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Prevalence of Substance Use Trends Among MSM Residing Outside of Major US Cities

By

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Master of Public Health

Epidemiology

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Prevalence of Substance Use Trends Among MSM Residing Outside of Major US Cities

By

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Bachelor of Science
University of Wisconsin, Madison
2018

Thesis Committee Chair: Travis Sanchez, DVM MPH

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

Prevalence of Substance Use Trends Among MSM Residing Outside of Major US Cities
By Jacob Pluznik

The American Men's Internet Survey (AMIS) is conducted annually with 10,000 men aged 15+ who have sex with men (MSM). Modeling was used with 6,388 AMIS surveys from rural MSM across 7 cycles between December 2013 to January 2020 to identify substance use prevalences and temporal trends in reported substance use (within the 12 months preceding the survey), both overall and stratified by participants' region of residence and age group. Overall, prevalences of use of each substance analyzed remained low, even when stratified by region and age group. The use of poppers (amyl nitrate) significantly increased among all rural MSM as a whole. Rural MSM in the Northeast showed significant increases in hallucinogen use. Rural MSM in the Midwest demonstrated significant increasing trends in the use marijuana, poppers, and non-injection powdered cocaine. Rural MSM in the South exhibited significant variation in substance use for painkillers and methamphetamines. Use of marijuana and hallucinogens significantly increased among participants aged 15-24 years. Reported lifetime injection drug use and methamphetamine use significantly increased among participants aged 30-39 years. Use of poppers and hallucinogens significantly increased among participants aged 40+ years. Although the overall low prevalences of substance use are encouraging, the increasing trends noted across sub-groups of MSM suggest reason for concern and more targeted intervention approaches if we are to mitigate the transmission and progression of the HIV epidemic in the rural United States.

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Introduction

Gay, bisexual, and other men who have sex with men (MSM) are the demographic group most at-risk of being infected with HIV in the United States (U.S.), accounting for 69% of all new HIV diagnoses in 2018.(1) Although the number of people living with HIV (PLWH) in urban areas exceed those in rural areas, rural MSM still experience high rates of HIV infection.(1, 2) Despite this, there is a paucity of culturally competent prevention and treatment resources available to MSM residing in rural areas in comparison to their urban counterparts.(3-5) For MSM who reside in rural areas, conditions of geographic isolation, stigma, and substance use synergistically act to restrict both access to and the use of sexual health and HIV preventative services.(3, 6, 7) This warrants special consideration for this population in all aspects of developing and evaluating interventions aimed for MSM residing outside of major cities.

One specific aspect of HIV prevention and treatment for rural MSM that is likely to require careful consideration is substance use. The use of non-prescription marijuana and other illicit substances by HIV-negative or unknown status MSM has been growing from 2013 to 2017.(8) That same study also found an increasing trend of methamphetamine use among PLWH. Other studies have reported high prevalence of substance use among PLWH and MSM, primarily in urban populations.(9-12) There are also significant regional variations severe health outcomes resulting from opioid use in mainly rural states(13), with studies demonstrating both some of the highest(14) and lowest(15) national rates of substance-related mortality and inpatient hospital stays in different rural states across the U.S. This suggests that substance use among rural MSM may also vary by geographic region, warranting special consideration along with differing substance types.

In addition to the negative health and community impacts of the drugs themselves, substance use among MSM has also been associated with increased sexual risk behaviors and reduced efficacy of preventative behavioral interventions.(8) Substance use among PLWH is noted to be associated with worse HIV treatment adherence and viral suppression.(16, 17) Thus, the clinical significance of reducing substance use among MSM and PLWH is critical in terms mitigating the transmission and progression of the HIV epidemic in the United States.

Considerably less is known about illicit substance use among MSM living in rural areas. There are no nationwide US studies of the prevalence, trends and correlates of illicit substance use among rural MSM. This information is critical in addressing the specific needs of different groups of rural MSM with tailored prevention resources. One study suggests that rural populations of MSM are more likely to experience a higher number of syndemic conditions than urban MSM, including polydrug use, that were associated with recent HIV transmission risk behaviors.(18) Although less is known about illicit substance use among rural MSM specifically, rural substance-using adults in general may face unique barriers to obtaining necessary care including low perceived need, reduced accessibility of substance use treatment, and increased stigmas.(19) A study by Borders et al. further highlights this rural versus urban disparity reporting a lower percentage of rural cocaine users perceiving a need for treatment and scoring worse on 7 of their 10 access measures.(20) Due to the myriad of unique treatment challenges and differences from urban MSM, rural MSM deserve special attention regarding their trends and correlates of substance use and cannot be assumed to follow their urban counterparts.

The primary objective of this study is to describe trends in the prevalence of illicit substance use among rural MSM from 2013 to 2019 utilizing an annual cross-sectional online survey. An additional aim of our research is to explore any variation in the trends of substance

use by age and region among rural MSM. Analyzing trend data for this population will illuminate whether substance has been increasing among rural MSM, and which groups of rural MSM may have higher usage. This research will help guide how to best allocate prevention resources for the specific needs of different groups of rural MSM.

Methods

Study Population

AMIS is a national survey conducted annually in cycles with a goal of obtaining 10,000 or more complete surveys from eligible MSM in each cycle. The AMIS methods have been previously reported.(21-23) Briefly, participants were recruited through convenience sampling from a selection of websites and social media applications using advertisements (hereafter referred to as "ads"). Men who clicked on the ads were taken directly to the survey website which contained a brief description of the study and was hosted on a secure server administered by SurveyGizmo (Boulder, CO, USA). Participants from 2015 onward were also recruited though emails sent to participants from the previous AMIS cycles who consented to be re-contacted for future studies.

The surveys were self-administered, could be taken on a computer or mobile device, and included questions on demographics, sexual behaviors, substance use, HIV and sexually transmitted infection (STI) testing and diagnosis, and use of HIV prevention services. The following AMIS data collection cycles were used for this study: December 2013-May 2014 (AMIS- 2013), October 2014-April 2015 (AMIS-2014), September 2015-April 2016 (AMIS-2015), September 2016-February 2017 (AMIS-2016), July 2017-November 2017 (AMIS-2017), September 2018-November 2018 (AMIS-2018), and September-2019 through January-2020 (AMIS-2019). To be eligible for the surveys, participants had to consider themselves as male,

reside in the United States, and report that they either had oral or anal sex with a man at least once in the past or, if age 15-17 years, identify as gay or bisexual. In AMIS-2013, only participants that were 18 years and older were eligible. In AMIS-2014 and onwards, however, the eligibility criteria were changed to include participants 15 years of age and older. Persons who reported being below the age of eligibility or refused to provide their age were asked no further screening questions. Participants who met the eligibility criteria and consented to participate in the studies were able to start the surveys immediately. No incentives were provided to participants. The study was conducted in compliance with Federal Regulations Governing Protection of Human Subjects and was reviewed and approved by Emory University's Institutional Review Board.

