

Hallucinogen use and intimate partner violence: Prospective evidence consistent with protective effects among men with histories of problematic substance use

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Abstract

Evidence suggests that hallucinogens may have therapeutic potential for addressing a variety of problem behaviors related to the externalizing spectrum of psychopathology, such as substance misuse and criminality. Intimate partner violence (IPV) is a prevalent form of criminal violence that is related to externalizing pathology. However, the association between hallucinogen use and IPV has not been comprehensively examined. In this prospective study, we examined the association between IPV and naturalistic hallucinogen use among 302 inmates at a US county jail. Cox regression analyses indicated that hallucinogen use predicted reduced arrest for IPV independently ($\beta = -0.54$, $SE = 0.20$, $\chi^2 = 7.19$, $\exp(B) = 0.58$, $p < 0.01$) and after accounting for covariates ($\beta = -0.48$, $SE = 0.23$, $\chi^2 = 4.44$, $\exp(B) = 0.62$, $p < 0.05$). These results add to a growing literature suggesting distinct therapeutic potential for hallucinogens to assist in the attenuation of problematic behavior.

Keywords

Hallucinogens, psychedelic, intimate partner violence, domestic violence

Recidivism

The medical, spiritual, and social use of psychoactive substances generally classified as hallucinogens, also known as psychedelics and entheogens, can be traced to antiquity (Nichols, 2004). In the context of contemporary health science, preliminary studies suggest that hallucinogens may have therapeutic potential for addressing a variety of psychological and behavioral problems, including externalizing behaviors such as substance misuse (e.g., Bogenschutz et al., 2015; Johnson et al., 2014) and criminality (Hendricks et al., 2014). However, despite considerable interest in the therapeutic potential of hallucinogens, the extent to which hallucinogen use might influence risk for externalizing behavior has not been definitively determined.

Hallucinogens encompass a diverse group of substances that affect cognition and perception. The effects of hallucinogens are varied and can include the induction of transcendent and mystical experiences, altered states of self-awareness, and pseudo-hallucinations (Griffiths et al., 2006; Johnson et al., 2008; Vollenweider and Kometer, 2010). The most commonly used hallucinogens are the “classic psychedelics,” which are serotonin 2A (5-HT_{2A}) receptor agonists such as lysergic acid diethylamide (LSD), and psilocybin, but also include less widely used substances such as mescaline and dimethyltryptamine (DMT). However, the broad class of hallucinogens extends beyond these “classic psychedelics” to include substances with other primary modes of actions such as ketamine, phenylcyclidine (PCP), ibogaine, *Salvia divinorum*, and methylenedioxymethamphetamine (MDMA) (Bogenschutz and Pommy, 2012; Nichols, 2004; Vollenweider and Kometer, 2010).

Diverse cultural groups such as the Shipibo of Peru, the Huichol of Mexico, and the Bwiti of Gabon have long-standing and well-developed traditions of incorporating hallucinogens into the care of mental and physical health (Richards, 2014; Schultes et al., 2001). In contrast, the introduction of hallucinogens to Western medicine is relatively recent, and the determination of the therapeutic potential of these substances has been hampered by strict legal limitations on research (Nutt et al., 2013). As a result, most studies of hallucinogens and behavioral health were conducted prior to the tightening of restrictions in the late 1960s. One focus of this early research was on addressing concerns related to the externalizing spectrum of psychopathology, such as problematic substance use, and antisocial and impulsive behavior (Krueger

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et al., 2005). With regard to antisociality, two studies of men in forensic settings reported positive personality change following LSD-assisted psychotherapy (Arendsen-Hein, 1963; Tenenbaum, 1961), and a study of a complex therapy that included concurrent administration of LSD and methamphetamine reported subjective benefits for participants but no observable differences (Barker and Buck, 1977). A study using psilocybin among incarcerated men also reported positive personality change (Leary, 1969), but failed to identify any effect on criminal recidivism (Doblin, 1998). Studies of the efficacy of LSD for the treatment of problematic use of alcohol and opiates also produced promising results (Krebs and Johanson, 2012; Savage and McCabe, 1973), but calls for further research in this area have remained largely unanswered (Pahnke et al., 1970; Hendricks, 2014).

