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## Mental Health and Substance Use Disorder Comorbidity among Methamphetamine-Using Men who have Sex with Men

Jesse B. Fletcher, Ph.D.<sup>1</sup>, Dallas Swendeman, MPH, Ph.D.<sup>2</sup>, and Cathy J. Reback, Ph.D.<sup>3</sup>

<sup>1</sup>Research Scientist; Friends Research Institute, Inc.

<sup>2</sup>Core Scientist, Co-Director; Center for HIV Identification, Prevention and Treatment Services, University of California, Los Angeles

<sup>3</sup>Executive Research Scientist; Friends Research Institute, Inc; David Geffen School of Medicine, Semel Institute of Neuroscience and Human Behavior, University of California, Los Angeles

### Abstract

Men who have sex with men (MSM) exhibit elevated rates of mental health and substance use disorder relative to their non-MSM male counterparts. Methamphetamine use in particular has been associated with both neuronal damage and mental health disorders among MSM, and this study reports on the prevalence and comorbidity of DSM-5 mental health and substance use disorders in a sample of methamphetamine-using MSM. From March 2014 through January 2015, 286 methamphetamine-using MSM enrolled in a study to reduce methamphetamine use and sexual risk behaviors. At baseline, participants demonstrated high rates of current major depressive episode (35.8%), antisocial personality disorder (23.9%), suicide risk (23.2%), obsessive-compulsive disorder (23.2%), and social phobia (20.4%), as well as methamphetamine use disorder (89.1%), marijuana use disorder (41.0%), alcohol use disorder (39.6%), cocaine use disorder (30.9%), and inhalants use disorder (15.4%). Analyses revealed significant ( $p < 0.05$ ) associations between methamphetamine use disorder severity and all listed mental health disorders, as well as between alcohol use disorder and all listed mental health disorders. Mental health disorder prevalence and substance use disorder severity were both elevated, and both methamphetamine and alcohol use disorder severity were associated with increased likelihood of comorbid mental health disorder.

### Keywords

men who have sex with men; methamphetamine; mental health disorder; substance use disorder severity; DSM-5

### INTRODUCTION

Meta-analytic evidence (King et al., 2008), as well as recent population-based estimates of mental health and substance use disorder prevalence among gay and bisexual men in the

United States (U.S.; Kerridge et al., 2017) demonstrate significantly elevated rates of diagnostic mental health and substance use disorders among gay, bisexual, and other men who have sex with men (MSM) compared to their non-MSM counterparts. Relative to general surveys of adult males in the U.S., MSM in the U.S. demonstrate elevated prevalence of past year major depressive disorder (14–17% vs. 7%), antisocial personality disorder (4–19% vs. 6%), as well as social phobia (7–8% vs. 2%; Center for Behavioral Health Statistics and Quality 2016; Grant et al., 2015; Kerridge et al., 2017). MSM in the U.S. also demonstrate elevated rates of past year alcohol use disorder (27–31% vs. 13%) and drug use disorder (7–10% vs. 5%; Grant et al., 2015; Kerridge et al., 2017) relative to non-MSM men.

Among drugs of abuse, methamphetamine use is especially prevalent among MSM in the U.S., particularly on the West Coast (Maxwell & Rutkowski 2008; Gonzales, Mooney, & Rawson 2010; Freeman, et al., 2011; Reback et al., 2013; Reilly et al., 2014). Although rates of methamphetamine use among communities of MSM vary widely, observed usage rates among samples of MSM are consistently at least an order of magnitude greater than those observed among males in the U.S. general population, which is estimated at 0.4% (Center for Behavioral Health Statistics and Quality 2015; Center for Behavioral Health Statistics and Quality 2016). Methamphetamine use disorder has been associated with both neurological damage (Hides et al., 2015; Northrop & Yamamoto 2015; Rusyniak 2013) and increased prevalence of a mental health disorder (Akinidipe, Wilson, & Stein 2014) among users, and among MSM specifically methamphetamine use is associated with significant increases in risk for HIV infection (Halkitis, Levy, & Solomon 2016). Mental health likely mediates and/or moderates associations between methamphetamine and engagement in HIV sexual risk among MSM (e.g., Alvy et al., 2011; Fletcher & Reback, 2015), further highlighting the importance of mental health and substance use comorbidity among MSM in the U.S., particularly methamphetamine-using MSM.

