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Research Paper

Social network ties to nightlife and healthcare professionals and prescription drug misuse among young adults

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ABSTRACT

Background: Nightlife scenes have been characterized as risk environments where social ecology and network ties facilitate substance use. In contrast to other substances, the prescription drug problem also has been shaped by the healthcare system. How network ties to professionals in these domains are associated with prescription drug misuse remains a key area of study.
Methods: We analyzed a sample of 404 young adults who misuse prescription drugs, recruited from nightlife venues primarily via time-space sampling. We evaluated nine types of network ties via friends and family (5 nightlife professions and 4 healthcare professions) as well as total ties in each occupational domain and their relationship to three different outcomes – frequency of misuse, escalation to non-oral use, and substance-related problems. Negative binomial, logistic, and linear regression methods were employed. We then examined mechanisms by which these network associations may operate.
Results: Ties to party promoters ($p < .05$) and bouncers ($p < .01$) were positively associated with all three outcomes. A single outcome each was associated with ties to DJs (problems, $p < .01$), musicians (frequency, $p < .05$), and bartenders (escalation, $p < .05$). The total number of network ties in the nightlife domain was positively associated with all three outcomes, with each additional tie increasing frequency (20.3%, $p < .001$), odds of escalation (OR = 42.9%, $p < .01$), and problems (12.5%, $p < .01$). The number of sources, peer norm context, and social bonding were explanatory mechanisms for all three outcomes for nightlife networks. Specific occupational ties and the total number of ties to healthcare professionals were not associated with any outcome.
Conclusion: Embeddedness in nightlife networks is related to patterns of prescription drug misuse, and some of this association can be explained by multiple mechanisms of social networks. By contrast, ties to healthcare professionals are not associated with patterns of misuse among such young adults.

Introduction

Prescription drug misuse remains a considerable problem within the United States, and is increasingly a global problem (Weisberg, Becker, Fiellin, & Stannard, 2014). Young adults comprise the age group in the general population with the highest prevalence of prescription drug misuse (McCabe, Teter, Boyd, Knight, & Wechsler, 2005; SAMHSA, 2017). In addition, studies have documented the incorporation of prescription drugs into the substance use repertoires of young people, including those involved in nightlife, often in combination with other substances (Kelly, Wells, Pawson, LeClair, & Parsons, 2014; McCabe, Cranford, & Boyd, 2006). Research has shown that young people involved in nightlife scenes – social activities occurring in bars, nightclubs, music venues, and other late night social venues – have a relatively high prevalence of prescription drug misuse with respect to opioids, sedatives, and stimulants (Kelly et al., 2013; Kurtz, Inciardi, Surratt, & Cottler, 2006; Kurtz, Buttram, & Surratt, 2017). These substances can have an array of negative outcomes, including that misuse of opioids can also lead to transitions to heroin use among some (Mateu-Gelabert, Guarino, Jessell, & Teper, 2015), yet young people often regard them as less harmful and less stigmatizing than illicit drugs (Quintero, Peterson, & Young, 2006). Unlike illicit substances, this view is in part due to pharmaceutical drugs' legitimate medical purposes. A major source of these substances is the medical realm. Thus, in addition to the role of social networks in substance use within nightlife scenes that young people frequent, connections to healthcare professionals may play a role with regard to patterns of prescription drug misuse. The association of network ties to these two domains – nightlife scenes and

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the healthcare professions – with prescription drug misuse represents our central focus of research.

Social networks and substance use

The use of substances within nightlife scenes is typically a social activity. Networks of young people come together for socializing, music, and other activities associated with nightlife participation, such as dancing and substance use (Duff, 2005; Holt & Treloar, 2008; Hunt, Moloney, & Evans, 2010; Kavanaugh & Anderson, 2008). In this regard, social networks are particularly salient for young adult substance use. Research has shown that social networks are associated with a range of health behaviors related to substance use including initiation, HIV risk, harm reduction, overdose, and desistence, among other behaviors (Christakis & Fowler, 2008; De, Cox, Boivin, Platt, & Jolly, 2007; Friedman et al., 1997; Kreager & Haynie, 2011; Latkin, Hua, & Tobin, 2004; Weeks, Clair, Borgatti, Radda, & Schensul, 2002). In this manner, networks are related to both risk and protective behaviors related to substance use.

Social networks have proven to be durably related to health behaviors in part because their effects are multidimensional and intersecting (Kelly, Vuolo, & Marin, 2017). In other words, there are multiple mechanisms by which networks play a role in health behaviors such as substance use, often operating simultaneously. With respect to substance use, networks provide opportunities to access drugs, either through the direct provision of substances or by brokering connections to those who provide drugs (Belackova & Vaccaro, 2013; Parker, 2000; Sales & Murphy, 2007). Social networks also provide opportunities to use during social occasions that bring people together and create moments in which the use of substances becomes part of the social routine. Beyond providing social occasions to use and access to drugs, networks establish and police social norms about appropriate use of substances. In particular, peer group norms are important factors since drug use occurs primarily in the company of friends, and norms are reinforced within these peer settings (Warr, 2002). Notably, peers can serve as role models or reference groups for how young people perceive drug-using behaviors (Berten & van Rossem, 2011). The role of social bonding in substance use is also important as research has identified that friends who use drugs together have more intimate friendships (Kandel & Davies, 1991). Networks also provide information about drug use, both with respect to disseminating information about new drugs or novel strategies of use as well as information about risks and opportunities to mitigate harms associated with use (Jacinto, Duterte, Sales, & Murphy, 2008). In addition to substance use more generally, these peer network mechanisms have been shown to be salient in the case of prescription drug misuse (Kelly et al., 2017).

Networks of nightlife and health professionals

Understanding embeddedness in social contexts, or the degree to which one's personal network contains members from a particular setting, is critical for reducing the harms associated with substance use (Rhodes, 2002). Nightlife scenes have been characterized by some as risk environments where both the social ecology and network ties facilitate substance use (Calafat, Fernandez, Juan, & Becona, 2008; Hunt et al., 2010). Embeddedness within these scenes may shape patterns of substance use among young people, and yet also provide a domain for substance using young people to come together within. However, patterns of prescription drug misuse that emerged in many regions of the world also have been shaped by contact with the healthcare system. As such, ties to healthcare professionals may play roles in shaping the misuse of prescription drugs by young people. Although diversion of pharmaceuticals by healthcare professionals has been documented (Inciardi, Surratt, Kurtz, & Burke, 2006; Ibañez, Levi-Minzi, Rigg, & Mooss, 2013; Rigg, March, & Inciardi, 2010), the more subtle effects of ties to those in health professions may be important. How network ties – particularly specific types of ties to individuals in nightlife and healthcare professions – are associated with patterns of prescription drug misuse among young adults remains unclear.