Measures

We examined 15 self-reported substance use behaviors as outcome measures that are described in these trend analyses. Three of these main outcomes have been reported in previous similar analyses(8): use of marijuana (alone or combined with other substances), use of any illicit drug other than marijuana, and the use of methamphetamines (alone or combined with other substances) through injection or other means. Marijuana use was analyzed as a separate individual variable as it is the most commonly reported illicit substance (under federal law) used by participants in AMIS studies. Methamphetamine use was also represented as a separate variable because it is the only substance with a proposed direct biologic pathway to increase HIV acquisition risk.(24) Furthermore, overall illicit substance use is commonly a standard indicator in other HIV behavioral surveillance projects.(25, 26) The remaining outcome measures included the reported use of the following substances (other than those prescribed to the participant): any illicit substance, non-injection drugs, injection drugs, painkillers (Oxycontin, Vicodin, Percocet),

poppers (amyl nitrate), powdered cocaine (smoked or snorted), X or Ecstasy, downers (Valium, Ativan, Xanax), hallucinogens (LSD, mushrooms), ketamine or special-K, GHB, and crack cocaine (non-injection). Of these measures, only injection drug use was reported as having ever occurred in the lifetime. All 14 other dependent measures were self-reported behaviors which occurred in the 12 months preceding survey participation.

In addition to conventional individual demographic characteristics, such as age and race/ethnicity, participants were also grouped according to their region of residence. We used a combination of county and ZIP code of residence to determine state and US Census-based region. Residential urbanicity was assessed at the county-level using the National Center for Health Statistics (NCHS) Rural–Urban classification scheme.(27) We further collapsed these categories into a four-level urbanicity variable: urban (central), suburban (fringe), medium/small metropolitan and rural (micropolitan and non-core). For the purposes of this study, only participants with urbanicity value of rural were included for analysis.

Statistical Analyses

Eligible consenting AMIS participants were included in the analyses if they were unduplicated by IP address, completed the survey, had sex with a man in the past 12 months, and provided a valid U.S. ZIP code. Methods and results for these recruitment and enrollment analytics have been previously reported.(4, 22) Overall, Chi square tests were used to assess whether participant characteristics differed significantly among annual recruitment cycles for rural MSM.

Poisson models using Generalized Estimating Equations (GEE) tested for linear trends between AMIS cycle years (2013-2019) for each of the reported substance use outcomes overall, as well as stratified by both region and age group. Results are presented for the total study

sample, as well as for subsets of MSM from stratified analyses. All GEE trend models included binary race/ethnicity (White, non-Hispanic or Other) as a covariate due to the vast majority of rural study participants identifying as White, non-Hispanic and low cell counts for other categories in stratified analyses. The GEE trend models for the overall study population additionally included age group and region as covariates. The GEE trend models for stratified analyses by region included age group and race/ethnicity as covariates. The GEE trend models for stratified analyses by age group, included region and race/ethnicity as covariates. AMIS cycle year was treated as a continuous variable for all analyses. Level of educational attainment was used to describe the overall study population; however, it was excluded from further analyses as results from preliminary analyses demonstrated no significant associations with substance use trends (data not presented). Furthermore, results were not presented for ketamine, GHB, or crack cocaine due to the small total number of participants that reported using these substances across all AMIS cycle years (24, 40, and 34 respectfully). Significance was determined at alpha=0.05. All analyses were conducted using SAS 9.4 statistical analysis software.

Results

Participant Characteristics

There were 6,388 rural MSM participants in the seven annual AMIS cycles conducted between 2013 and 2019 that were eligible for analysis (Table 1). Most participants were aged 30 years or older, non-Hispanic white, and had received at least some college or technical degree. Approximately 6% of participants in each AMIS cycle reported being HIV positive. Participants were recruited from all US states with a majority residing in either the South or Midwest regions each year. All participant characteristics varied significantly by AMIS cycle year.

Overall Substance Use Trends

When included in a GEE model for linear trends across AMIS cycles adjusting for age group, region, and race/ethnicity, only the use of poppers (amyl nitrate) in the past 12 months significantly increased from 2.93% in 2013 to 6.47% in 2019 (Table 2; p = 0.001). With each additional AMIS cycle year, the overall estimated prevalence of popper use increased by 0.08 on average, with an overall estimated prevalence ratio of 1.08 (Table 2; 95% CI: (1.03, 1.13)) across all cycle years. All other included substances showed no significant linear trends across AMIS cycles.

Trends by Region

When drug use trends were stratified by region and adjusted for age group and race/ethnicity, we found significant trends in drug use in different regions. Among rural MSM residing in the Northeast, use of hallucinogens varied significantly across AMIS cycle years, with a peak of 6.98% in 2016 and lows of 0% in both 2014 and 2015 (Table 3a; p = 0.014). With each additional AMIS cycle year, the estimated prevalence of hallucinogen use increased by an average of 0.29, with an estimated prevalence ratio of 1.29 (Table 3a; 95% CI: (1.06, 1,57)) across all AMIS cycle years. There were no other significant trends in this region. Among rural MSM residing in the West, there was no significant variation in trends substance use across AMIS cycles.

Among rural MSM residing in the Midwest, use of marijuana increased from 17.54% in 2013 to 22.71% in 2019 (Table 3b; p = 0.039). The estimated prevalence of using marijuana among rural MSM in the Midwest increased by an average of 0.05 with each increasing cycle year, with an estimated prevalence ratio of 1.05 (Table 3b; 95% CI: (1.00, 1.09)) across all cycle years. The estimated prevalence of using poppers among rural MSM in this region varied by 0.11 with each additional cycle year, with an estimated prevalence ratio of 1.11 (Table 3b; 95% CI:

(1.02, 1.21)) across all study years. Additionally, the use of poppers increased from 2.81% in 2013 to 5.76% in 2019 (Table 3c; p = 0.022). Use of non-injection powdered cocaine increased from 2.11% in 2013 to 4.75% in 2019 (Table 3c; p = 0.047). Furthermore, with each one-year increase in AMIS cycle year, the estimated prevalence of using non-injection powdered cocaine increased by an average of 0.14 with an overall estimated prevalence ratio of approximately 1.14 (Table 3b; 95% CI: (1.00, 1.29)).

Among rural MSM residing in the South, the use of painkillers varied significantly across AMIS cycles with a high of 8.91% in 2015 and a low of 2.11% in 2018 (Table 3c; p = 0.018). Additionally, with each increasing cycle year the estimated prevalence of using painkillers decreased, on average, by 0.09 with an overall estimated prevalence ratio across all cycle years of 0.91 (Table 3c; 95% CI: (0.85, 0.98)) for rural MSM residing in the South. Methamphetamine use also significantly varied across AMIS cycles with a low of 2.30% in 2013 and a peak of 4.22% in 2018 (Table 3c; p = 0.048). The estimated prevalence of using any methamphetamines increased by an average of 0.11 with each increasing AMIS cycle year, with an overall estimated prevalence ratio of 1.11 (Table 3c; 95% (1.00, 1.23)) across all study years for this group.