Although several studies have demonstrated the existence of elevated mental health distress, severity, or symptomology among MSM in the U.S., most have employed non-diagnostic psychometric assessments (e.g., Mustanski, Garofalo, Herrick, & Donenberg, 2007; Fendrich et al., 2013; Hirshfield et al., 2008), which provide valid indications of mental health concerns but which can also be difficult to relate to each other and/or to standardized psychiatric diagnoses. To date, only two peer-reviewed studies have assessed diagnostic comorbidity of mental health disorder and substance use disorders among substance-using MSM. One study included only diagnostic assessment of depressive disorders and did not report comorbidities with substances other than methamphetamine (Bousman et al. 2009), while the other included both homelessness and a current substance use disorder as eligibility criteria (Fletcher & Reback 2016), limiting generalizability. Both studies used the now outdated “abuse/dependence” operationalization from the DSM-IV. Thus, in spite of the critical relevance of mental health and substance use disorder for the health of MSM, there are currently no studies which provide estimates of the prevalence, severity, or comorbidity of DSM-5 diagnostic mental health and substance use disorder among samples of substance-using MSM.

The current report begins to fill this gap by providing associations between current diagnostic mental health disorder and the severity of current substance use disorder among methamphetamine-using MSM. Given the findings reviewed above, it was hypothesized that diagnosis with a current mental health disorder would be positively associated with the severity (i.e., none, mild, moderate, severe) of diagnostic substance use disorder.

## METHODS

### Participants

Participants (N=286) were enrolled from March 2014 through January 2016. Individuals were eligible if they reported any methamphetamine use within the previous three months, and condomless anal intercourse (insertive or receptive) with a non-primary male partner in the previous six months, were not currently in treatment or seeking methamphetamine abuse treatment, were between the ages of 18 and 65 years at intake, and were able to comply with study requirements and provide informed consents. Inability to meet all criteria, understand the Informed Consent Form, or baseline diagnosis with a serious mental health condition that was beyond the safe enrollment of the study procedures (such as those assessed as being in a current manic or psychotic episode, not taking medication for those conditions, and/or unwilling to be referred to a local mental health clinic for a psychiatric evaluation) deemed a potential participant as ineligible. One participant was excluded from analysis due to incomplete all baseline measures, giving a final sample size of 285. All study procedures were approved by the Friends Research Institute, Inc. and UCLA Institutional Review Boards.

### Assessment

The Structured Clinical Interview for the Diagnostic Statistical Manual of Mental Disorders—Fifth Edition (SCID; First, Williams, Karg, & Spitzer 2016) was administered by a trained research assistant at baseline and assessed current and lifetime major depressive episode, dysthymia, suicide risk, mania, hypomania, panic disorder, social phobia, obsessive-compulsive disorder, post-traumatic stress disorder, generalized anxiety disorder, and antisocial personality disorder. Mental health disorders are operationalized dichotomously (0= absent; 1 = present). The SCID also assessed current substance use disorder severities, from none (0), mild (1), moderate (2), to severe (3). Substances assessed included alcohol, cocaine (powder or rock), marijuana, methamphetamine, and inhalants (e.g., amyl nitrite).