The few more recent studies that have examined the influence of hallucinogens on externalizing problems have yielded findings that are generally positive. Two studies have reported reductions in problematic substance use following brief ketamine-assisted psychotherapy (Krupitsky et al., 2002, 2007), and pilot trials of psilocybin-assisted treatment suggest efficacy for both alcohol and tobacco dependence (Bogenschutz et al., 2016; Johnson et al., 2014). The psychoactive admixture ayahuasca, which includes DMT among its active constituents, has also received recent empirical attention. Results of a preliminary examination suggest potential for reducing problematic cocaine use (Thomas et al., 2013), and decreased levels of partner conflict and substance misuse have been reported among frequent ayahuasca users (Grob et al., 1996). The most compelling evidence of the potential effectiveness of hallucinogens for reducing criminality comes from a recent large prospective study of individuals under community corrections supervision with a history of substance use (Hendricks et al., 2014). In this study, naturalistic hallucinogen use at intake, as reflected by the presence of a DSM-IV hallucinogen use disorder, was associated with a 40% reduced likelihood of supervision failure (i.e., recidivism). Among 15 predictors of recidivism, hallucinogen use proved the single strongest protective factor.

Intimate partner violence (IPV), also labeled “domestic violence,” involves violent acts in which the victim is a marital or dating partner of the perpetrator. Violence against intimate partners comprises a substantial proportion of all interpersonal violence and constitutes a major public health concern (Coker et al., 2002). Substance use has been identified as an important predictor of IPV perpetration (Foran and O’Leary, 2008; Moore et al., 2008), and research has demonstrated that treatment for substance abuse is associated with a decrease in IPV perpetration (Stuart et al., 2009). Although most IPV research has focused on alcohol use, illicit substances such as cocaine and methamphetamine have also been associated with an increased risk of perpetrating IPV (Ernst et al., 2008; Kramer et al., 2012). However, the nature of the relationship between substance use and violence appears to vary across psychoactive substances (Boles and Miotto, 2003; Hoaken and Stewart, 2003). For example, a recent prospective study reported a protective effect for cannabis use and IPV perpetration (Smith et al., 2014). The association between hallucinogen use and IPV has not been thoroughly examined, and the few extant findings are equivocal. Reviews of the substance use and violence literature concluded that there was not sufficient evidence that hallucinogen use represents a risk factor for general violence (Boles and Miotto, 2003; Hoaken and

Stewart, 2003). In contrast, a subsequent study of high-risk men identified hallucinogen use as a risk factor for IPV, even after controlling for antisocial personality (Feingold et al., 2008).

Research on the subjective effects of hallucinogens may be interpreted to suggest the potential for hallucinogens to improve interpersonal functioning and thus lead to decreased aggression and conflict between intimate partners. Specifically, the reported effects of hallucinogens include the enhancement of intimacy and affection, as noted in the proposed use of the term “empathogen” to describe a subcategory of hallucinogens (Adamson and Metzger, 1988), and subjective descriptions of hallucinogen-occasioned effects include greater interpersonal regard (Griffiths et al., 2006, 2011; McGlothlin et al., 1967). An interview-based study reported that marital satisfaction was the life area that evinced the greatest levels of positive change subsequent to a single administration of LSD, with reports of improved communication and reduced conflict (Fadiman, 2011). Complementary findings emerge from a study that reported that administration of MDMA resulted in the production of language consistent with increased intimate emotional communication (Baggott et al., 2015). Two of the few recent studies to administer a classic psychedelic reported increased positive social behaviors as observed by friends, co-workers, and intimate partners following experimental administration of psilocybin to hallucinogen-naïve adults (Griffiths et al., 2006, 2011). When examined one year later, participants retained gains in the personality domain of openness (MacLean et al., 2011), which by virtue of its relationship to empathy and broad-minded tolerance of others (Costa et al., 2014), may be important in decreasing violence.

