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Substance use network characteristics and drug and alcohol use behaviors among young men who have sex with men (YMSM)

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Abstract

Background—Young men who have sex with men (YMSM) use alcohol and other drugs at rates higher than their heterosexual peers. While social networks of YMSM have been acknowledged as an important contextual influence on their health behavior, studies have largely focused on social and sexual networks rather than substance use networks, despite the potential importance of substance use alters in shaping substance use behavior.

Method—Using data collected from a diverse sample of YMSM ($n = 156$), two multilevel models examined the associations between network (e.g., degree and transitivity), dyadic (e.g., strength of relationship), and individual characteristics and two alter level dependent variables: recent drug use (versus no recent drug use) and frequency of substance use.

Results—Results indicated that transitivity was associated with both recent drug use ($OR = 1.21$, $p = 0.012$) and more frequent substance use ($b = 0.08$, $p = 0.002$). Degree was not significantly associated with either variable. Furthermore, participants were also less likely to have recently used drugs ($OR = 0.93$, $p < 0.001$) and tended to use substances less frequently ($b = -0.01$, $p = 0.028$) with older alters.

Conclusions—Despite substantial interest in network influences on health, much remains unknown about the impact of network structures on substance use. The current findings suggest that structural characteristics of substance use networks may provide important information regarding the drug and alcohol use behavior of YMSM even when controlling for dyadic and individual characteristics.

Keywords

Substance use networks; Drug networks; YMSM

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Conflict of Interest

No conflict declared.

Contributors

All authors contributed to the design, interpretation, and preparation of this manuscript.

1. INTRODUCTION

Alcohol (Marshall et al., 2008) and drug use (Corliss et al., 2010; Marshall et al., 2009; Newcomb et al., 2014) are disproportionately higher among young men who have sex with men (YMSM) and other sexual minority adolescents than among their heterosexual peers. Alcohol and other drug use among YMSM has also been closely associated with a number of risk behaviors and negative health outcomes such as condomless sex (Bruce et al., 2012; Newcomb, 2013) and mental health problems such as post-traumatic stress disorder and depression (Halkitis et al., 2013). Given the heightened levels of substance use among YMSM and health burdens associated with this use, a growing body of research has examined predictors of alcohol and drug use (Newcomb et al., 2012; Thiede et al., 2003; Traube et al., 2012, 2013).

However, much remains unknown about contextual factors that may facilitate or reduce drug and alcohol use among YMSM. Social networks, or the structure of social ties between individuals, are an important determinant of substance use behavior among adolescents and young adults (Ennett et al., 2006; Schensul and Burkholder, 2005; Unger and Chen, 1999; Valente et al., 2004). Substance use networks (i.e., relationships between individuals that use drugs or alcohol together) are a subset of one's social network that may be especially important for understanding substance use in young adults. For example, previous studies indicate that members of an individual's social network, such as friends, are the most common source used to obtain drugs (Harrison et al., 2000; McCabe and Boyd, 2005) and, for individuals under the legal drinking age, alcohol (Harrison et al., 2000; Wagenaar et al., 1996). Given the reliance on networks to obtain these substances, the structure and composition of substance use networks may be especially important to understanding drug and alcohol use behaviors.

The aim of the current study is to examine the relationships between network (i.e., transitivity and network size), dyadic (e.g., age difference), and individual characteristics and drug and alcohol behavior with substance use alters to better understand the social and contextual factors associated with substance use behavior among YMSM. Specifically, we examined if these characteristics are associated with drug use and the frequency of substance use. Our analysis is novel as much of the previous research on substance use networks has almost exclusively focused on people who inject drugs (Latkin et al., 2010; Tobin et al., 2010), and most network studies of YMSM have largely focused on social and sexual networks (Birkett et al., 2015; McFadden et al., 2014; Mustanski et al., 2015; Tucker et al., 2012) rather than on substance use networks.