### Statistical Analysis

Counts and percentages are provided for all mental health and substance use disorders. The percentages in Table 1 represent the distribution of participants with a given mental health designation for each class of drug use disorder (number of patients with mental health disorder / number of participants with equivalent severity of substance use disorder). Tabulation and associational analyses include only those mental health and substance use disorders currently affecting at least 15% of the total sample to allow for sufficient power during significance tests and cell frequencies during cross tabulation. Pearson's chi-square and Fisher's Exact analyses were used to assess significant association between mental health disorders and substance use disorder severities. Over- and under-representation

among cell frequencies can be assessed by comparing each cell percentage with the corresponding percentage along the left-hand column of Table 1. Associations between current mental health disorders were assessed through tetrachoric correlation analysis. Tetrachoric correlations conform to the format of Pearson's correlational coefficients (i.e., they vary from  $-1$  to  $+1$ , and larger deviations from zero indicate stronger associations between variables), but are designed for use when both variables being correlated are dichotomous. Correlations among substance use disorder severities were estimated using Spearman's rank correlation coefficient, given the expected monotonic nature of the relationship and the ordinal nature of the diagnoses. All correlation coefficients are reported as *rho*. All significant tests are two-tailed, results are considered significant at  $\alpha = 0.05$ , and all analyses were carried out using Stata v13SE.

## RESULTS

The sample averaged 42 years of age ( $SD = 11$ ), predominantly identified as African American/ Black (44%) or Hispanic/Latino (25%), and self-identified as gay (67%). Table 1 demonstrates the most prevalent diagnoses of mental health disorders at baseline, which are arrayed along the columns. These include current major depressive episode (36%), antisocial personality disorder (24%), suicide risk (23%), obsessive-compulsive disorder (23%), and social phobia (20%). Not reaching the tabulation threshold of 15% prevalence were posttraumatic stress disorder (9%), mania (8%), generalized anxiety disorder (8%), panic disorder (7%), dysthymia (5%), and hypomania (4%). The most prevalent substance use disorders at baseline are listed in descending order down the rows, each arrayed by diagnostic severity, and include methamphetamine use disorder (80% prevalence), marijuana use disorder (41%), alcohol use disorder (40%), cocaine use disorder (31%), and inhalants use disorder (15%). Disorders for opiate (9%), hallucinogen (7%), non-opiate sedative (7%), amphetamine-type stimulant (4% prevalence), and PCP (1%) use disorders were also assessed.

Associational tests between substance use disorder severity and mental health disorder diagnosis in Table 1 revealed significant variation between methamphetamine use disorder and all tabulated mental health disorders, as well as between alcohol use disorder and all tabulated mental health disorders. Marijuana use disorder was associated with all tabulated mental health disorders except suicide risk, and cocaine use disorder was associated only with diagnosis of antisocial personality disorder. Inhalant use disorder was unassociated with mental health disorder diagnoses.

Table 2 presents the tetrachoric (top half) and Spearman's rank correlations (bottom half) within baseline mental health disorders and substance use disorder severities, respectively. As the top half of Table 2 demonstrates, all mental health diagnoses were significantly associated with one another, ranging from a *rho* of 0.35 (antisocial personality disorder and suicide risk) to a *rho* of 0.67 (major depressive episode and social phobia; all correlations  $p < 0.01$ ). The bottom half demonstrates a similar pattern among substance use disorder severities, with *rho* ranging from 0.16 (cocaine use disorder severity and inhalant use disorder severity) to 0.36 (alcohol use disorder severity and cocaine use disorder severity; all correlations  $p < 0.01$ ).

## DISCUSSION

This sample of predominantly gay-identified, predominantly racial/ethnic minority, substance-using MSM demonstrated increased prevalence of comorbid mental health and substance use disorder relative to comparable rates observed among the U.S. general population (63% vs. 3%; Center for Behavioral Health Statistics and Quality 2016). Relative to a recent nationally representative sample of MSM, the participants in this sample evidenced greater prevalence of current major depression (36% vs. 14–17%), social phobia (20% vs. 7–8%), antisocial personality disorder (24% vs. 4–19%), panic disorder (7% vs. 4–6%), and comparable rates of posttraumatic stress disorder (9% vs. 6–10%) and generalized anxiety disorder (8% vs. 8–10%). Additionally, participants in the current study demonstrated greater prevalence of current alcohol (40% vs. 27–31%) and/or drug use (92% vs. 7–10%) disorders (Kerridge et al., 2017). Rates of mental health and substance use disorder prevalence in this sample were nearer in magnitude to those observed among homeless, substance-dependent MSM (Fletcher & Reback 2016) than among MSM in the general U.S. population (Kerridge et al., 2017).