Trends by Age Group

When drug use trends were stratified by age group and adjusted for region and race/ethnicity, we found significant trends in drug use across different age groups. Among rural MSM aged 15 to 24 years old, use of marijuana significantly increased from 30.00% in 2013 to 36.13% in 2019 (Table 4a; p = 0.01). The estimated prevalence of marijuana use increased by an average of 0.04 with each increasing AMIS cycle year, with an overall estimated prevalence ratio of 1.04 (Table 4a; 95% (1.01, 1.08)) across all study years for this age group. Use of hallucinogens increased from 4.09% in 2013 to 6.51% in 2019 (Table 3c; p = 0.045). The

estimated prevalence ratio for using hallucinogens across all cycle years was approximately 1.10 (Table 4a; 95% CI: (1.00, 1.20)), with the estimated prevalence increasing by 0.09 with each increasing cycle year for participants aged 15 to 24 years. Among rural MSM aged 25 to 29 years, there were no significant trends in substance use.

Among rural MSM aged 30 to 39 years, report of having ever injected an illicit substance significantly increased from 5.19% in 2013 to 12.09% in 2019 (Table 4c; $p = 0.037$). With each increasing AMIS cycle year, the estimated prevalence of having ever injected an illicit substance increased by an average of 0.17, with an estimated prevalence ratio of 1.18 (Table 4c; 95% CI: (1.03, 1.35)) across all study years for this age group. Use of methamphetamines significantly increased from 2.22% in 2013 to 10.99% in 2019 (Table 3c; $p = 0.021$). Furthermore, the estimated prevalence ratio for using any methamphetamines across all cycle years was also 1.18 (Table 4a; 95% CI: (1.03, 1.36)), with the estimated prevalence increasing by 0.17 with each increasing cycle year for rural MSM aged 30 to 39 years.

Among rural MSM aged 40 years or older, use of poppers significantly increased from 2.62% in 2013 to 6.62% in 2019 (Table 4d; $p = 0.006$). With each increasing AMIS cycle year, the estimated prevalence of using poppers among participants in this age group increased by approximately 0.10 on average with an estimated prevalence ratio of 1.10 (Table 4d; 95% CI: (1.03, 1.18)) across all cycle years. There was significant variation in reported use of hallucinogens with a low of 0.22% in 2013 and peak of 1.78% in 2018 (Table 4d; $p = 0.033$). The overall estimated prevalence ratio of using hallucinogens for participants 40 years or older across all cycle years was approximately 1.31 (Table 4d; 95% CI: (1.04, 1.65)), with the estimated prevalence increasing by 0.09 with each increasing cycle year.

Discussion

Previous research has noted elevated levels of substance use among PLWH and MSM, however these findings are primarily driven by trends in urban substance use and do not tell the full story experienced by rural MSM.(9-12) To establish this baseline data, we analyzed both the overall trends and prevalences in reported substance use among rural MSM as well as trends and prevalences stratified by region of residence and age group in this population leading to several important findings. First, we noted that for rural MSM overall, only reported use of poppers significantly varied from year to year. Second, we observed significant changes in the use of different substances based on region of residence. Third, trends in reported substance use also varied significantly across cycle years for different substances based on specific age groups of participants.

We found that use of poppers was the only substance to be significantly changing from 2013 to 2019 among the total study population of rural MSM despite its overall low prevalence across all AMIS cycle years. The term “ChemSex” has been described in previous literature as the phenomenon in which, particularly MSM and PLWH, use psychoactive and other drugs in the context of sexual intercourse in order to facilitate and/or enhance their sexual experience.(28, 29) Poppers, specifically, are popular in the practice of ChemSex among MSM due to its effects of easier anal penetration and mild hallucinatory effects.(28) Additionally, a recent study evaluating the links between ChemSex and reduced mental health among Norwegian MSM and other men revealed that more MSM reported engaging in ChemSex than other men in the past year and that odds of having reduced mental health were greater for individuals engaging in ChemSex than those that did not.(30) These findings, in conjunction with our present research indicate that, although the prevalence of using poppers in relatively low among rural MSM, the noted increasing trend in popper use may be an indicator of increasing ChemSex and mental

health issues present in this population resulting from elevated degrees negative stigma and syndemic conditions described earlier. Previous studies on national substance use trends among MSM and PLWH utilizing the same AMIS study data had noted an increasing trend in non-prescription marijuana and methamphetamines(8), however we did not observe these trends in our study solely with rural MSM. It is likely that the observed increasing trends in marijuana and methamphetamines from previous studies are mainly driven by urban substance use.

We additionally observed significant variations in the reported use of different substances based on participants' region of residence from 2013 to 2019 despite the relatively low prevalence of using each substance tested in each of the study regions. More specifically, we noted an increase in the reported use of hallucinogens among rural MSM from the Northeast, increases in the reported use of marijuana, poppers, and non-injection powdered cocaine among rural MSM residing in the Midwest, as well as an increase in reported use of any methamphetamines, and a rise and fall in the use of painkillers among rural MSM from the South. These differences in trends of substance use by region indicate that rural MSM are not uniform in their risks of substance use and that these risks may vary by region of residence, possibly due to the varying regional preferences or availability of substances. This is consistent with other recent research finding that the risk of drug-related mortality varies systematically over time across population subgroups nationally, in connection with the availability and cost of drugs as well as the state of local economies.(31) The observed trends of methamphetamine and painkiller use among rural MSM residing in the South indicate that the opioid epidemic described by previous literature(32, 33) might still be persisting throughout South despite declining national trends. Previous research has also noted similar findings of regional variation

in substance use trends, both across and within states, and that national trend averages are masking these local variations.(34, 35)

Furthermore, we noted significant variations in the reported use of different substances based on participants' age groups. Although the increased trends remain low for all substances across each age group analyzed, the age group variations suggest that the risk factors for substance use among rural MSM may differ by stages of life. Specifically, for rural MSM aged 15 to 24 years, we observed increases in the reported use of marijuana and hallucinogens from 2013 to 2019. These findings are largely consistent with previous analyses of national substance use trends among MSM, using the same national AMIS study data, which noted increases in non-prescription marijuana and other illicit substances among HIV-negative or unknown status MSM.(8) This variability by age group is also consistent with previous research noting variability in substance use patterns by age for substances involved in acute drug toxicity presentations, as well as research on benzodiazepine use and misuse.(36) The findings of our study could further these previously noted trends, suggesting that the increasing in marijuana use among HIV-negative or unknown status MSM could potentially be driven by younger MSM, especially in rural locales. For rural MSM aged 30 to 39 years, we noted significant increases in reports of having ever used injection drugs as well as the use of methamphetamines from 2013 to 2019. These findings are of particular importance among MSM and PLWH considering the direct links between injection drug use and increased HIV susceptibility. Previous national trend analyses of substance use among MSM similarly noted significant increases in the reported use of methamphetamines for only HIV-positive MSM residing in all regions, but not for HIV-positive MSM residing in NHBS cities.(8) To our knowledge, this is the first study to specifically report these increasing trends among rural MSM of this age group, although previous

national trend analysis of self-reported past-year methamphetamine use has noted significant increases among individuals in the U.S. aged 18-25 and 26-34 years(37) which we did not observe in our sample of rural MSM. Our results suggest that the use of methamphetamines may be still be increasing among some MSM outside of major cities and particularly among rural MSM between the ages of 30 and 39. These findings are additionally consistent with previous national substance use trend research demonstrating that individuals reporting using any methamphetamines were more likely to reside in rural areas.(38) Methamphetamines are another substance often utilized for ChemSex purposes and these increasing trends in their use may be an indicator of increasing ChemSex practices and mental health issues additionally experienced by rural MSM of this age group from syndemic conditions of stigma. Lastly, among rural MSM aged 40 and older, we noted significant variation in the reported use of both poppers and hallucinogens across AMIS cycle years. This further solidifies the notion that risk factors for substance use are not the same among rural MSM of different age groups, likely as a result of the different lived experiences and stressors they undergo at each stage of their lives.