Network ties to nightlife and healthcare professionals may enable the misuse of prescription drugs among young adults. Subcultural networks have long provided access to a wide range of substances in nightlife scenes (Duff, 2003; Zimmerman & Wieder, 1977). Similarly, healthcare professionals may act as sites of access for prescription drugs, as the trend in legitimate prescribing has increased alongside misuse in recent decades (Olfson, Gameroff, Marcus, & Jensen, 2003; Thomas, Conrad, Casler, & Goodman, 2006). The desire to provide care without patient complaints may facilitate overprescribing (Zgierska, Miller, & Rabago, 2012), and may be particularly acute with respect to individuals with whom they have personal ties. In other instances, physicians indicate that "sometimes, it's easier to write the prescription" (Moloney, 2017). Nightlife networks may provide social norms supportive of substance use more generally (Duff, 2005; Hunt et al., 2010). Similarly, healthcare professionals may enable the process of pharmaceuticalization within their networks, which may promote the misuse of prescription drugs as a normative means to manage symptoms stemming from other problems (Fox & Ward, 2008), particularly substance use related symptoms. Taken together, we can posit that prescription drug misuse may be positively associated with network ties to both nightlife and healthcare professionals, and this relationship may operate via multiple mechanisms.

Additionally, we may consider that network ties to nightlife and health professionals may deter the misuse of prescription drugs. Prescription drugs do not carry the same type of social currency within many nightlife networks that certain subculturally rooted substances do (e.g. ecstasy within electronic dance music scenes). A lack of symbolic value of these substances may inhibit misuse of prescription drugs in some nightlife domains (Kelly et al., 2015). Health professionals may be more likely to deter drug use in general via the dissemination of health information about harms related to substance use of various types, thus promoting norms that constrain the use of substances. Healthcare professional networks may also directly prohibit off-label use of prescription medications, thus serving as a mechanism of informal social control (Conrad, 1992). In this manner, ties to individuals in these occupational domains may be protective. Taken together, we can alternatively posit that prescription drug misuse may be negatively associated with network ties to nightlife and healthcare professionals.

Current study

We aim to answer three primary research questions: 1) Are network ties to specific occupations in nightlife and healthcare domains associated (positively or negatively) with patterns of prescription drug misuse? 2) Are the total number of network ties to individuals in these occupational domains related to patterns of prescription drug misuse? 3) If these network ties are associated with misuse, what are possible mechanisms that explain these relationships? We engage these questions by examining three distinct outcomes – frequency of misuse, escalation to non-oral administration, and problems associated with prescription drug misuse – among a sample of young adults who misuse prescription drugs.

Methods

Sampling

We primarily utilized time-space sampling in nightlife venues in New York to recruit the sample. Time-space sampling was first developed to capture hard-to-reach populations (Muhib et al., 2001; Stueve, O'Donnell, Duran, Sandoval, & Blome, 2001), but is useful to generate samples of venue-based populations (Parsons, Grov, & Kelly, 2008). Accordingly, we used venues as our basic sampling unit to

systematically generate a sample of socially active youth. We randomized "time" and "space" – the days/times for sampling individuals and the venues attended – using a sampling frame of venues and times of operation. To construct the sampling frame, ethnographic fieldwork during the previous year enabled the assessment of viable venues for each day of the week. A venue was viable if it was a nightlife venue (e.g. bar, nightclub, concert venue) with a threshold of young adult patron traffic existing on that day of the week. We generated lists of venues in numerous nightlife subcultures for each day across various nightlife scenes – e.g. electronic dance music, hip hop, indie rock. For each day of the week, socially viable venues were listed and assigned a number. Using a random digit generator, a random number was drawn corresponding to a particular venue on a particular day, yielding our schedule for recruitment.

At the venue, project staff conducted a screening survey, aiming to screen as many patrons as possible in that randomly sampled venue. Staff approached a patron, identified themselves, described the screening survey, and requested verbal consent for the anonymous survey conducted on an iPod Touch®. Response rates to the screening survey (75.0%) were relatively high given the difficult conditions of surveying young adults in dimly lit, loud nightlife settings and the lack of compensation for participating. For those who provided consent, the surveys were initially administered by trained staff (consent, age, and residence) and respondents self-reported other information (race, sexual identity, gender, and substance use). Staff members were trained not to survey individuals visibly impaired by intoxication to ensure the capacity to consent. Upon completion of the survey, the software determined whether the individual was eligible for the study (9.4% of screened met eligibility criteria; see below). If participants were eligible, they were given a brief description of the study and asked to provide contact information. A majority of those eligible (77.4%) provided contact information for further participation.

Time-space sampling recruitment was supplemented by online targeted recruitment of groups associated with nightlife scenes. Group members between the ages of 18–29 and resided in the NYC metropolitan area saw an advertisement for the study; if they clicked on it, they were directed to a Qualtrics® survey that screened for eligibility and, if eligible, collected contact information. A small proportion of the total sample (< 15%) was recruited via this supplemental method; these individuals did not differ on the frequency of misuse of prescription drugs.

Project staff contacted all participants by phone and e-mail to provide more information about the study, confirm eligibility, and schedule a study assessment. Eligibility criteria were: (1) ages 18–29; (2) misuse of prescription drugs at least three times in the past six months; and (3) misuse of prescription drugs during the past three months. During the study assessment, participants provided informed consent and completed a structured survey. The data were collected between 2011 and 2013. All procedures received Institutional Review Board approval.