1 2. METHODS

1.1 2.1. Participants

Cross-sectional egocentric network interviews were conducted with 175 YMSM (Birkett et al., 2015; Kuhns et al., 2015; Mustanski et al., 2014) taken from an ongoing longitudinal research study of YMSM recruited via a modified respondent driven sampling design. Participants whose visit coincided with the period of the network sub-study were eligible for the network interviews and all participants provided informed consent to be part of this

study. A subsample of participants ($n = 156$) who indicated they had used drugs or alcohol with at least one alter were included in the current analyses. Study participants named 1,914 alters with whom they had ever directly used alcohol or other drugs, representing 61.0% of the 3,136 alters named by these participants. As per the design of the parent study and indicated in Table 1, participants were young (mean age = 20.08 years, standard deviation (SD) = 1.42), with diverse racial/ethnic identification (52.6% Black and 21.7% Hispanic), and predominantly identified as gay (84.0%) or bisexual (12.2%).

1.1.1 2.2. Network Interview

Study participants completed a comprehensive network interview. An egocentric approach was used, where participants provided data on their immediate social ties and individuals with multiple ties to the participant's immediate alters. Directly tied alters (i.e., direct network members) were elicited using seven name generators (i.e., people you are close with or talk to regularly, people who would spend time and energy to help you, people who would lend you \$25, people you would turn to for advice on gay-related issues, people you spend time with regularly but may not be close to, people you have had sex with, and people you use drugs or alcohol with). Alters not directly tied to the participant were elicited via two name generators capturing ego's perception of alters who used drugs or had sex with two or more of the participant's alters. Data on the relationship between each alter and the participant (e.g., frequency and type of drug use in the past six months) as well as perceived structural ties between alters for social, sexual, and substance use networks were also obtained from the participant. For example, if the participant perceived two alters had ever used drugs or alcohol together, a substance use network tie was created between those members. Comprehensive details on this network interview can be found elsewhere (Birkett et al., 2015; Kuhns et al., 2015; Mustanski et al., 2015).

1.1.2 2.3. Analysis

Two mixed models with random intercepts were used to examine the dependent variables. Mixed models were chosen to account for the dependency created by multiple observed substance use alters nested within each participant (i.e., alters nested in egos). Accordingly, all outcomes and dyadic characteristics were modeled as Level 1 variables specific to each participant-alter tie, while individual and network characteristics were modeled at Level 2. All analysis was performed using Mplus 7.31. The first dependent variable was if the participant had used substances other than alcohol within the last 6 months with each partner (0 = no recent substance use other than alcohol, 1 = recent drug use). This outcome was assessed using a logistic mixed model with a random intercept. The second dependent variable indicated the frequency of substance use with each partner in the last six months on a scale from 0 (Never) to 6 (Every day or almost every day) and was assessed using a mixed model with a random intercept. Variables at the partner-level included: frequency of communication in the last six months with the partner, perceived strength of relationship with the partner, if the participant had sex with the partner once, if the participant had sex with the partner more than once, the relationship type between the participant and alter (i.e., serious partner (reference category), family, friend, support, or other), and the difference in age between the participant (measured by subtracting the ego's age from the alter's).

Individual variables included both demographics and network characteristics. Individual-level demographic variables included race/ethnicity (dummy coded for Hispanic, White, or Other as compared to Black) and the age of the participant. Network characteristics included: transitivity and substance use network degree. Transitivity was measured using the average degree (i.e., number of substance use ties) of an ego's substance use alters, calculated by summing the total number of ties between alters and dividing by the number of substance use alters. Therefore, this measure of transitivity captures the level of connectedness between substance using alters. Substance use network degree simply represented the number of substance use alters for each participant.

2 3. RESULTS

2.1.1 3.1 Descriptive Statistics

Participants reported an average of 12.27 substance use alters ($SD = 8.78$), with each alter having substance use ties with on average three other substance use alters ($M = 3.00$, $SD = 2.91$). The majority of substance use alters were identified as friends (61.6%) followed by other roles (15.3%; e.g., coworker, roommate, acquaintance), family (12.3%), serious partners (10.1%), and support (0.7%; e.g., minister, teacher). The majority of substance use alters were not sexual partners (73.2%), followed by sex partners that were long-term (17.9%) or one-time (8.9%). Substance use alters tended to be slightly older than the participants ($M = 2.27$ years, $SD = 6.10$).