We note several of limitations of our study. First, AMIS survey data are not generalizable to all MSM in the U.S. The online convenience sample approach, used to increase sample diversity, increases the potential for selection or enrollment biases. It also increases the opportunity for AMIS cycle year variations in the study population which is demonstrated by the statistically significant differences in all participant demographics across cycle years and required additional statistical approaches to control for such variations. In addition to some of this variation being a byproduct of the online convenience sampling from websites that produce different sample compositions, some of the variation is additionally explained by efforts to improve recruitment of youth and African Americans to the study over time. Despite these

improvements in participant diversity, African American MSM are still underrepresented in AMIS, as is commonly the case with other internet research on MSM.(39) This was especially true among our subset of specifically rural MSM, of which 80.73% identified as White, non-Hispanic. As a result of this, we were only able to include race/ethnicity as binary variable (White, non-Hispanic vs. Other) in all of our trend analyses, thus overshadowing any potential differences in substance use trends that may be occurring on a more granular level between different racial/ethnic groups. To address the issue of lack of diversity of the study population in studies such as this one, future research should also consider using a broader definition of non-urban which additionally includes small/medium metro areas, rather than solely rural MSM. This would likely substantially increase the number of non-white participants in the study sample in addition to the fact that MSM residing in small/medium metro areas are likely to have more in common with rural MSM than their urban counterparts. Furthermore, as the surveys only utilized self-reported data, there is also potential for respondents to under-report less socially desirable responses to using certain substances. This may have led to our lack of ability to identify certain significant trends in the use of some substances.

The burden of substance use and overdose mortality are already issues of great public health importance among many rural communities across the United States, aside from their implications for MSM and PLWH.(13, 40) Considering that substance use among MSM has been shown to be associated with increased sexual risk behaviors, reduced efficacy of preventative behavioral interventions,(8) as well as worse HIV treatment adherence and viral suppression among PLWH,(12, 16, 17) the clinical and public health significance of reducing substance use in these populations is essential to ending the HIV epidemic in the United States. The findings of this study shine a light on the need for more targeted substance use prevention

and treatment efforts that better address the specific needs of rural MSM of different age groups that are residing in different regions of the U.S.

Many studies exploring substance use among MSM and other sexual minority groups have found strong ties between substance use and mental health disorders such as depression or PTSD, suggesting the potential role of substance use as a coping mechanism in these populations.(18, 41-44) This previous research highlights the different stigmas and minority stressors (e.g. internalized heterogeneity or rejection sensitivity) that might be leading to utilization of substance use as a coping mechanism for various syndemic adverse events, such as childhood physical abuse, sexual abuse, and neglect, adult sexual assault, and higher number of victimization experiences than heterosexual men. Thus, future research should aim to explore some of these correlates of substance use among rural MSM, and more specifically ones surrounding stigma and mental health disorders.

Reducing substance use among MSM and PLWH is an essential step in mitigating the transmission and progression of the HIV epidemic in the United States. As result of the unique treatment challenges and syndemic conditions experienced rural MSM, the presented research emphasizes the need for special attention to the trends and correlates of substance use, targeted prevention resources, and underlying psychosocial risk factors among this population. If we are to finally eradicate HIV in the United States, it is absolutely essential that we are able to allocate the appropriate prevention and treatment resources that address the specific needs of different demographics of rural MSM in different regions in a more targeted fashion. A better understanding of how substance use among rural MSM may be linked to syndemic conditions of stigma and mental health disorders is needed to begin addressing the structural health inequities experienced by rural MSM. With this baseline data and knowledge, we have the resources to

further investigate the specific needs of rural MSM and begin targeting treatment and prevention resources appropriately. Rural MSM are just one part of the nationwide epidemic but reaching those affected individuals with the fewest resources and most boundaries to care may be the limiting factor and the final push if we are to completely end the HIV epidemic in the United States.

Table 1. Rural MSM Participant Characteristics, American Men's Internet Survey, 2013-2019

Descriptive / Demographic Characteristics	*2013 N (%)*	*2014 N (%)*	*2015 N (%)*	*2016 N (%)*	*2017 N (%)*	*2018 N (%)*	*2019 N (%)*	*Chi-sq. P-value*
Totals (n=6388)	920	773	988	884	806	1013	1004	
Age (years)								**<0.0001**
15-24	220 (23.91)	139 (17.98)	321 (32.43)	322 (36.43)	247 (30.65)	444 (43.83)	476 (47.41)	
25-29	107 (11.63)	89 (11.51)	154 (15.59)	118 (13.35)	82 (10.17)	111 (10.96)	135 (13.45)	
30-39	135 (14.67)	147 (19.02)	135 (13.66)	82 (9.28)	85 (10.55)	120 (11.85)	91 (9.06)	
40+	458 (49.78)	398 (51.49)	378 (38.26)	362 (40.95)	392 (48.64)	338 (33.37)	302 (30.08)	
Race/Ethnicity*								**<0.0001**
Black, non-Hispanic	16 (1.74)	17 (2.20)	33 (3.34)	33 (3.37)	18 (2.28)	29 (2.95)	75 (7.61)	
Hispanic	56 (6.09)	56 (7.24)	81 (8.20)	61 (6.90)	58 (7.36)	104 (10.59)	71 (7.21)	
White, non-Hispanic	777 (84.46)	638 (82.54)	776 (78.54)	708 (80.09)	666 (84.52)	781 (79.53)	756 (76.75)	
Other or multiple races	71 (7.72)	62 (8.02)	98 (9.92)	82 (9.28)	46 (5.84)	68 (6.92)	83 (8.43)	
Region								**<0.0001**
Northeast	161 (17.81)	108 (13.97)	166 (16.8)	129 (14.59)	119 (14.76)	135 (13.33)	114 (11.35)	
Midwest	285 (31.53)	235 (30.40)	328 (33.20)	281 (31.79)	243 (30.15)	350 (34.55)	295 (29.38)	
South	307 (33.96)	304 (39.33)	348 (35.22)	340 (38.46)	310 (38.46)	379 (37.41)	466 (46.41)	
West	151 (16.70)	126 (16.30)	146 (14.78)	134 (15.16)	134 (16.63)	149 (14.71)	129 (12.85)	
Self-Reported HIV Status								**<0.0001**
Positive	66 (7.17)	54 (6.99)	64 (6.48)	60 (6.79)	55 (6.82)	41 (4.05)	47 (4.68)	
Negative	607 (65.98)	570 (73.74)	624 (63.33)	551 (62.33)	532 (66.00)	611 (60.32)	581 (57.87)	
Unknown/Never Tested	247 (26.85)	149 (19.28)	300 (30.36)	273 (30.88)	219 (27.17)	361 (35.64)	376 (37.45)	
Educational Attainment								**<0.0001**
< HS diploma	20 (2.19)	20 (2.61)	55 (5.66)	55 (6.05)	48 (6.05)	97 (9.63)	107 (10.71)	
HS diploma or equivalent	147 (16.12)	99 (12.91)	150 (15.45)	189 (21.93)	154 (19.42)	191 (18.97)	188 (18.82)	
Some college or technical degree	360 (39.47)	311 (40.55)	387 (39.86)	318 (36.89)	276 (34.80)	420 (41.71)	380 (38.04)	
College degree or postgraduate education	385 (42.21)	337 (43.94)	379 (39.03)	300 (34.80)	315 (39.72)	299 (29.69)	324 (32.43)	