In sum, although extant research is characterized by inconsistency and substantial gaps, preliminary and inferential evidence suggest that hallucinogen use may attenuate externalizing behaviors such as substance misuse and antisociality. The potential to decrease these behaviors and increase positive interpersonal functioning concurrently suggests that hallucinogen use may have protective effects for IPV perpetration, particularly among those with problematic substance use. The current longitudinal investigation is the first prospective evaluation of the relationship between hallucinogen use and IPV among a high-risk sample of incarcerated men with substance use disorders. We hypothesized that prior hallucinogen use would be associated with a reduced likelihood of post-release IPV.

Methods

Participants

Participants were 302 male inmates, aged 17–40 years, serving sentences of one year or less for felony or misdemeanor convictions at a county jail in Illinois, USA. Eligible inmates were contacted in alphabetical order from the jail roster and invited to participate as part of a larger study of personality pathology, substance use, and antisocial behavior. The mean age of the sample was 26.06 years ($SD=6.68$ years). With regard to ethnicity, 45.70% were European American, 40.73% were African American, and 13.58% were Latino Americans. Prior charges for violent crimes—defined as charges for robbery, assault, murder, weapons charges, kidnapping, and sex crimes other than indecent exposure—were identified for 71.52% of participants. Inclusion criteria also involved lifetime presence of at least one DSM-IV

substance use disorder (APA, 2000). Those who reported current use of psychotropic medication or who were unable to read English were excluded. Participants provided written informed consent, and they were paid to participate. The Institutional Review Board of Rosalind Franklin University of Medicine and Science approved the study.

Hallucinogen use

Hallucinogen use was assessed by interview during incarceration using the substance use disorder module of the Structured Clinical Interview for the DSM-IV (SCID-I; First et al., 2002), and was coded in two ways. The primary index was *any lifetime use of hallucinogens*. This liberal index provided the most inclusive classification of hallucinogen users. In order to conduct analyses that parallel prior research that identified a relationship between criminality and presence of a hallucinogen use disorder (Hendricks et al., 2014), we supplemented our analyses with the secondary, more conservative, index of *lifetime presence of a DSM-IV hallucinogen use disorder* based on positive identification of three or more of the seven dependence criteria, or one or more of the four abuse criteria together across the lifetime.

IPV

The criterion variable was arrest for an offence related to IPV (i.e., domestic battery) subsequent to release from incarceration. This information was coded based on the Law Enforcement Agencies Data System database, which combines state-level and national records to provide the most comprehensive available national index of US criminal arrests. This criterion was assessed prospectively, beginning with date of release from the period of incarceration during which the assessment of hallucinogen use and other baseline variables were assessed, and ending with IPV arrest, or the end of the follow-up period for those not arrested. This interval was measured in months and was adjusted to reflect incarceration during the follow-up period for reasons other than IPV.

Covariates

Psychopathic personality has been identified as among the most robust individual-level predictors of interpersonal violence (Hare et al., 2000), and is also associated with diverse forms of substance use (Smith and Newman, 1990; Walsh et al., 2007). In consideration of this pattern of relationships, we evaluated psychopathy as a covariate. Psychopathy was assessed by trained raters using the Psychopathy Checklist-Revised (PCL-R; Hare, 2003) based on interview and review of institutional files. The PCL-R is the most extensively validated tool for assessing psychopathy in correctional samples, and is included as a component of many actuarial risk assessment instruments (Hare, 2003). Because problematic alcohol use demonstrates robust associations with both violence (Foran and O'Leary, 2008) and substance use (Stinson et al., 2005), problematic alcohol use was also evaluated as a covariate. Evidence for a positive association between cannabis use and IPV is not robust, but cannabis has nonetheless been noted as a potentially important correlate of IPV (Moore et al., 2008). Lifetime numbers of symptoms of