Measures

The study focused on the misuse of opioids, sedatives, and stimulants. Within the survey, we provided the following operational definition of misuse to subjects: "…using prescription drugs obtained from a non-medical source, using more than the prescribed dose, or using prescription drugs for a non-medical or recreational purpose." We modeled three dependent variables. The first outcome is the number of prescription drug misuse instances during the previous 90 days (mean = 37.8, SD = 47.8), as 3-month recall periods have been shown to produce reliable data (Napper, Fisher, Reynolds, & Johnson, 2010). Second, we measured escalating patterns of misuse via the misuse of prescription drugs through non-oral administration (i.e., sniffing, smoking, or injecting). Finally, we examined problems with prescription drug misuse through a modified version of the Short Inventory of Problems – Alcohol & Drugs (SIP-AD; Blanchard, Morgenstern, Morgan, Labouvie, & Bux, 2003). The tailored measure assessed social and interpersonal problems associated with prescription drugs. The measure is logged within the analyses due to skew.

We analyze the role of network ties to individuals in two professional domains: nightlife professions and healthcare professions. Participants were instructed to, "Please tell us the number of people you know involved in the following activities," with responses to each occupation separated by the type of relationship (e.g. friend, family member). Measures of family ties, romantic partner ties, and friendship ties were combined to identify close network ties for this paper; co-worker/classmate ties were not included in the measures to ensure a focus on stronger network ties. However, we note that alternative models including co-worker and classmate ties, not shown here, generated similar substantive results. We take two approaches to assess the association of these network ties with our outcomes. First, we use a dichotomous measure of the presence of each type of network tie to individuals in five nightlife professions (bartenders, DJs, party promoters, musicians, bouncers) as well as four healthcare professions (physician, nurse, psychiatrist, pharmacist). Second, we utilize a measure of the total number of network ties within each occupational domain. This measure is a summation of ties across each profession within each occupational domain. As these data are cross-sectional, they do not permit distinctions between selection and influence for the network factors, a point to which we return in the discussion.

To identify potential mechanisms through which network ties might operate, we also examined four network factors – network sources of drugs, normative contexts, social pressure, and social bonding motivated substance use. For networks as sources of prescription drugs, we utilized a count variable that assessed the total number of sources subjects indicated that they could use to acquire prescription drugs. For peer normative context, we utilized the Peer Drug Associations scale (α = .726; Oetting & Beauvais, 1987), which provides a measure of norms favorable or unfavorable towards substance use. For peer pressure, we utilized the social pressure sub-scale from the Inventory of Drug Taking Situations (IDTS; α = .833; Turner, Annis, & Sklar, 1997). For social bonding through substance use, we utilized the pleasant times with others sub-scale from the IDTS (α = .872).

We include numerous personal characteristics as covariates. Participants self-reported their age, gender, sexual identity, race/ethnicity, parental social class, and highest education completed. Descriptive statistics for all demographic variables are available in Table 1. The sample (n = 404) had an average age of 24.6, was two-thirds White (66.8%), and roughly evenly split by gender and sexual identity. A majority either were currently enrolled in college or achieved a Bachelor's degree.

Statistical analyses

The statistical analysis performed on frequency of misuse was negative binomial regression, due to the nature of the data – a count variable with overdispersed values. The other two outcomes, non-oral administration and prescription drug misuse problems, were analyzed through logistic and linear regression, respectively. We then re-ran models for each domain of total network ties while simultaneously including the four possible mechanisms described above. Given the link functions for the negative binomial and logistic regressions and the logged outcome in our linear regression, our tables exponentiate the coefficients in all three model types for more intuitive interpretations. For the negative binomial regression of frequency of misuse, logistic regression of escalation, and linear regression of problems, these exponentiated values respectively represent the incident rate ratio, odds ratio, and percent change.

Table 1
Demographic and Network Characteristics.

	Mean (SD)
Outcomes	
Frequency of past 90 days Rx misuse	37.78 (47.76)
Alternatively administered Rx in past 90 days	38.62%
Score for SIP-AD	5.01 (6.63)
Presence of Type of Network Tie	
Nightlife	
Bartender	71.1%
DJ	67.3%
Promoter	50.3%
Musicians	80.0%
Bouncer	25.5%
Healthcare	
Physician	29.5%
Nurse	37.6%
Psychiatrist	21.6%
Pharmacist	14.1%
Covariates	
Age	24.6 (2.69)
Parental Social Class	*%*
Rich	5.0%
Upper middle class	32.9%
Middle class	39.2%
Working class	19.7%
Poor	3.2%
Education	
HS or less	6.9%
Some college/A.A. degree	16.1%
Currently in college	20.5%
B.A./B.S. degree or more	56.4%
Race	
White	66.8%
Latino	7.9%
Black	5.2%
Asian/Pac Islander	5.2%
Mixed	12.9%
Other	2.0%
Female Gender	45.3%
Sexual Identity	
Gay/Lesbian	35.9%
Bi	9.7%
Straight	52.0%
Unsure	2.5%

Results

The second column of Table 2 provides results of negative binomial regression analyses for frequency of prescription drug misuse, inclusive of all covariates (not shown for the sake of parsimony; see Table 3 for effects of covariates). The results indicate that the presence of a network tie to party promoters, musicians, and bouncers is associated with higher frequency of prescription drug misuse by 31.5%, 40.5%, and 43.9%, respectively. A marginal trend ($p = 0.07$) existed for network ties to DJs. For escalation to non-oral administration, the fourth column shows network ties to bartenders (OR = 1.92), party promoters (OR = 1.73), and bouncers (OR = 2.06) all were associated with higher odds of escalation. Ties to DJs and musicians produced marginal trends ($p = .06$) with respect to such associations. In the final column, network ties to DJs, promoters, and bouncers were all positively associated with higher scores for problems related to prescription drug misuse, increasing the score by 35.5%, 38.7%, and 41.6%, respectively ($p < .01$). Network ties to bartenders produced a marginal trend in higher scores ($p = .07$). Across outcomes then, we find that all nightlife ties are associated with at least one outcome. Ties to promoters and bouncers were significant for all outcomes, while ties to DJs were at least marginally significant in all models. Network ties to health professionals produced no statistically significant associations across all three of the outcomes.