* Missing values for participant characteristics: 68 missing observations for Race/Ethnicity; 16 missing observations for Region; 77 missing observations for Educational Attainment

Table 2. Substance Use Trends Among Rural MSM, American Men's Internet Survey, 2013-2019

Substance use behaviors over the previous 12 months	*2013 N (%)*	*2014 N (%)*	*2015 N (%)*	*2016 N (%)*	*2017 N (%)*	*2018 N (%)*	*2019 N (%)*	*Estimated Prevalence Ratio*	*95% CI*	*GEE Model P-value**
Totals	920	773	988	884	806	1013	1004			
Illicit Drug Use	227 (24.67)	180 (23.29)	282 (28.54)	241 (27.26)	231 (28.66)	286 (28.23)	295 (29.38)	1.01	(0.99, 1.03)	0.1963
Injection Drug Use†**	31 (3.37)	33 (4.27)	50 (5.06)	37 (4.19)	47 (5.83)	29 (2.86)	37 (3.69)	1.04	(0.97, 1.12)	0.2601
Non-Injection Drug Use**	220 (23.99)	176 (22.80)	281 (28.70)	240 (27.46)	229 (28.70)	282 (28.03)	288 (28.92)	1.00	(0.97, 1.03)	0.8686
Marijuana	190 (20.65)	141 (18.24)	215 (21.76)	196 (22.17)	184 (22.83)	238 (23.49)	263 (26.20)	1.02	(0.99, 1.04)	0.1287
Drug other than Marijuana	135 (14.67)	108 (13.97)	162 (16.40)	148 (16.74)	118 (14.64)	143 (14.12)	164 (16.33)	1.00	(0.97, 1.03)	0.9803
Methamphetamines††	14 (1.52)	26 (3.36)	30 (3.04)	23 (2.60)	21 (2.61)	27 (2.67)	24 (2.39)	1.05	(0.97, 1.12)	0.2276
Painkillers	34 (3.70)	33 (4.27)	74 (7.49)	47 (5.32)	42 (5.21)	40 (3.95)	47 (4.68)	0.97	(0.92, 1.02)	0.2279
Poppers (Amyl Nitrate)	27 (2.93)	49 (6.34)	72 (7.29)	51 (5.77)	48 (5.96)	67 (6.61)	65 (6.47)	**1.08**	**(1.03, 1.13)**	**0.0014**
Powdered Cocaine (Non-injection)	24 (2.61)	30 (3.88)	44 (4.45)	39 (4.41)	38 (4.71)	41 (4.05)	49 (4.88)	1.04	(0.98, 1.10)	0.1559
X or Ecstasy	15 (1.63)	12 (1.55)	21 (2.13)	21 (2.38)	15 (1.86)	20 (1.97)	31 (3.09)	1.03	(0.94, 1.12)	0.5566
Downers	19 (2.07)	21 (2.72)	43 (4.35)	39 (4.41)	32 (3.97)	39 (3.85)	31 (3.09)	1.00	(0.94, 1.06)	0.9283
Hallucinogens	19 (2.07)	12 (1.55)	20 (2.02)	34 (3.85)	24 (2.98)	37 (3.65)	41 (4.08)	1.07	(0.99, 1.15)	0.0762

* Adjusted for Age Group, Region, and Race/Ethnicity

** Missing values for reported substance use behavior: 9 missing observations for Injection Drug Use; 87 missing observations for Non-Injection Drug Use

† Participants reported on having ever injected an illicit substance rather than in the previous 12 months

†† Participants reported use of any methamphetamines, including both injection and non-injection methamphetamines, in the previous 12 months

Table 3. Substance Use Trends among Rural MSM, by Region of Residence, American Men's Internet Survey, 2013-2019