alcohol and cannabis dependence were derived from dependence symptoms from the SCID-I (First et al., 2002). With regard to ethnicity, European American individuals are less likely than African American or Latino American individuals are to report being victims of violence and to be apprehended for the commission of a violent crime (Lauritsen and Sampson, 1998). Importantly, we do not consider ethnic identity to be a distinct cause of violence, but conceptualize it as a marker for demographic contexts in American society (Sampson et al., 2005). Nonetheless, in light of substantial ethnic disparities, the consideration of ethnicity is warranted when examining predictors of criminal violence. Ethnicity was based on classifications in the jail roster, which was based on self-report. Economic and educational disadvantage are also predictors of criminality (Ringel, 1996), and therefore we evaluated socioeconomic status and education as candidate covariates. Years of education was assessed via self-report, and socioeconomic status was rated using the Hollingshead Index (Hollingshead and Redlich, 1958), which is among the most widely used measures of socioeconomic status in psychological research (Ribas et al., 2003). Covariates were included in the analyses if preliminary analyses identified associations with both IPV and hallucinogen use.

Analysis

Survival analyses of time from release to IPV recidivism were conducted using Cox regression, a technique that allows for the examination of survival data after adjusting for covariates. Parallel analyses were conducted using both indices of hallucinogen use as criterion, and were also conducted with and without covariates. The level for declaring significance was set at $p < 0.05$. The mean follow-up time was 82.24 months (range=39–118 months, $SE=0.76$). Preliminary analyses indicated that participants who had used hallucinogens were followed for a slightly longer time (83.63 months, $SE = 1.00$) than were the non-user group (80.49 months, $SE=0.15$; $F(1, 300)=4.27$, $p=0.04$). Preliminary bivariate analyses of covariates were conducted using analyses of variance and a chi-square test.

Results

The mean survival time for the entire sample was 59.25 months ($SE=1.73$), and 33.44% ($n=101$) of participants were arrested for IPV. Lifetime use of hallucinogens was reported by 55.63% of participants ($n=168$), of whom 86.90% ($n=146$) reported using classic psychedelics (i.e., psilocybin, LSD, mescaline). Of those who reported having used classic psychedelics, 44.52% ($n=65$) also reported having used atypical hallucinogens (i.e., MDMA, PCP, ketamine). Criteria for lifetime hallucinogen use disorder was met by 13.09% ($n=22$) of those who reported hallucinogen use: 5.95% ($n=10$) met the criteria for dependence, and 7.14% ($n=12$) met the criteria for abuse. Of those who met the criteria for hallucinogen use disorder, 90.90% ($n=20$) reported lifetime use of classic psychedelics. All participants who met the criteria for hallucinogen use disorder also met the lifetime criteria for another substance use disorder. Preliminary bivariate analyses of covariates (Table 1) indicated that those with a history of any lifetime use of hallucinogens had more symptoms of alcohol dependence, and that European Americans were overrepresented

Table 1. Sample characteristics.

	All	Hallucinogen use			Hallucinogen use disorder			Intimate partner violence		
	<i>M (SD)</i>	Yes	No	<i>F/χ²</i>	Yes	No	<i>F/χ²</i>	Yes	No	<i>F/χ²</i>
		(<i>n</i> =168)	(<i>n</i> =134)		(<i>n</i> =22)	(<i>n</i> =280)		(<i>n</i> =101)	(<i>n</i> =201)	
	<i>M (SD)</i>				<i>M (SD)</i>				<i>M (SD)</i>	
Alcohol dependence	2.58 (2.37)	2.95 (2.47)	2.12 (2.16)	9.31*	3.36 (1.99)	2.52 (2.39)	2.61	2.97 (2.40)	2.38 (2.34)	4.16*
Cannabis dependence	2.03 (1.97)	2.19 (1.97)	1.83 (1.96)	2.37	3.14 (2.19)	1.94 (1.93)	7.67*	2.15 (2.02)	1.97 (0.94)	0.55
Psychopathy	23.72 (6.90)	24.29 (6.55)	23.01 (7.26)	2.57	26.50 (5.98)	23.50 (6.93)	3.88*	25.37 (6.06)	22.89 (7.15)	8.94*
Socioeconomic status	61.41 (7.79)	60.87 (7.86)	62.08 (7.69)	1.75	60.09 (8.82)	61.51 (7.72)	0.68	61.38 (7.69)	61.42 (7.87)	<0.01
Years of education	11.17 (1.78)	11.13 (1.86)	11.21 (1.70)	0.14	11.23 (1.93)	11.16 (1.78)	0.03	11.09 (1.64)	11.20 (1.86)	0.28
European American	45.70%	67.26%	18.67%	70.97*	90.90%	42.14%	19.55*	34.65%	51.24%	7.46*

