnosed HIV infection who have sex with men and report any amphetamine use in the past 12 months, Medical Monitoring Project, 2015–2016

	Weighted %	95% CI
Used methamphetamine		
Yes	96.7	94.7, 98.6
No	3.3	1.4, 5.3
Used other amphetamines		
Yes	22.9	16.1, 29.7
No	77.1	70.3, 83.9
Frequency of use		
Daily	12.8	9.4, 16.3
Weekly	16.4	12.7, 20.1
Monthly	24.8	18.2, 31.4
Less than monthly	45.9	40.0, 51.9
Primary drug used		
Amphetamines	39.2	33.5, 44.9
Other drug(s)[b]	32.8	26.2, 39.4
Amphetamines and other drugs equally	28.1	22.4, 33.7
Injected amphetamines		
Yes	38.6	32.1, 45.1
No	61.4	54.9, 67.9
Frequency of injection among injection users		
Daily	19.5	12.2, 26.8
Weekly	10.7	5.9, 15.6
Monthly	19.6	12.0, 27.2
Less than monthly	50.2	40.9, 59.5
Primary mode of use among injection users		
Injection	18.5	10.8, 26.2
Equal frequency for non-injection and injection	53.2	40.7, 65.7
Non-injection	28.3	16.2, 40.3
Used before or during sex [c]		
Yes	81.2	75.2, 87.3
No	18.8	12.7, 24.8

Note: All variables measured by self-report within the past 12 months. Abbreviations: HIV = human immunodeficiency virus; CI = confidence interval

[a] Includes methamphetamine and/or other amphetamines

[b] Includes other stimulants, club drugs, opioids, tranquilizers, and marijuana

[c] Among sexually active persons

Table IV:

Sexual behavior and substance use correlates of amphetamine use among men with diagnosed HIV infection who have sex with men, Medical Monitoring Project, 2015–2016

	Amphetamine use[a]		No amphetamine use		Bivariate analysis		
	Weighted Column %	95% CI	Weighted Column %	95% CI	PR	95% CI	p-value
Sexually active							
Yes	91.0	87.6, 94.3	63.2	61.2, 65.2	1.44	1.38, 1.51	<0.0001
No	9.0	5.7, 12.4	36.8	34.8, 38.8	---		
≥ 10 sexual partners [b]							
Yes	33.6	27.9, 39.4	9.4	7.7, 11.0	3.60	2.76, 4.69	<0.0001
No	66.4	60.6, 72.1	90.6	89.0, 92.3	---		
Condomless vaginal/anal sex with any partners [b]							
Yes	87.9	82.5, 93.3	59.5	55.7, 63.3	1.48	1.37, 1.59	<0.0001
No	12.1	6.7, 17.5	40.5	36.7, 44.3	---		
Condomless vaginal/anal sex with any negative or unknown status partners [b]							
Yes	60.7	54.8, 66.7	32.5	29.0, 35.9	1.87	1.62, 2.16	<0.0001
No	39.3	33.3, 45.2	67.5	64.1, 71.0	---		
High risk sex[b,c]							
Yes	25.9	19.3, 32.5	8.2	6.5, 9.8	3.17	2.27, 4.43	<0.0001
No	74.1	67.5, 80.7	91.8	90.2, 93.5	---		
Non-medical use of erectile dysfunction medications [b]							
Yes	44.3	37.7, 51.0	7.9	6.4, 9.4	5.61	4.37, 7.20	<0.0001
No	55.7	49.0, 62.3	92.1	90.6, 93.6	---		
Use of poppers [b]							
Yes	50.7	43.7, 57.8	9.4	7.7, 11.2	5.38	4.24, 6.83	<0.0001
No	49.3	42.2, 56.3	90.6	88.8, 92.3	---		
Exchange sex for money, drugs, shelter or other goods [b]							
Yes	14.3	9.1, 19.6	2.4	1.5, 3.4	5.96	3.62, 9.81	<0.0001