Substance use behaviors over the previous 12 months	*2013 N (%)*	*2014 N (%)*	*2015 N (%)*	*2016 N (%)*	*2017 N (%)*	*2018 N (%)*	*2019 N (%)*	*Estimated Prevalence Ratio*	*95% CI*	*GEE Model P-value**
(a) Northeast										
Totals (n=932)	161	108	166	129	119	135	114			
Illicit Drug Use	39 (24.22)	22 (20.37)	48 (28.92)	37 (28.68)	26 (21.85)	41 (30.37)	37 (32.46)	1.03	(0.98, 1.09)	0.2294
Injection Drug Use†**	3 (1.86)	1 (0.93)	5 (3.01)	4 (3.10)	4 (3.36)	5 (3.70)	6 (5.26)	1.27	(0.99, 1.60)	0.0726
Non-Injection Drug Use**	38 (23.75)	22 (20.37)	48 (28.92)	37 (28.68)	25 (21.37)	40 (29.63)	36 (31.58)	1.02	(0.95, 1.09)	0.6094
Marijuana	36 (22.36)	18 (16.67)	36 (21.69)	32 (24.81)	20 (16.81)	32 (23.70)	32 (28.07)	1.01	(0.95, 1.08)	0.6817
Drug other than Marijuana	19 (11.80)	12 (11.11)	29 (17.47)	26 (20.16)	14 (11.76)	19 (14.07)	19 (16.67)	1.03	(0.96, 1.11)	0.4285
Methamphetamines††	0 (0.00)	2 (1.85)	3 (1.81)	2 (1.55)	4 (3.36)	1 (0.74)	1 (0.88)	1.15	(0.93, 1.43)	0.2155
Painkillers	6 (3.73)	4 (3.70)	18 (10.84)	10 (7.75)	7 (5.88)	4 (2.96)	4 (3.51)	0.93	(0.83, 1.04)	0.2094
Poppers (Amyl Nitrate)	7 (4.35)	7 (6.48)	13 (7.83)	10 (7.75)	3 (2.52)	10 (7.41)	10 (8.77)	1.08	(0.95, 1.22)	0.2339
Powdered Cocaine (Non-injection)	4 (2.48)	3 (2.78)	8 (4.82)	7 (5.43)	1 (0.84)	3 (2.22)	1 (0.88)	0.87	(0.75, 1.02)	0.0887
X or Ecstasy	2 (1.24)	0 (0.00)	1 (0.60)	5 (3.88)	1 (0.84)	3 (2.22)	2 (1.74)	1.12	(0.87, 1,45)	0.3701
Downers	4 (2.48)	2 (1.85)	9 (5.42)	7 (5.43)	2 (1.68)	2 (1.48)	2 (1.75)	0.87	(0.75, 1.01)	0.0689
Hallucinogens	1 (0.62)	0 (0.00)	0 (0.00)	9 (6.98)	2 (1.68)	5 (3.70)	4 (3.51)	**1.29**	**(1.06, 1.57)**	**0.0144**
(b) Midwest										
Totals (n=2017)	285	235	328	281	243	350	295			
Illicit Drug Use	60 (21.05)	47 (20.00)	82 (25.00)	65 (23.13)	74 (30.45)	105 (30.00)	74 (25.08)	1.03	(0.99, 1.07)	0.1169
Injection Drug Use†**	7 (2.46)	10 (4.26)	14 (4.27)	11 (3.91)	10 (4.12)	9 (2.57)	6 (2.03)	0.99	(0.89, 1.10)	0.8108
Non-Injection Drug Use**	59 (20.77)	45 (19.15)	81 (25.00)	65 (23.30)	74 (30.71)	104 (29.80)	73 (24.91)	1.00	(0.95, 1.06)	0.8667
Marijuana	50 (17.54)	34 (14.47)	62 (18.90)	55 (19.57)	59 (24.28)	91 (26.00)	67 (22.71)	**1.05**	**(1.00, 1.09)**	**0.039**
Drug other than Marijuana	33 (11.58)	25 (10.64)	44 (13.41)	38 (13.52)	34 (13.99)	47 (13.43)	39 (13.22)	1.02	(0.96, 1.08)	0.5779
Methamphetamines††	5 (1.75)	7 (2.98)	10 (3.05)	5 (1.78)	1 (0.41)	8 (2.29)	3 (1.02)	0.94	(0.80, 1.11)	0.447
Painkillers	10 (3.51)	6 (2.55)	19 (5.79)	12 (4.27)	12 (4.94)	18 (5.14)	11 (3.73)	1.01	(0.92, 1.12)	0.7689
Poppers (Amyl Nitrate)	8 (2.81)	11 (4.68)	19 (5.79)	14 (4.98)	14 (5.76)	25 (7.14)	17 (5.76)	**1.11**	**(1.02, 1.21)**	**0.0218**
Powdered Cocaine (Non-injection)	6 (2.11)	4 (1.70)	10 (3.05)	6 (2.14)	10 (4.12)	14 (4.00)	14 (4.75)	**1.14**	**(1.00, 1.29)**	**0.0465**
X or Ecstasy	5 (1.75)	3 (1.28)	9 (2.74)	7 (2.49)	3 (1.23)	5 (1.43)	7 (2.37)	0.96	(0.83, 1.12)	0.6018
Downers	5 (1.75)	2 (0.85)	11 (3.35)	11 (3.91)	10 (4.12)	13 (3.71)	9 (3.05)	1.08	(0.96, 1.22)	0.1823
Hallucinogens	4 (1.40)	2 (0.85)	12 (3.66)	9 (3.20)	8 (3.29)	10 (2.86)	6 (2.03)	1.01	(0.89, 1.14)	0.9275
(c) South										
Totals (n=2454)	307	304	348	340	310	379	466			
Illicit Drug Use	70 (22.80)	74 (24.34)	109 (31.32)	93 (27.35)	87 (28.06)	91 (24.01)	142 (30.47)	1.00	(0.97, 1.04)	0.8538
Injection Drug Use†**	12 (3.91)	12 (3.95)	20 (5.75)	15 (4.41)	23 (7.42)	7 (1.85)	19 (4.08)	1.02	(0.94, 1.11)	0.5774

Non-Injection Drug Use**	67 (21.90)	73 (24.09)	109 (31.69)	93 (27.76)	86 (28.01)	90 (24.06)	138 (29.87)	1.01	(0.97, 1.05)	0.6931
Marijuana	57 (18.57)	58 (19.08)	84 (24.14)	71 (20.88)	67 (21.61)	74 (19.53)	125 (26.82)	1.01	(0.97, 1.05)	0.7005
Drug other than Marijuana	49 (15.96)	51 (16.78)	67 (19.25)	61 (17.94)	48 (15.48)	52 (13.72)	82 (17.60)	0.98	(0.94, 1.03)	0.401
Methamphetamines††	7 (2.28)	7 (2.30)	11 (3.16)	10 (2.94)	13 (4.19)	16 (4.22)	14 (3.00)	**1.11**	**(1.00, 1.23)**	**0.0476**
Painkillers	13 (4.23)	19 (6.25)	31 (8.91)	22 (6.47)	19 (6.13)	8 (2.11)	23 (4.94)	**0.91**	**(0.85, 0.98)**	**0.0179**
Poppers (Amyl Nitrate)	6 (1.95)	23 (7.57)	32 (9.20)	17 (5.00)	17 (5.48)	19 (5.01)	30 (6.44)	1.05	(0.98, 1.14)	0.1729
Powdered Cocaine (Non-injection)	12 (3.91)	14 (4.61)	18 (5.17)	19 (5.59)	19 (6.13)	15 (3.96)	24 (5.15)	1.01	(0.93, 1.10)	0.7352
X or Ecstasy	6 (1.95)	4 (1.32)	7 (2.01)	5 (1.47)	7 (2.26)	6 (1.58)	19 (4.08)	1.07	(0.92, 1.24)	0.3762
Downers	8 (2.61)	15 (4.93)	19 (5.46)	19 (5.59)	15 (4.84)	17 (4.49)	15 (3.22)	0.95	(0.87, 1.03)	0.2084
Hallucinogens	8 (2.61)	5 (1.64)	4 (1.15)	11 (3.24)	7 (2.26)	13 (3.43)	20 (4.29)	1.05	(0.92, 1.20)	0.461
(d) West										
Totals (n=969)	151	126	146	134	134	149	129			
Illicit Drug Use	47 (31.13)	37 (29.37)	43 (29.45)	46 (34.33)	44 (32.84)	49 (32.89)	42 (32.56)	1.00	(0.96, 1.05)	0.8339
Injection Drug Use†**	7 (4.64)	10 (7.94)	11 (7.53)	7 (5.22)	10 (7.46)	8 (5.37)	6 (4.65)	1.03	(0.87, 1.22)	0.7585
Non-Injection Drug Use**	45 (29.8)	36 (28.57)	43 (29.66)	45 (34.35)	44 (33.08)	48 (32.43)	41 (32.28)	0.99	(0.91, 1.08)	0.8282
Marijuana	40 (26.49)	31 (24.60)	33 (22.60)	38 (28.36)	38 (28.36)	41 (27.52)	39 (30/23)	1.01	(0.96, 1.07)	0.6032
Drug other than Marijuana	27 (17.88)	20 (15.87)	22 (15.07)	23 (17.16)	22 (16.42)	25 (16.78)	24 (18.60)	1.00	(0.93, 1.07)	0.9958
Methamphetamines††	2 (1.32)	10 (7.94)	6 (4.11)	6 (4.48)	3 (2.24)	2 (1.34)	6 (4.65)	0.99	(0.84, 1.15)	0.8547
Painkillers	5 (3.31)	4 (3.17)	6 (4.11)	3 (2.24)	4 (2.99)	10 (6.71)	9 (6.98)	1.13	(0.95, 1.34)	0.1641
Poppers (Amyl Nitrate)	6 (3.97)	8 (6.35)	8 (5.48)	10 (7,46)	14 (10.45)	13 (8.72)	8 (6.20)	1.12	(0.99, 1.25)	0.0615
Powdered Cocaine (Non-injection)	2 (1.32)	9 (7.14)	8 (5.48)	7 (5.22)	8 (5.97)	9 (6.04)	10 (7.75)	1.10	(0.97, 1.24)	0.1547
X or Ecstasy	2 (1.32)	5 (3.97)	4 (2.74)	4 (2.99)	4 (2.99)	6 (4.03)	3 (2.33)	1.01	(0.85, 1.20)	0.9162
Downers	2 (1.32)	2 (1.59)	4 (2.74)	2 (1.49)	5 (3.73)	7 (4.70)	5 (3.88)	1.19	(0.98, 1.44)	0.0772
Hallucinogens	6 (3.97)	5 (3.97)	4 (2.74)	5 (3.73)	7 (5.22)	9 (6.04)	11 (8.53)	1.10	(0.95, 1.28)	0.213