The results shown in Table 3 pertain to the total number of network ties within each occupational domain. The number of network ties within nightlife professions are positively associated with all three prescription drug misuse outcomes, net of the covariates. A one-unit increase in the log of total network ties is associated with a 20.3% higher frequency of prescription drug misuse. A one-unit increase in the log of total network ties is associated with 42.9% higher odds of escalation to non-oral administration. An increase in nightlife network ties is associated with a 12.5% increase in problems associated with prescription drug misuse. The predicted outcomes associated with the number of network ties to individuals in nightlife occupations is depicted in Fig. 1, holding the other covariates at their respective means. For each, there is a rapid increase in the outcome from about 0 to 11 nightlife network ties, before increasing more slowly thereafter – a shape typical for a logged dependent variable. For example, the predicted frequency of misuse increases from 11.7 days with 0 nightlife ties to 31.8 days with 11 ties. By 30 ties, the predicted days misusing is 38.3. In the second panel, the predicted probability of escalation increases from 7.9% with 0 nightlife ties to 37.2% with 11 ties. Finally, the predicted SIP-AD score increases from about 2.0 with 0 nightlife ties to 3.8 with 11 ties. Similar to the ties to each nightlife profession, the

Table 2
Network Tie Influences on Prescription Drug Misuse Outcomes.

Type of Network Tie	*Freq of Rx use* IRR (95% CI)		*Escalation* OR (95% CI)		*SIP-AD* % change (95% CI)	
Nightlife	Bivariate	Full Model	Bivariate	Full Model	Bivariate	Full Model
Bartender	1.144 (.909–1.441)	1.089 (.859–1.380)	1.697* (1.070–2.690)	1.922* (1.172–3.149)	1.025^{+} (.978–1.484)	1.213^{+} (.986–1.490)
DJ	1.251* (1.001–1.562)	1.225^{+} (.983–1.527)	1.532^{+} (.988–2.377)	1.558^{+} (.978–2.483)	1.401*** (1.148–1.709)	1.355** (1.113–1.651)
Promoter	1.418*** (1.153–1.743)	1.315* (1.062–1.627)	1.700* (1.134–2.548)	1.733* (1.123–2.673)	1.544*** (1.284–1.855)	1.387** (1.151–1.669)
Musicians	1.228 (.946–1.593)	1.405* (1.078–1.831)	1.641^{+} (.970–2.777)	1.742^{+} (.977–3.105)	1.088 (.860–1.377)	1.175 (.925–1.491)
Bouncer	1.437** (1.134–1.821)	1.439** (1.126–1.838)	1.931** (1.227–3.040)	2.062** (1.261–3.373)	1.445*** (1.167–1.789)	1.416** (1.147–1.751)
Healthcare						
Physician	1.001 (.796–1.259)	1.005 (.791–1.277)	.997 (.642–1.547)	1.067 (.667–1.707)	.889 (.723–1.093)	.911 (.742–1.118)
Nurse	.903 (.728–1.120)	.934 (.753–1.160)	1.444^{+} (.957–2.178)	1.520^{+} (.980–2.355)	1.006 (.828–1.223)	1.055 (.872–1.278)
Psychiatrist	.842 (.653–1.086)	.864 (.668–1.118)	.901 (.551–1.472)	.880 (.521–1.485)	.857 (.682–1.078)	.872 (.696–1.095)
Pharmacist	1.242 (.921–1.674)	1.262 (.927–1.717)	1.088 (.615–1.928)	1.170 (.635–2.156)	1.015 (.774–1.332)	1.682 (.804–1.378)

Note: Full models include all controls specified within the text.
$^{+}$ $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 3
Total Number of Ties within Each Domain and Prescription Drug Outcomes.

	Freq of Rx use		*Escalation*		*SIP-AD*	
	IRR (95% CI)		OR (95% CI)		% change (95% CI)	
	Bivariate	Full Model	Bivariate	Full Model	Bivariate	Full Model
Number of nightlife ties	1.169*** (1.066–1.283)	1.203*** (1.092–1.326)	1.319** (1.098–1.586)	1.429** (1.165–1.752)	1.123** (1.034–1.219)	1.125** (1.035–1.224)
Number of healthcare ties	1.000 (.894–1.120)	0.989 (0.878–1.115)	.994 (.781–1.265)	1.012 (0.782–1.210)	.952 (.850–1.065)	0.976 (0873–1.092)
Age		1.052* (1.000–1.107)		0.900* (0.812–0.996)		0.964 (0.924–1.006)
Parental Social Class (Rich = reference)						
Upper middle class		0.872 (0.529–1.435)		0.753 (0.267–2.118)		0.878 (0.560–1.378)
Middle class		0.703 (0.431–1.146)		0.597 (0.215–1.655)		0.853 (0.548–1.328)
Working class		0.639 (0.377–1.085)		1.017 (0.343–3.015)		0.949 (0.591–1.525)
Poor		0.742 (0.348–1.581)		0.646 (0.128–3.263)		0.761 (0.385–1.503)
Education (HS or less = reference)						
Some college or AA		0.781 (0.481–1.268)		3.310* (1.085–10.10)		1.060 (0.684–1.642)
Currently in college		0.620* (0.387–0.993)		3.724* (1.249–11.10)		0.676 (0.439–1.040)
BA/BS or greater		0.485** (0.306–0.770)		3.145* (1.076–9.187)		0.661* (0.437–0.998)
Race (White = reference)						
Latino		1.468 (0.985–2.188)		1.118 (0.486–2.568)		1.386 (0.976–1.969)
Black		1.218 (0.757–1.960)		0.911 (0.332–2.497)		1.620* (1.056–2.486)
Asian/Pacific Islander		1.365 (0.848–2.198)		1.133 (0.418–3.072)		1.579* (1.025–2.432)
Mixed		1.165 (0.830–1.637		1.154 (0.591–2.253)		0.720* (0.539–0.962)
Other		0.407 (0.165–1.005)		0.262 (0.027–2.596)		1.157 (0.526–2.544)
Female Gender		1.075 (0.868–1.331)		0.647 (0.412–1.015)		0.884 (0.730–1.071)
Sexual Identity (reference = gay/lesbian)						
Bi		1.297 (0.883–1.906)		2.324* (1.066–5.064)		1.628** (1.161–2.282)
Straight		0.919 (0.726–1.163)		0.826 (0.507–1.345)		1.002 (0.814–1.234)
Unsure		0.311** (0.154–0.627)		0.624 (0.139–2.795)		0.726 (0.395–1.334)

* $p < .05$.
** $p < .01$.
*** $p < .001$.