	Amphetamine use[a]		No amphetamine use		Bivariate analysis		
	Weighted Column %	95% CI	Weighted Column %	95% CI	PR	95% CI	p-value
No	85.7	80.4, 90.9	97.6	96.6, 98.5	---		
Binge drinking in past 30 days							
Yes	24.1	18.5, 29.7	19.3	17.3, 21.2	1.25	0.97, 1.61	0.0939
No	75.9	70.3, 81.5	80.7	78.8, 82.7	---		
Other drug use							
Other stimulants [d]							
Yes	24.8	19.6, 30.0	5.8	4.8, 6.7	4.31	3.32, 5.59	<0.0001
No	75.2	70.0, 80.4	94.2	93.3, 95.2	---		
Club drugs [e]							
Yes	37.6	31.5, 43.8	2.2	1.6, 2.8	17.15	12.60, 23.34	<0.0001
No	62.4	56.2, 68.5	97.8	97.2, 98.4	---		
Opioids [f]							
Yes	19.5	14.0, 24.9	3.2	2.5, 4.0	6.02	4.09, 8.86	<0.0001
No	80.5	75.1, 86.0	96.8	96.0, 97.5	---		
Tranquillizers [g]							
Yes	20.5	14.3, 26.7	1.6	1.1, 2.1	12.79	8.48, 19.28	<0.0001
No	79.5	73.3, 85.7	98.4	97.9, 98.9	---		
Marijuana							
Yes	65.7	59.4, 71.9	29.3	27.2, 31.4	2.24	2.01, 2.51	<0.0001
No	34.3	28.1, 40.6	70.7	68.6, 72.8	---		

Note: All variables measured by self-report within the past 12 months except where noted. Abbreviations: HIV = human immunodeficiency virus; PR = prevalence ratio; CI = confidence interval

[a] Includes methamphetamine and/or other amphetamine use in the past 12 months

[b] Among sexually active persons

[c] Defined as having any condomless anal or vaginal sex with a partner without HIV or of unknown serostatus and not known to be using HIV pre-exposure prophylaxis, while not being durably virally suppressed

[d] Includes cocaine, crack, and cocaine-heroin mixtures or “speedballs”

[e] Includes ecstasy, ketamine, and gamma-hydroxybutyrate or “GHB”

[f] Includes painkillers, heroin, and cocaine-heroin mixtures or "speedballs"

[g] Includes prescription benzodiazepines

Table V:

Clinical outcomes among men with diagnosed HIV infection who have sex with men, stratified by amphetamine use in the past 12 months, Medical Monitoring Project, 2015–2016

	Amphetamine use[a]		No amphetamine use		Bivariate analysis		p-value
	Weighted Column %	95% CI	Weighted Column %	95% CI	PR	95% CI	
Engaged in care[b,c]							
Yes	72.7	66.3, 79.1	80.5	78.6, 82.5	0.90	0.82, 0.99	0.0135
No	27.3	20.9, 33.7	19.5	17.5, 21.4	---		
Currently taking ART [b]							
Yes	86.7	81.3, 92.0	93.6	92.3, 95.0	0.93	0.87, 0.99	0.0013
No	13.3	8.0, 18.7	6.8	5.5, 8.1	---		
Perfect adherence score [d]							
Yes	22.0	17.0, 26.9	46.7	44.4, 48.9	0.47	0.38, 0.59	<0.0001
No	78.0	73.1, 83.0	53.3	51.1, 55.6	---		
Geometric mean CD4 count ≥ 350 [b]							
Yes	81.3	75.8, 86.9	82.4	80.7, 84.0	0.99	0.92, 1.06	0.7124
No	18.7	13.1, 24.2	17.6	16.0, 19.3	---		
Durable viral suppression[b,e]							
Yes	53.9	47.3, 60.5	66.9	64.5, 69.3	0.81	0.71, 0.91	0.0001
No	46.1	39.5, 52.7	33.1	30.7, 35.5	---		
Major or other depression [f]							
Yes	33.0	27.1, 38.8	19.2	17.4, 21.0	1.72	1.41, 2.08	<0.0001
No	67.0	61.2, 72.9	80.8	79.0, 82.6	---		

Note: All variables measured by self-report within the past 12 months before interview except where noted. Abbreviations: HIV = human immunodeficiency virus; PR = prevalence ratio; CI = confidence interval; ART = antiretroviral therapy

[a] Includes methamphetamine and/or other amphetamine use in the past 12 months

[b] Measured through medical record abstraction

[c] Defined as having received at least two elements of outpatient HIV care at least 90 days apart; outpatient HIV care was defined as any of the following: encounter with an HIV care provider (could also be self-reported), viral load test result, CD4 test result, HIV resistance test or tropism assay, ART prescription, PCP prophylaxis, or MAC prophylaxis

[d] Composite score, with range from 0 to 100 (higher score indicates better adherence), based on adherence on 3 domains (number of days of missed doses per month, frequency of taking medication, and a self-rated adherence scale); a perfect score was defined as equal to 100

[e] All viral loads over the past 12 months <200 copies/mL

[f] Based on responses to the Patient Health Questionnaire (PHQ-8) and criteria from the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (DSM-IV)