Methamphetamine use disorder severity at baseline was associated with current major depressive episode, antisocial personality disorder, suicide risk, obsessive-compulsive disorder, and social phobia. Chronic methamphetamine use is associated with neuronal damage and loss (Panenka et al., 2013; Cadet, Jayanthi, & Deng 2005) as well as the disruption of healthy social relationships (Boshears, Boeri, & Harbry 2011) and health maintenance behaviors (e.g., medication adherence: Moore et al., 2012; Reback, Larkins, & Shoptaw, 2003), all of which may generate and/or exacerbate mental health issues and contribute to the associations observed. Prior general population studies of methamphetamine's effects on mental health have focused predominantly on methamphetamine-induced psychoticism (Grant et al., 2012), although preliminary evidence does support associations between methamphetamine and a broader range of mental health disorders, including depression, suicidality, and anxiety disorders (Akinidipe, Wilson, & Stein 2014; Marshall et al., 2011; Glasner-Edwards et al., 2009). It is interesting to note that a similar set of analyses using DSM-IV diagnosis for methamphetamine dependence (i.e., dichotomous) did not find significant associations between methamphetamine use disorder and a broad range of mental health diagnoses (Fletcher & Reback 2016). This difference may reflect differences in the eligibility criteria of the two studies, or may be due to the more nuanced information provided by the DSM-5 severity schemata (i.e., ordinal arrays of diagnostic severity may allow for more informative statistical contrasts).

Alcohol use disorder severity at baseline was also associated with current major depressive episode, antisocial personality disorder, suicide risk, obsessive-compulsive disorder, and social phobia. Representative samples of gay and bisexual men in the U.S. have demonstrated significant associations between alcohol use disorder and the presence of comorbid mental health disorders (Lee et al., 2015; Compton et al. 2005). These associations were corroborated in this sample of methamphetamine-using MSM. Like methamphetamine, alcohol dependence or abuse erodes physical health and healthy social relationships (Room, Babor, & Rehm 2005), which may contribute to mental health disorder and which may explain the associations observed here. Further, meta-analytic data suggest alcohol and

methamphetamine use are uniquely associated with increased engagement in sexual risk behavior among MSM (Vosburgh, Mansergh, Sullivan, & Purcell 2012), increasing risk of exposure to HIV/STIs and further endangering their physical and mental health.

Marijuana use disorder severity was associated with each of the same mental health disorders as alcohol except suicide risk, and cocaine use disorder severity was associated only with antisocial personality disorder. Marijuana has been associated with major depressive episode in prior population-based studies (Chen, Wagner & Anthony 2002), though meta-analytic results demonstrate consistent associations between marijuana use and psychoticism only (Moore et al., 2007). As marijuana legalization becomes more common in the US and globally, it is critical to understand the effects of marijuana use disorder, particularly among vulnerable populations.

More than 40% of participants diagnosed with current antisocial personality disorder in this study were also diagnosed with a current cocaine use disorder. Several prior studies have also noted significantly elevated rates of cocaine use disorder and antisocial personality disorder comorbidity (e.g., Rutherford, Cacciola, & Alderman, 1999; Moeller et al., 1997; Leal, Ziedonis, & Kosten, 1994; Carroll, Ball, & Rounsaville, 1993). The relevance of this high rate of comorbidity hinges on recent evidence suggesting that behavioral economics interventions to reduce stimulant use (such as contingency management) may be particularly effective among participants diagnosed with antisocial personality disorder, including among MSM. Antisocial personality disorder, though often viewed as counterproductive for substance use treatment outcomes, may actually be leveraged through the provision of earnable rewards for stimulant abstinence to generate better-than-average outcomes among MSM diagnosed with the disorder (Fletcher & Reback, 2013; Messina, Farabee, & Rawson, 2003). Given the relatively high prevalence of antisocial personality disorder in this and other samples of stimulant-using MSM (e.g., Messina, Farabee, & Rawson, 2003; Fletcher & Reback, 2013; Fletcher & Reback, 2016), such insights provide an important bulwark of action for interventionists working with this and similar populations.