Note: Hallucinogen use=lifetime hallucinogen use; Hallucinogen disorder=lifetime presence of DSM-IV hallucinogen abuse or hallucinogen dependence; intimate partner violence=arrest for offence related to intimate partner violence; alcohol dependence=number of lifetime symptoms of DSM-IV alcohol dependence; cannabis dependence=number of lifetime symptoms of DSM-IV cannabis dependence; psychopathy=scores on the Psychopathy Checklist Revised; socioeconomic status=scores on the Hollingshead Index; European American=European American or non-European American.

Table 2. Cox regression analyses predicting intimate partner violence.

	β	<i>SE</i>	χ^2	OR	<i>p</i>
<i>Step 1</i>					
Hallucinogen use	-0.54	0.20	7.19	0.58	<0.01
<i>Step 2</i>					
Hallucinogen use	-0.48	0.23	4.44	0.62	0.04
Alcohol dependence	0.10	0.04	5.55	1.11	0.02
Psychopathy	0.04	0.01	7.82	1.04	<0.01
Ethnicity	0.39	0.24	2.69	1.48	0.10
<i>Step 1</i>					
Hallucinogen disorder	-1.11	0.59	3.57	0.33	0.06
<i>Step 2</i>					
Hallucinogen disorder	-1.05	0.60	3.06	0.35	0.08
Alcohol dependence	0.09	0.04	4.69	1.09	0.03
Psychopathy	0.04	0.02	7.92	1.04	<0.01
Ethnicity	0.49	0.22	5.29	1.64	0.02

Note: Ethnicity=European American or non-European American; OR=odds ratio.

among hallucinogen users. Individuals with a lifetime presence of a hallucinogen use disorder were also more predominantly European American than were those without such a disorder, and evinced higher levels of psychopathy and more symptoms of cannabis dependence. Associations between covariates and IPV indicated that higher rates of IPV were predicted by higher levels of alcohol dependence, psychopathic personality, and non-European American ethnicity. Education, socioeconomic status, and symptoms of cannabis dependence were not predictive of IPV, and thus were not included in subsequent analyses.

Bivariate Cox regressions revealed that *any lifetime use of hallucinogens* was associated with lower rates of IPV (Table 2); 26.79% of the hallucinogen-use group were arrested for later IPV (mean survival time=62.76 months; *SE*=2.25) compared with 41.79% of the group that reported no hallucinogen use (mean survival time=54.85 months (*SE*=2.65); see Figure 1). Psychopathy, alcohol dependence symptoms, and ethnicity met the criteria for inclusion as covariates. Analyses with covariates indicated that the predictive power of hallucinogen use was maintained after

controlling for ethnicity, psychopathic personality, and alcohol use disorder (see Table 2).

Supplementary analyses examined the predictive power of *lifetime presence of a hallucinogen use disorder*. Analyses with this more conservative index evinced a comparable, but weaker, pattern of predictive relationships. Presence of a lifetime hallucinogen use disorder was associated at the trend level with lower rates of IPV arrest at the bivariate level, and after controlling for alcohol use, psychopathy, and ethnicity (Table 2); 13.64% of the lifetime hallucinogen-use disorder group were arrested for IPV (mean survival time=68.82 months; *SE*=3.49) compared with 35% of the group that reported no lifetime hallucinogen use disorder (mean survival time=58.50 months; *SE*=1.84).