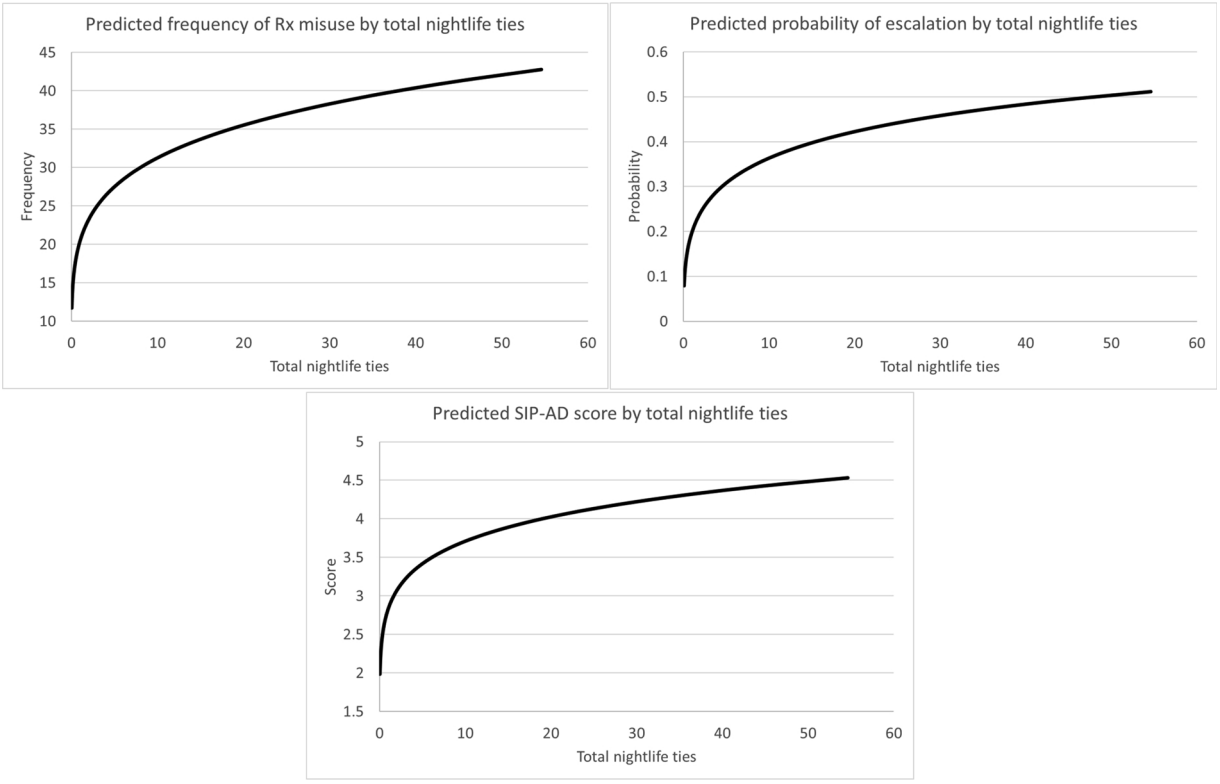

Fig. 1. Predicted Outcomes Associated with Number of Ties to Nightlife Actors.

total number of network ties to individuals in the healthcare professions are not associated with any of the prescription drug outcomes.

The results shown in Table 4 provide an assessment of potential mechanisms by which these network ties may be related to patterns of prescription drug misuse. First, we turn to the upper panel, which contains the results for network ties to nightlife professionals. For frequency of misuse, the number of sources (12.2%), peer norms (43.6%), and use for social bonding (8.7%) are all associated with higher frequency of misuse. For escalation, the number of sources (OR = 1.47), peer norms (OR = 2.65), and use for social bonding (OR = 1.12) are all associated with higher odds of escalation. For prescription drug related problems, the number of sources (8.4%), peer norms (48.7%), social pressure (4.1%), and use for social bonding (6.3%) are all associated with report of greater problems. Across all of these models, the effect of network ties to nightlife professionals is greatly reduced in magnitude and in the case of escalation and problems, the effect is reduced to non-significance, suggesting that these potentially may be important mechanisms by which ties shape patterns of misuse. The analyses of ties to medical professionals indicate that most of these network mechanisms are significant – sources, norms, and social bonding are significant across all three outcomes – but the overall effect of ties to medical professionals does not change within the inclusion of these factors.

Discussion

Social networks have been well-established as important for substance use (Christakis & Fowler, 2008; De et al., 2007; Friedman et al., 1997; Kreager & Haynie, 2011; Latkin et al., 2004; Weeks et al., 2002). Network ties – particularly close ties to friends and family – are indicators of embeddedness within certain social domains. As described

Table 4
Peer Mechanisms of Network Influences on Prescription Drug Outcomes.

	Freq of Rx use IRR (95% CI)	*Escalation* OR (95% CI)	*SIP-AD* % change (95% CI)
Number of nightlife ties	1.108* (1.016–1.208)	1.228 (0.984–1.532)	1.012 (0.944–1.086)
Number of sources	1.122** (1.033–1.219)	1.466*** (1.184–1.816)	1.084* (1.012–1.161)
Peer norm context	1.436* (1.055–1.956)	2.650* (1.186–5.921)	1.487** (1.155–1.915)
Social pressure	0.980 (0.945–1.017)	1.086 (0.978–1.206)	1.041* (1.010–1.076)
Use for social bonding	1.087*** (1.058–1.116)	1.119*** (1.045–1.198)	1.063*** (1.040–1.086)
Number of healthcare ties	1.002 (0.985–1.121)	1.013 (0.762–1.347)	0.975 (0.888–1.071)
Number of sources	1.139** (1.045–1.242)	1.499*** (1.206–1.863)	1.092* (1.018–1.171)
Peer norm context	1.488* (1.087–2.035)	2.732* (1.225–6.092)	1.479** (1.148–1.905)
Social pressure	0.986 (0.950–1.024)	1.104 (0.993–1.227)	1.043* (1.010–1.078)
Use for social bonding	1.085*** (1.056–1.116)	1.113** (1.040–1.191)	1.062*** (1.038–1.086)