Correlational analyses revealed significant association between all pairs of mental health disorders, as well as between all paired combinations of substance use disorder severities. Comorbidity among mental health and substance use disorders is not uncommon, with an estimated lifetime prevalence of 27.7% in the U.S. general population (Kessler et al., 2005). It is interesting to note that correlation among mental health disorders were almost universally greater in magnitude than those found among substance use disorders.

Evidence indicates that patterns of substance use among MSM are subject to dramatic regional variation (e.g., Maxwell & Rutkowski 2008; Gonzales, Mooney, & Rawson 2010), with different substances or constellations of substances reaching prominence or popularity at different times in different areas of the U.S. The current report provides granular associations between the most common substance use disorders among MSM and a broad spectrum of mental health disorder diagnoses. Interventionists working with substance-using MSM may refer to this for information on the mental health referrals, services, or treatment most likely to be relevant and beneficial for their local population. Additionally, psychiatric professionals working with substance-using MSM may refer to these findings to better

understand which substance use disorders are most likely to co-occur at higher severity levels with specific diagnostic mental health disorders.

This study was limited by its sampling design (i.e., participants self-enrolled in a study to reduce methamphetamine use and HIV sexual risk behaviors), and results may not be generalizable to samples of MSM who do not use methamphetamine and/or do not seek to reduce their HIV sexual risk behaviors. The study was conducted in an urban West Coast city, and findings could differ even among methamphetamine-using MSM from other geographical areas or from rural locations. Given limited statistical power, the study was restricted in its ability to reach conclusions about disorders exhibiting low prevalence (e.g., panic disorder, hallucinogen use disorder severity), or to account for the shared or interactive impacts of comorbid substance use/mental health disorders through the application of multivariate/multivariable analyses. Limitations notwithstanding, this report provides important estimates of current DSM-5 mental health disorders and substance use disorder severities, including comorbidities, among methamphetamine-using MSM. Importantly, rates of mental health disorder in this sample were significantly elevated relative to those found among MSM in the general population, suggesting mental health counseling or treatment may be indicated for those seeking treatment for methamphetamine use.

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**Table 1**  
Prevalence and Comorbidity of Mental Health and Substance Use Disorders among Methamphetamine-using MSM (N = 285)