* Adjusted for Age Group and Race/Ethnicity

** Missing values for reported substance use behavior: Injection Drug Use - 3 missing observations among Northeast participants, 1 missing observations among Midwest participants, 1 missing observation among South participants, 4 missing observation among West participants; Non-Injection Drug Use - 9 missing observations among Northeast participants, 21 missing observations among Midwest participants, 38 missing observation among South participants, 19 missing observation among West participants

† Participants reported on having ever injected an illicit substance rather than in the previous 12 months

†† Participants reported use of any methamphetamines, including both injection and non-injection methamphetamines, in the previous 12 months

Table 4. Substance Use Trends, Among Rural MSM, by Age Group, American Men's Internet Survey, 2013-2019

Substance use behaviors over the previous 12 months	*2013 N (%)*	*2014 N (%)*	*2015 N (%)*	*2016 N (%)*	*2017 N (%)*	*2018 N (%)*	*2019 N (%)*	*Estimated Prevalence Ratio*	*95% CI*	*GEE Model P-value**
(a) Aged 15-24 (years)										
Totals (n=2169)	107	89	154	118	82	111	135			
Illicit Drug Use	31 (28.97)	28 (31.46)	48 (31.17)	45 (38.14)	37 (45.12)	30 (27.03)	35 (25.93)	1.03	(0.99, 1.06)	0.0706
Injection Drug Use†**	4 (3.74)	5 (5.62)	12 (7.79)	7 (5.93)	6 (7.32)	5 (4.50)	1 (0.74)	0.94	(0.82, 1.07)	0.3409
Non-Injection Drug Use**	31 (28.97)	28 (31.46)	48 (31.17)	45 (38.14)	37 (45.12)	29 (26.13)	34 (25.56)	1.02	(0.98, 1.07)	0.343
Marijuana	27 (25.23)	26 (29.21)	39 (25.32)	38 (32.20)	28 (34.15)	24 (21.62)	29 (21.48)	**1.04**	**(1.01, 1.08)**	**0.0098**
Drug other than Marijuana	23 (21.50)	15 (16.85)	28 (18.18)	30 (25.42)	18 (21.95)	17 (15.32)	26 (19.26)	0.99	(0.95, 1.04)	0.8069
Methamphetamines††	1 (0.93)	5 (5.62)	6 (3.90)	4 (3.39)	3 (3.66)	4 (3.60)	3 (2.22)	1.01	(0.82, 1.25)	0.8937
Painkillers	12 (5.45)	6 (4.32)	29 (9.03)	21 (6.52)	19 (7.69)	23 (5.18)	28 (5.88)	0.98	(0.91, 1.06)	0.6590
Poppers (Amyl Nitrate)	6 (2.73)	9 (6.47)	14 (4.36)	18 (5.59)	7 (2.83)	21 (4.73)	24 (5.04)	1.04	(0.94, 1.14)	0.4819
Powdered Cocaine (Non-injection)	8 (3.64)	5 (3.60)	16 (4.98)	14 (4.35)	13 (5.26)	27 (6.08)	29 (6.09)	1.09	(0.99, 1.20)	0.0695
X or Ecstasy	9 (4.09)	6 (4.32)	9 (2.80)	9 (2.80)	6 (2.43)	10 (2.25)	23 (4.83)	1.00	(0.88, 1.14)	0.9958
Downers	10 (4.55)	5 (3.60)	21 (6.54)	17 (5.28)	17 (6.88)	24 (5.41)	18 (3.78)	0.98	(0.90, 1.07)	0.6197
Hallucinogens	9 (4.09)	5 (3.60)	11 (3.43)	20 (6.21)	16 (6.48)	26 (5.86)	31 (6.51)	**1.10**	**(1.00, 1.20)**	**0.0453**
(b) Aged 25-29 (years)										
Totals (n=796)	107	89	154	118	82	111	135			
Illicit Drug Use	31 (28.97)	28 (31.46)	48 (31.17)	45 (38.14)	37 (45.12)	30 (27.03)	35 (25.93)	0.99	(0.94, 1.04)	0.6743
Injection Drug Use†**	4 (3.74)	5 (5.62)	12 (7.79)	7 (5.93)	6 (7.32)	5 (4.50)	1 (0.74)	1.01	(0.81, 1.26)	0.9161
Non-Injection Drug Use**	31 (28.97)	28 (31.46)	48 (31.17)	45 (38.14)	37 (45.12)	29 (26.13)	34 (25.56)	1.00	(0.93, 1.09)	0.9206
Marijuana	27 (25.23)	26 (29.21)	39 (25.32)	38 (32.20)	28 (34.15)	24 (21.62)	29 (21.48)	0.98	(0.92, 1.03)	0.4088
Drug other than Marijuana	23 (21.50)	15 (16.85)	28 (18.18)	30 (25.42)	18 (21.95)	17 (15.32)	26 (19.26)	0.99	(0.92, 1.06)	0.7691
Methamphetamines††	1 (0.93)	5 (5.62)	6 (3.90)	4 (3.39)	3 (3.66)	4 (3.60)	3 (2.22)	0.96	(0.81, 1.14)	0.671
Painkillers	8 (7.48)	8 (8.99)	18 (11.69)	13 (11.02)	8 (9.76)	4 (3.60)	7 (5.19)	0.90	(0.81, 1.00)	0.0543
Poppers (Amyl Nitrate)	4 (3.74)	4 (4.49)	10 (6.49)	7 (5.93)	6 (7.32)	7 (6.31)	12 (8.89)	1.13	(0.99, 1.29)	0.0736
Powdered Cocaine (Non-injection)	5 (4.67)	5 (5.62)	10 (6.49)	6 (5.08)	5 (6.10)	5 (4.50)	10 (7.41)	1.04	(0.90, 1.19)	0.6089
X or Ecstasy	4 (3.74)	1 (1.12)	2 (1.30)	7 (5.93)	1 (1.22)	5 (4.50)	4 (2.96)	1.04	(0.85, 1.27)	0.6895
Downers	6 (5.61)	4 (4.49)	11 (7.14)	12 (10.17)	6 (7.32)	7 (6.31)	8 (5.93)	1.01	(0.90, 1.14)	0.8597
Hallucinogens	6 (5.61)	4 (4.49)	5 (3.25)	7 (5.93)	3 (3.66)	4 (3.60)	6 (4.44)	0.95	(0.80, 1.14)	0.5921
(c) Aged 30-39 (years)										
Totals (n=795)	135	147	135	82	85	120	91			