Note: All models include all covariates specified within the text.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

above, both the nightlife and healthcare sectors may play important roles in prescription drug misuse among young adults. To identify how embeddedness in these important domains is associated with patterns of misuse, we evaluated the role of network ties to individuals in nightlife and health professions on three prescription drug misuse outcomes. We generally found that ties to individuals in certain nightlife occupations were associated with more frequent prescription drug misuse, higher odds of non-oral administration, and greater problems associated with misuse. More specifically, network ties to bouncers and party promoters, and to a lesser degree DJs, were associated with all three outcomes. Ties to bartenders and musicians were associated with some, but not all outcomes, suggesting that they were less central in shaping patterns of misuse, perhaps because these occupations are more common and do not indicate subcultural embeddedness in the manner of network ties to other occupations. The presence of ties to these occupations through friends and family – social ties closer than mere acquaintances – appear to play a role in shaping prescription drug misuse among young people active in nightlife in facilitative ways. Importantly, various occupations within this domain play a role, although some more intensely than others, and thus it cannot be attributed to only one aspect of nightlife involvement.

Beyond the mere presence or absence of ties to individuals in specific nightlife occupations, an increasing number of network ties to nightlife professionals was associated with all three prescription drug outcomes. In other words, the more ties an individual has to people in nightlife occupations, the more likely they are to report greater frequency of misuse and more problems with misuse, as well as greater odds of non-oral misuse. We contend that the number of ties is an indicator of deeper subcultural embeddedness that affects patterns of misuse. Embeddedness matters with respect to how young people engage in various behaviors tied to subcultural participation, including drug use (Thornton, 1995). Embeddedness within subcultural domains can expose individuals to norms and other cultural processes distinct to these domains that shape how patterns of substance use are taken up, maintained, or change – either in ways that facilitate or inhibit use (Kelly et al., 2015). Deeper embeddedness can also limit exposure to countervailing norms from mainstream interactions. Ultimately, the presence of network ties to nightlife occupations can be both a signifier of exposure to the subcultural domain as well as a possible source of direct influence, and quite likely it is a matter of both processes occurring. Substance use also may be a factor by which young people select into subcultural involvement. Further research on these processes is needed.

Ties to healthcare professionals – both ties to individuals in specific occupations and the total number of ties to professionals – were not associated with prescription drug misuse. Although we conjectured explanations for associations in either direction, there were neither positive nor negative associations for any of the three outcomes. As such, we may infer that network ties to healthcare professionals do not facilitate prescription drug misuse among young adults, whether through provision of access or normative influences of pharmaceuticalization. Yet, at the same time, ties to healthcare professionals do not inhibit prescription drug misuse, suggesting that the norms and mechanisms of social control related to such ties do not have a protective effect. It is possible that a combination of facilitative and inhibitive mechanisms may cancel each other out. For example, norms promoting pharmaceuticalization may be offset by norms proscribing off-label use. Additionally, as prior research has identified that young people are primarily obtaining prescription drugs through peer networks (Garnier-Dykstra, Caldeira, Vincent, O'Grady, & Arria, 2012), the availability through non-medical sources may obviate the need to utilize network ties to healthcare providers. Deeper examinations into the mechanisms of these healthcare network processes may reveal more.

Returning to potential mechanisms of embeddedness in nightlife networks, we found that nightlife networks are associated with patterns of misuse through multiple mechanisms, specifically, access to substances via networks, the normative context, and use for social bonding. We found less evidence that social pressure plays a role in these processes. In this manner, the number of ties to individuals in nightlife occupations may shape patterns of prescription drug misuse in tangible ways by providing more points of access to prescription drugs (Garnier-Dykstra et al., 2012). It is quite possible, likely even, that young people deeply embedded in subcultural scenes possess greater savvy about acquiring substances and ties to those from whom they may procure them (Belackova & Vaccaro, 2013; Parker, 2000; Sales & Murphy, 2007). The accumulation of network ties within nightlife scenes may also shape patterns of misuse intangibly via the reception of social norms about drug use as well as facilitating the flow of social interactions. Norms have been established as key influences of substance use, especially since substance use is typically a social activity and occurs primarily in the company of friends (Warr, 2002). Greater embeddedness within subcultural networks may facilitate the entrenchment of non-mainstream norms that may enable substance use, particularly for those who use substances to have positive experiences with their friends. Taken together, deeper subcultural embeddedness may also signify a greater number of opportunities to misuse prescription drugs in social settings. Additional research on these mechanisms may further clarify the manner in which such network embeddedness is associated with patterns of prescription drug misuse.

Limitations

While this study has many strengths, we must also consider certain limitations. First, our sample purposefully examines young adults who actively misuse prescription drugs. Thus, we cannot make any claims about the role of these network domains in shaping patterns of initiation into misuse or the wider influence of such network ties on the general population. Second, we primarily sampled young adults from nightlife venues using time-space sampling, which may not be generalizable to all populations. We may have been more likely to reach individuals who are more frequent nightlife participants. We also recognize that rural prescription drug misusers may not have the same opportunities for ties to nightlife scenes, perhaps such that ties to healthcare professionals are more salient, and we encourage similar studies of the experiences of rural misusers of prescription pills (Monnat & Rigg, 2016; Rigg & Monnat, 2015). Additionally, ties to healthcare professionals may be more important for older adults who misuse prescription drugs. Third, although the analyses do not permit distinctions between influence and selection, the selection into network ties to certain occupations is less likely than influence processes. At the same time, it is quite possible that processes of both influence *and* selection are occurring. Additionally, although the measure of peer drug associations accounts for positive and negative network norms, we do not have measures of the specific content of messages between network ties and thus cannot study how this content might be associated with results. This is important future work since occupational clustering of prescription drug misuse may lead to distinct messages via network ties to occupations (MADOH, 2018). Future studies should examine other mechanisms and mediators of these processes in order to more specifically account for the role of norms, access, and other mechanisms related to social networks. Finally, subjects self-reported behaviors, and social desirability or recall biases may shape the reporting of these behaviors, a common concern in social science research. However, studies have shown that the use of computer-assisted surveys improves self-report measures of sensitive topics (Williams et al., 2000), which improves our confidence in these responses.