Discussion

The identification of risk and protective factors for IPV is an important goal for health research. This prospective study is the first to test the predictive power of hallucinogen use for IPV, and we found evidence suggesting that hallucinogen use was protective for arrest for IPV perpetration across both an inclusive index of any lifetime use and a more exclusive index of lifetime presence of a hallucinogen use disorder. The observed effects were substantial. An examination of the proportions of participants who were arrested for IPV revealed that lifetime hallucinogen users were less than two thirds as likely to be arrested for perpetration of IPV as were those who did not report having used hallucinogens, and the relatively few participants who met criteria for a lifetime hallucinogen use disorder were less than half as likely as those without such a disorder to be arrested. These findings complement those of a recent study from a correctional setting that reported protective effects of current hallucinogen use for supervision failure (Hendricks et al., 2014). Moreover, our results extend those of that prior study by demonstrating effects for *any* lifetime hallucinogen use. This finding is consistent with prior reports of personality change from as little as a single experience with a hallucinogen (Griffiths et al., 2006, 2011; MacLean et al., 2011). However, our findings are discrepant with a prior report of hallucinogen use increasing risk for IPV (Feingold et al., 2008). The design of that retrospective study differed from

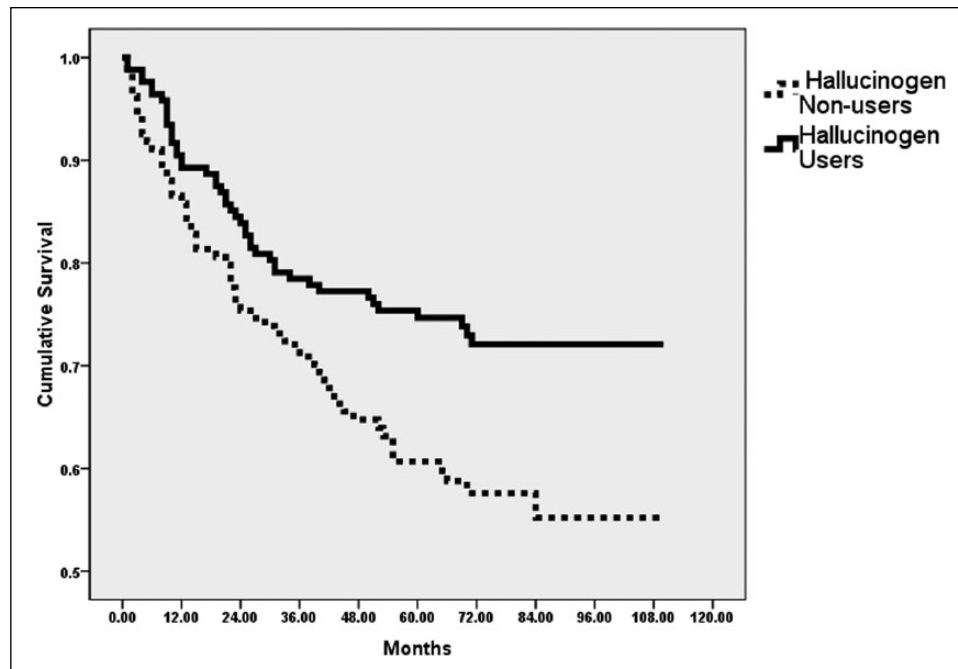


Figure 1. Months to arrest for intimate partner violence.

Note: Unadjusted survival plots for time to arrest by presence/absence of hallucinogen use.

our study in important ways. Whereas the prior study used retrospective assessment of self-reported IPV among a community sample, we used a forensic sample, a prospective design, and institutional records of arrest. Future studies that concurrently examine community and clinical samples may be helpful for determining moderators of the relationship between hallucinogen use and violence. More broadly, our findings add to the small but promising literature suggesting that the use of hallucinogenic substances may have potential to protect against behaviors associated with externalizing psychopathology. The present findings provide an additional indication that further investigation into the potential of hallucinogen therapies to prevent criminal recidivism is warranted. In consideration of this potential, we echo the increasing calls for the removal of impediments to research on the therapeutic use of hallucinogens (Nutt et al., 2013; Scientific American, 2014).