	Major Depressive Episode (n = 102; 35.8%)	Antisocial Personality Disorder (n = 68; 23.9%)	Suicide Risk (n = 66; 23.2%)	Obsessive-Compulsive Disorder (n = 66; 23.2%)	Social Phobia (n = 58; 20.4%)
	n (%)	n (%)	n (%)	n (%)	n (%)
<b>Methamphetamine Use Disorder</b>					
None (n = 31; 10.9%)	7 (22.6%)	4 (12.9%)	6 (19.4%)	4 (12.9%)	2 (6.5%)
Mild (n = 36; 12.6%)	$\chi^2 = 15.4$	$\chi^2 = 11.4$	$\chi^2 = 9.1$	$\chi^2 = 8.3$	$\chi^2 = 8.4$
Moderate (n = 35; 12.3%)	<b>p = 0.001**</b>	<b>p = 0.009</b>	<b>p = 0.026</b>	<b>p = 0.045</b>	<b>p = 0.037</b>
Severe (n = 183; 64.2%)	80 (43.7%)	55 (30.1%)	52 (28.4%)	52 (28.4%)	46 (25.1%)
<b>Marijuana Use Disorder</b>					
None (n = 168; 59.0%)	44 (26.2%)	31 (18.5%)	38 (22.6%)	27 (16.1%)	23 (13.7%)
Mild (n = 43; 15.1%)	$\chi^2 = 19.4$	$\chi^2 = 14.3$	$\chi^2 = 2.9$	$\chi^2 = 14.5$	$\chi^2 = 20.0$
Moderate (n = 31; 10.9%)	<b>p = 0.001</b>	<b>p = 0.003</b>	<b>p = 0.431</b>	<b>p = 0.002</b>	<b>p = 0.001</b>
Severe (n = 43; 15.1%)	24 (55.8%)	19 (44.2%)	14 (32.6%)	18 (41.9%)	18 (41.9%)
<b>Alcohol Use Disorder</b>					
None (n = 172; 60.4%)	47 (27.3%)	28 (16.3%)	38 (22.1%)	28 (16.3%)	26 (51.1%)
Mild (n = 23; 8.1%)	$\chi^2 = 18.1$	$\chi^2 = 16.1$	$\chi^2 = 10.9$	$\chi^2 = 22.5$	$\chi^2 = 15.6$
Moderate (n = 22; 7.7%)	<b>p = 0.001</b>	<b>p = 0.001</b>	<b>p = 0.015</b>	<b>p = 0.001</b>	<b>p = 0.002</b>
Severe (n = 68; 23.9%)	38 (55.9%)	26 (38.2%)	24 (35.3%)	30 (44.1%)	25 (36.8%)
<b>Cocaine Use Disorder</b>					
None (n = 197; 69.1%)	65 (33.0%)	40 (20.3%)	49 (25.9%)	42 (21.3%)	39 (19.8%)
Mild (n = 16; 5.6%)	$\chi^2 = 2.4$	$\chi^2 = 11.9$	$\chi^2 = 1.8$	$\chi^2 = 3.6$	$\chi^2 = 3.9$
Moderate (n = 13; 4.6%)	<b>p = 0.474</b>	<b>p = 0.008</b>	<b>p = 0.720</b>	<b>p = 0.309</b>	<b>p = 0.309</b>
Severe (n = 59; 20.7%)	25 (42.4%)	23 (39.0%)	13 (22.0%)	18 (30.5%)	16 (27.1%)
<b>Inhalants Use Disorder</b>					
None (n = 241; 84.6%)	80 (33.2%)	57 (23.7%)	51 (21.2%)	50 (20.8%)	44 (18.3%)
Mild (n = 19; 6.7%)	$\chi^2 = 4.7$	$\chi^2 = 0.3$	$\chi^2 = 4.5$	$\chi^2 = 5.7$	$\chi^2 = 6.4$
Moderate (n = 11; 3.9%)	<b>p = 0.174</b>	<b>p = 0.930</b>	<b>p = 0.188</b>	<b>p = 0.104</b>	<b>p = 0.085</b>
Severe (n = 14; 4.9%)	7 (50.0%)	4 (28.6%)	6 (42.9%)	6 (42.9%)	3 (21.4%)

\* Includes disorders affecting at least 15% of participants, arrayed in descending order of prevalence; percentages in the body of the table reflect participants at each level of disorder severity diagnosed with the mental health disorder heading the column.

\*All p values in this table were calculated using Fisher's Exact Test.

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**Table 2**  
 Bivariate Tetrachoric Correlations between DSM-5 Mental Health Disorders and Spearman's Rank Correlations between DSM-5 Substance Use Disorder Severities (N = 285)

	Major Depressive Episode	Antisocial Personality Disorder	Suicide Risk	Obsessive-Compulsive Disorder	Social Phobia
Major Depressive Episode	1	-	-	-	-
Antisocial Personality Disorder	0.389***	1	-	-	-
Suicide Risk	0.515***	0.346**	1	-	-
Obsessive-Compulsive Disorder	0.634***	0.406***	0.453***	1	-
Social Phobia	0.671***	0.364***	0.502***	0.585***	1

  

	Methamphetamine	Marijuana	Alcohol	Cocaine	Inhalants
Methamphetamine	1	-	-	-	-
Marijuana	0.245***	1	-	-	-
Alcohol	0.250***	0.239***	1	-	-
Cocaine	0.180**	0.307***	0.356***	1	-
Inhalants	0.185**	0.213***	0.238***	0.156**	1

\*\* p 0.01;

\*\*\* p 0.001; all sig. tests two-tailed