Conclusions

Embeddedness in certain nightlife networks, as indicated by greater network ties and ties to specific nightlife occupations, is associated with greater frequency of prescription drug misuse and associated risks. In

contrast, despite serving as primary access points for legitimate use and the potential for spillover into non-medical use of prescription drugs, ties to healthcare professionals were not associated with patterns of misuse. While social networks have been widely proven as important in shaping health behaviors, they have also proven to be important sites for intervention. In this regard, engaging nightlife networks with respect to access, opportunities, and norms may provide great occasions to intervene on prescription drug misuse and related problems among socially active young adults. Given the growth of network-based intervention efforts within public health, this may be an area of focus in efforts to reduce prescription drug misuse among young adults.

Conflict of interest statement

Regarding the paper “Influence of Network Ties to Nightlife and Healthcare Professionals on Prescription Drug Misuse” recently submitted to the International Journal of Drug Policy, the authors – Brian C Kelly and Mike Vuolo – have no actual or potential conflicts of interest to report. We have no financial, personal or other relationships with other people or organizations that could inappropriately influence, or be perceived to influence, this work.

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References

Belackova, V., & Vaccaro, C. A. (2013). A friend with weed is a friend indeed": Understanding the relationship between friendship identity and market relations among marijuana users. *Journal of Drug Issues, 43*(3), 289–313.
Berten, H., & van Rossem, R. (2011). Mechanisms of peer influence among adolescents: Cohesion versus structural equivalence. *Sociological Perspectives, 54*(2), 183–204.
Blanchard, K., Morgenstern, J., Morgan, T. J., Labouvie, E. W., & Bux, D. A. (2003). Assessing consequences of substance use: Psychometric properties of the Inventory of Drug Use Consequences. *Psychology of Addictive Behaviors, 17*, 328–331.
Calafat, A., Fernandez, C., Juan, M., & Becona, E. (2008). Recreational nightlife: Risk and protective factors for drug misuse among young Europeans in recreational environments. *Drugs: Education, Prevention and Policy, 15*(2), 189–200.
Christakis, N. A., & Fowler, J. H. (2008). The collective dynamics of smoking in a large social network. *New England Journal of Medicine, 358*(21), 2249–2258.
Conrad, P. (1992). Medicalization and social control. *Annual Review of Sociology, 18*(1), 209–232.
De, P., Cox, J., Boivin, J. F., Platt, R. W., & Jolly, A. M. (2007). The importance of social networks in their association to drug equipment sharing among injection drug users: A review. *Addiction, 102*(11), 1730–1739.
Duff, C. (2003). Drugs and youth cultures: Is Australia experiencing the ‘normalization’of adolescent drug use? *Journal of Youth Studies, 6*(4), 433–447.
Duff, C. (2005). Party drugs and party people: Examining the ‘normalization’of recreational drug use in Melbourne, Australia. *International Journal of Drug Policy, 16*(3), 161–170.
Fox, N. J., & Ward, K. J. (2008). Pharma in the bedroom… and the kitchen…. The pharmaceuticalisation of daily life. *Sociology of Health & Illness, 30*(6), 856–868.
Friedman, S. R., Neaigus, A., Jose, B., Curtis, R., Goldstein, M., Ildefonso, G., et al. (1997). Sociometric risk networks and risk for HIV infection. *American Journal of Public Health, 87*(8), 1289–1296.
Garnier-Dykstra, L. M., Caldeira, K. M., Vincent, K. B., O’Grady, K. E., & Arria, A. M. (2012). Nonmedical use of prescription stimulants during college: Four-year trends in exposure opportunity, use, motives, and sources. *Journal of American College Health, 60*(3), 226–234.
Holt, M., & Treloar, C. (2008). Pleasure and drugs. *International Journal of Drug Policy, 19*(5), 349–352.
Hunt, G., Moloney, M., & Evans, K. (2010). *Youth, drugs, and nightlife.* Routledge.
Ibañez, G. E., Levi-Minzi, M. A., Rigg, K. K., & Mooss, A. D. (2013). Diversion of benzodiazepines through healthcare sources. *Journal of Psychoactive Drugs, 45*(1), 48–56.
Inciardi, J. A., Surratt, H. L., Kurtz, S. P., & Burke, J. J. (2006). The diversion of prescription drugs by health care workers in Cincinnati, Ohio. *Substance Use & Misuse, 41*(2), 255–264.
Jacinto, C., Duterte, M., Sales, P., & Murphy, S. (2008). Maximising the highs and minimising the lows: Harm reduction guidance within ecstasy distribution networks. *The International Journal of Drug Policy, 19*(5), 393–400.
Kandel, D., & Davies, M. (1991). Friendship networks, intimacy, and illicit drug use in young adulthood: A comparison of two competing theories. *Criminology, 29*(3), 441–469.
Kavanaugh, P. R., & Anderson, T. L. (2008). Solidarity and drug use in the electronic dance music scene. *The Sociological Quarterly, 49*(1), 181–208.
Kelly, B. C., Wells, B. E., LeClair, A., Tracy, D., Parsons, J. T., & Golub, S. A. (2013). Prevalence and correlates of prescription drug misuse among socially active young adults. *International Journal of Drug Policy, 24*(4), 297–303.
Kelly, B. C., Wells, B. E., Pawson, M., LeClair, A., & Parsons, J. T. (2014). Combinations of prescription drug misuse and illicit drugs among young adults. *Addictive Behaviors, 39*(5), 941–944.
Kelly, B. C., Trimarco, J., LeClair, A., Pawson, M., Parsons, J. T., & Golub, S. A. (2015). Symbolic boundaries, subcultural capital and prescription drug misuse across youth cultures. *Sociology of Health & Illness, 37*(3), 325–339.
Kelly, B. C., Vuolo, M., & Marin, A. C. (2017). Multiple dimensions of peer effects and deviance: The case of prescription drug misuse among young adults. *Socius, 3* 237802317706819.
Kreager, D. A., & Haynie, D. L. (2011). Dangerous liaisons? Dating and drinking diffusion in adolescent peer networks. *American Sociological Review, 76*(5), 737–763.
Kurtz, S. P., Inciardi, J. A., Surratt, H. L., & Cottler, L. (2006). Prescription drug abuse among ecstasy users in Miami. *Journal of Addictive Diseases, 24*(4), 1–16.
Kurtz, S. P., Buttram, M. E., & Surratt, H. L. (2017). Benzodiazepine dependence among young adult participants in the club scene who use drugs. *Journal of Psychoactive Drugs, 49*(1), 39–46.
Latkin, C. A., Hua, W., & Tobin, K. (2004). Social network correlates of self-reported non-fatal overdose. *Drug and Alcohol Dependence, 73*(1), 61–67.
Massachusetts Department of Public Health, & Occupational Health Surveillance Program (2018). *Opioid-related overdose deaths in Massachusetts by industry and occupation, 2011–2015*.
Mateu-Gelabert, P., Guarino, H., Jessell, L., & Teper, A. (2015). Injection and sexual HIV/HCV risk behaviors associated with nonmedical use of prescription opioids among young adults in New York City. *Journal of Substance Abuse Treatment, 48*(1), 13–20.
McCabe, S. E., Teter, C. J., Boyd, C. J., Knight, J. R., & Wechsler, H. (2005). Nonmedical use of prescription opioids among U.S. College students: Prevalence and correlates from a national survey. *Addictive Behaviors, 30*(4), 789–805.
McCabe, S. E., Cranford, J. A., & Boyd, C. J. (2006). The relationship between past-year drinking behaviors and nonmedical use of prescription drugs: Prevalence of co-occurrence in a national sample. *Drug & Alcohol Dependence, 84*(3), 281–288.
Moloney, M. E. (2017). Sometimes, it's easier to write the prescription': Physician and patient accounts of the reluctant medicalisation of sleeplessness. *Sociology of Health & Illness, 39*(3), 333–348.
Monnat, S. M., & Rigg, K. K. (2016). Examining rural/urban differences in prescription opioid misuse among US adolescents. *The Journal of Rural Health, 32*(2), 204–218.
Muhib, F. B., Lin, L. S., Stueve, A., Miller, R. L., Ford, W. L., Johnson, W. D., et al. (2001). A venue-based method for sampling hard-to-reach populations. *Public Health Reports, 116*(Suppl. 1), 216–222.
Napper, L. E., Fisher, D. G., Reynolds, G. L., & Johnson, M. E. (2010). The effect of recall period on HIV risk behavior self-report reliability. *AIDS and Behavior, 14*(1), 152–161.
Oetting, E. R., & Beauvais, F. (1987). Peer cluster theory, socialization characteristics, and adolescent drug use: A path analysis. *Journal of Counseling Psychology, 34*(2), 205–213.
Olfson, M., Gameroff, M. J., Marcus, S. C., & Jensen, P. S. (2003). National trends in the treatment of attention deficit hyperactivity disorder. *American Journal of Psychiatry, 160*(6), 1071–1077.
Parker, H. (2000). How young britons obtain their drugs: Drug transactions at the point of consumption. *Crime Prevention Studies, 11*, 59–82.
Parsons, J. T., Grov, C., & Kelly, B. C. (2008). Comparing the effectiveness of two forms of time-space sampling to identify club drug-using young adults. *Journal of Drug Issues, 38*(4), 1061–1081.
Quintero, G., Peterson, J., & Young, B. (2006). An exploratory study of socio-cultural factors contributing to prescription drug misuse among college students. *Journal of Drug Issues, 36*(4), 903–931.
Rhodes, T. (2002). The ‘risk environment’: A framework for understanding and reducing drug-related harm. *International Journal of Drug Policy, 13*(2), 85–94.
Rigg, K. K., & Monnat, S. M. (2015). Urban vs. rural differences in prescription opioid misuse among adults in the United States: Informing region specific drug policies and interventions. *International Journal of Drug Policy, 26*(5), 484–491.
Rigg, K. K., March, S. J., & Inciardi, J. A. (2010). Prescription drug abuse & diversion: Role of the pain clinic. *Journal of Drug Issues, 40*(3), 681–701.
Sales, P., & Murphy, S. (2007). San Francisco’s freelancing ecstasy dealers: Towards a sociological understanding of drug markets. *Journal of Drug Issues, 37*(4), 919–949.
Substance Abuse and Mental Health Services Administration (SAMHSA) (2017). *2016 National Survey on Drug Use and Health: Detailed Tables.* Rockville, MD: Substance Abuse and Mental Health Services Administration.
Stueve, A., O’Donnell, L., Duran, R., Sandoval, A., & Blome, J. (2001). Time-space sampling in minority communities: Results with young Latino men who have sex with men. *American Journal of Public Health, 91*(6), 922–926.
Thomas, C. P., Conrad, P., Casler, R., & Goodman, E. (2006). Trends in the use of psychotropic medications among adolescents, 1994 to 2001. *Psychiatric Services, 57*(1), 63–69.
Thornton, S. (1995). *Club cultures: Music, media and subcultural capital.* London: Routledge.
Turner, N. E., Annis, H. M., & Sklar, S. M. (1997). Measurement of antecedents to drug and alcohol use: Psychometric properties of the Inventory of Drug-Taking Situations