Although the study is prospective, naturalistic design prohibits causal inference, and it is possible that unmeasured factors associated with both hallucinogen use and IPV (e.g., psychopathology other than problematic use of alcohol and cannabis, and psychopathic personality) underlie the observed results. However, our confidence in the distinct influence of hallucinogen use is increased by the stability of the predictive relationships across both indices of hallucinogen use, and with and without the inclusion of key covariates. Our design is also unable to provide direct information regarding the mechanisms by which hallucinogens might exert their protective effects. In light of proposals that hallucinogen use may counter the misuse of other substances, it is possible that the observed effects may operate through reduction of other substances, such as alcohol, that have pronounced violence-provoking effects. Longitudinal studies that examine temporal relationships between hallucinogen use, other substance use, and IPV may

elucidate these potentially informative patterns of interrelationship. More broadly, the genesis of the apparent salutary effects of hallucinogen use has been the subject of much theorizing (Sessa, 2012), the review of which is beyond the scope of the present examination. However, we would not be surprised if the experiences of unity, positivity, and transcendence that are widely reported to characterize the psychedelic experience (Pahnke and Richards, 1966; Richards, 2014) are beneficial to groups that are frequently marginalized and isolated, such as the incarcerated men who participated in this study.

The survival rates in our sample are consistent with official estimates of national rates of IPV (Langan and Levin, 2002), and the positive associations among IPV and alcohol use, psychopathy, and ethnicity are consistent with the robust body of prior research that has examined the patterns of association among these factors (Harrison and Beck, 2002; Walsh et al., 2010). The prevalence of hallucinogen use disorder among the hallucinogen users in our study are within the range of disorders found among hallucinogen users in the community (APA, 2013). That our findings are largely consistent with prior research adds to our confidence in the representativeness of our sample. Our confidence in the validity of these findings is further enhanced by a number of methodological strengths, including a prospective design and a comprehensive review of official criminal records. This study is also marked by several important limitations. First, our index of IPV was limited to acts leading to police involvement, which likely underestimated the true prevalence of IPV in our sample (Maltz, 2001). Second, hallucinogen use was measured by interview, although this is likely the most valid approach to assessing non-acute use, future research that uses a more detailed assessment, supplemented with informant report, might provide a more comprehensive assessment. Third, our measurement of hallucinogen use was limited to use prior to release from incarceration,

which did not allow estimation of the effects of use during the critical period in which participants were at liberty to use subsequent to release. Future research that examines use in this context has the potential to contribute to our understanding of the observed effects. Fourth, the use of both classic psychedelics and other hallucinogens was common, which complicates the extent to which effects can be attributed to one or both of these classes of substances. However, although the best evidence for positive change following hallucinogen use comes from research with classic hallucinogens (e.g., Hendricks et al., 2015), there is also evidence to suggest that substance such as MDMA may foster intimacy and improve communication. Further research is required to better match specific substances to distinct therapeutic goals. Finally, our sample was drawn from a single institution, and our focus on a substance use population with high levels of lifetime polysubstance use limits generalizability. Further research is required to determine the extent to which the apparent protective effects of hallucinogen use extend to other samples and to those who have not engaged in the problematic use of other psychoactive substances. However, given high levels of the use of other substances among hallucinogen users (APA, 2013), future studies should control for polysubstance use to avoid misattributing the increased risk associated with the use of other substances (e.g., alcohol; Foran and O'Leary, 2008) to the use of hallucinogens.

In summary, our prospective findings of reduced IPV among those who have used a hallucinogen provide further preliminary evidence that this class of substances may represent an exception to the rule of a positive association between substance use and criminal behavior. As such, our findings challenge the stigmatization and criminalization of hallucinogens due to putatively harmful social effects, and add to a reemerging literature on the therapeutic potential of these ancient medicines.

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