Illicit Drug Use	38 (28.15)	44 (29.93)	42 (31.11)	22 (26.83)	31 (36.47)	31 (25.83)	31 (34.07)	1.02	(0.97, 1.08)	0.4431
Injection Drug Use†**	7 (5.19)	8 (5.44)	6 (4.44)	2 (2.44)	6 (7.06)	7 (5.83)	11 (12.09)	**1.18**	**(1.03, 1.35)**	**0.0371**
Non-Injection Drug Use**	37 (27.41)	43 (29.25)	42 (31.11)	22 (26.83)	30 (35.29)	29 (24.37)	25 (27.78)	1.02	(0.95, 1.09)	0.6137
Marijuana	28 (20.74)	33 (22.45)	31 (22.96)	15 (18.29)	18 (21.18)	18 (15.00)	21 (23.08)	0.99	(0.92, 1.06)	0.668
Drug other than Marijuana	26 (19.26)	31 (21.09)	26 (19.26)	16 (19.51)	18 (21.18)	20 (16.67)	23 (25.27)	1.02	(0.95, 1.09)	0.6761
Methamphetamines††	3 (2.22)	10 (6.80)	6 (4.44)	3 (3.66)	7 (8.24)	9 (7.50)	10 (10.99)	**1.18**	**(1.03, 1.36)**	**0.021**
Painkillers	3 (2.22)	11 (7.48)	12 (8.89)	4 (4.88)	5 (5.88)	4 (3.33)	4 (4.40)	0.95	(0.84, 1.09)	0.4789
Poppers (Amyl Nitrate)	5 (3.70)	16 (10.88)	12 (8.89)	2 (2.44)	9 (10.50)	11 (9.17)	9 (9.89)	1.06	(0.94, 1.18)	0.3406
Powdered Cocaine (Non-injection)	4 (2.96)	10 (6.80)	12 (8.89)	6 (7.32)	11 (12.94)	3 (2.50)	6 (6.59)	1.02	(0.91, 1.14)	0.7362
X or Ecstasy	1 (0.74)	2 (1.36)	5 (3.70)	0 (0.00)	5 (5.88)	2 (1.67)	3 (3.30)	1.12	(0.91, 1.37)	0.2888
Downers	1 (0.74)	4 (2.72)	4 (2.96)	3 (3.66)	4 (4.71)	3 (2.50)	1 (1.10)	1.02	(0.86, 1.22)	0.8180
Hallucinogens	3 (2.22)	2 (1.36)	3 (2.22)	2 (2.44)	3 (3.53)	1 (0.83)	1 (0.10)	0.90	(0.71, 1.15)	0.3887
(d) Aged 40+ (years)										
Totals (n=2628)	458	398	378	362	392	338	302			
Illicit Drug Use	86 (18.78)	70 (17.59)	81 (21.43)	70 (29.34)	70 (17.86)	72 (21.30)	51 (16.89)	1.00	(0.96, 1.04)	0.9252
Injection Drug Use†**	15 (3.28)	18 (4.52)	22 (5.82)	26 (7.18)	31 (7.91)	12 (3.55)	18 (5.96)	1.04	(0.94, 1.15)	0.4135
Non-Injection Drug Use**	80 (17.58)	67 (16.88)	80 (21.51)	69 (19.44)	69 (17.88)	72 (21.62)	51 (17.11)	0.97	(0.91, 1.03)	0.3004
Marijuana	69 (15;.07)	49 (12.31)	53 (14.02)	54 (14.92)	54 (13.78)	58 (17.16)	41 (13.58)	1.01	(0.97, 1.06)	0.5821
Drug other than Marijuana	47 (10.26)	40 (10.05)	52 (13.76)	46 (12.71)	38 (9.69)	38 (11.24)	32 (10.60)	1.00	(0.95, 1.06)	0.8844
Methamphetamines††	6 (1.31)	10 (2.51)	14 (3.70)	14 (3.87)	9 (2.30)	6 (1.78)	5 (1.66)	0.99	(0.89, 1.10)	0.8683
Painkillers	11 (2.40)	8 (2.01)	15 (3.97)	9 (2.49)	10 (2.55)	9 (2.66)	8 (2.65)	1.01	(0.90, 1.14)	0.7977
Poppers (Amyl Nitrate)	12 (2.62)	20 (5.03)	36 (9.52)	24 (6.63)	26 (6.63)	28 (8.28)	20 (6.62)	**1.10**	**(1.03, 1.18)**	**0.0055**
Powdered Cocaine (Non-injection)	7 (1.53)	10 (2.51)	6 (1.59)	13 (3.59)	9 (2.30)	6 (1.78)	4 (1.32)	0.98	(0.87, 1.11)	0.7915
X or Ecstasy	1 (0.22)	3 (0.75)	5 (1.32)	5 (1.38)	3 (0.77)	3 (0.89)	1 (0.33)	1.02	(0.85, 1.21)	0.8570
Downers	2 (0.44)	8 (2.01)	7 (1.85)	7 (1.93)	5 (1.28)	5 (1.48)	4 (1.32)	1.04	(0.91, 1.20)	0.5581
Hallucinogens	1 (0.22)	1 (0.25)	1 (0.26)	5 (1.38)	2 (0.51)	6 (1.78)	3 (0.99)	**1.31**	**(1.04, 1.65)**	**0.0329**

* Adjusted for Region of Residence and Race/Ethnicity

** Missing values for reported substance use behavior: Injection Drug Use - 3 missing observations among participants aged 15-24 years, 2 missing observations among participants aged 25-29 years, 1 missing observations among participants aged 30-39 years, 3 missing observations among participants aged 40+ years; Non-Injection Drug Use - 22 missing observations among participants aged 15-24 years, 16 missing observations among participants aged 25-29 years, 4 missing observations among participants aged 30-39 years, 45 missing observations among participants aged 40+ years

† Participants reported on having ever injected an illicit substance rather than in the previous 12 months

†† Participants reported use of any methamphetamines, including both injection and non-injection methamphetamines, in the previous 12 months

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