(IDTS). *Behaviour Research and Therapy, 35*(5), 465–483.
Warr, M. (2002). *Companions in crime.* New York: Cambridge University Press.
Weeks, M. R., Clair, S., Borgatti, S. P., Radda, K., & Schensul, J. J. (2002). Social networks of drug users in high-risk sites: Finding the connections. *AIDS and Behavior, 6*(2), 193–206.
Weisberg, D. F., Becker, W. C., Fiellin, D. A., & Stannard, C. (2014). Prescription opioid misuse in the United States and the United Kingdom: Cautionary lessons. *International Journal of Drug Policy, 25*(6), 1124–1130.
Williams, M. L., Freeman, R. C., Bowen, A. M., Zhao, Z., Elwoe > Bowen, W. N., Zhao, Z., Elwood, W. N., Gordon, C., et al. (2000). A comparison of the reliability of self-reported drug use and sexual behaviors using computer-assisted versus face-to-face interviewing. *AIDS Education and Prevention, 12*(3), 199–213.
Zgierska, A., Miller, M., & Rabago, D. (2012). Patient satisfaction, prescription drug abuse, and potential unintended consequences. *JAMA, 307*(13), 1377–1378.
Zimmerman, D. H., & Wieder, D. L. (1977). You can't help but get stoned: Notes on the social organization of marijuana smoking. *Social Problems, 25*(2), 198–207.