2.1.2 3.2 Models

Table 2 displays results for both mixed models. As shown, the only network variable associated with recent drug use was transitivity ($OR = 1.21$ [95% confidence interval (CI): 1.04, 1.41]), suggesting that participants with denser substance use networks (networks in which substance use alters used substances together) were more likely to use drugs with any given substance use alter. For dyadic characteristics, participants were less likely to use drugs with alters who were older than they were ($OR = 0.93$ [95% CI: 0.90, 0.96]), but more likely to use drugs with alters identified as friends ($OR = 1.86$ [95% CI: 1.06, 3.28]) or another role ($OR = 2.71$ [95% CI: 1.50, 4.89]), as compared to serious partners.

For frequency of substance use, transitivity was again the only significant network variable associated with more frequent substance use ($b = 0.08$ [95% CI: 0.03, 0.13]). At the dyadic level, more frequent communication with alters was associated with more frequent substance use ($b = 0.56$ [95% CI: 0.48, 0.63]) while older alters were associated with less frequent use ($b = -0.01$ [95% CI: -0.03 , 0.00]).

3 4. DISCUSSION

Despite the abundant enthusiasm for utilizing network information to improve the implementation of health interventions (Valente, 2012), very little is known or understood about the specific network-level drivers of health, and how these specific drivers may differ in function by tie type, by population, and by health behavior. Therefore, to begin to tease apart the complex individual, dyadic, and network drivers of drug and alcohol use, this study provides the first detailed analysis of substance use networks in YMSM.

Our analysis found that both an ego's drug use and an ego's frequency of substance use with substance use alters were positively associated with the network transitivity of their substance use network. Additionally, this association with transitivity, a network structural characteristic, was significant even when controlling for individual and dyadic characteristics. This work suggests that the ties between alters that an individual uses substances with is related to the type and frequency of substance use with those alters. This finding, paired with our results around the dyadic characteristics, like friendship, frequency of communication, and age difference, all suggest that the riskier use of substances (i.e., more frequent substance use or drug use) occurs with individuals who not only communicate frequently with the ego, but who are also in transitive networks, suggesting that risky egos are likely embedded in a closely connected substance use circle and may share social or physical settings.

Indeed, network connectivity (e.g., density or transitivity) has been suggested as a key component of network influence on young people's substance use (Valente, 2004), but most research has examined the connectivity of social ties only, with little focus on substance use ties. Accordingly, this work is one of the first to demonstrate the importance of relational structure in substance use with alters. Although, it is important to note that the directionality of this association cannot be determined.

This study has a number of limitations that should be considered when interpreting these findings. First, as with many studies of hard-to-reach populations, the current study was not a probability sample of this population and therefore, findings cannot be generalized to all YMSM. Second, network data is inherently difficult to collect and is beholden to participant error and biases (Marsden, 1990) so there likely exists un-modeled error in reporting of alters. Third, the alter-to-alter ties in the substance use network were measured in a way that conflated both alcohol and drug use. This distinction between alcohol and drug use networks is likely important to more accurately modeling these networks and understanding the context of drug use behavior. Finally, the recruitment strategy for the parent study may have introduced dependency between participants that is not accounted for in the current analysis.

Given the complexity of network influence on substance use behaviors, this study provides only a preliminary look at the potential for network research to decipher the social processes that may promote or inhibit these behaviors. Future research should further explore how the complexities of substance use and other network types may provide a more comprehensive understanding of the social context of these behaviors, particularly in populations at high risk for substance use such as YMSM.

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REFERENCES

- Birkett M, Kuhns L, Latkin C, Muth S, Mustanski B. The sexual networks of racially diverse young men who have sex with men. *Arch. Sex. Behav.* 2015 In Press.
- Bruce D, Kahana S, Harper GW, Fernandez MI. Alcohol use predicts sexual risk behavior with HIV-negative or partners of unknown status among young HIV-positive men who have sex with men. *AIDS Care.* 2012; 25:559–565. [PubMed: 22971018]
- Corliss HL, Rosario M, Wypij D, Wylie SA, Frazier AL, Austin SB. Sexual orientation and drug use in a longitudinal cohort study of U.S. adolescents. *Addict. Behav.* 2010; 35:517–521. [PubMed: 20061091]
- Ennett ST, Bauman KE, Hussong A, Faris R, Foshee VA, Cai L, DuRant RH. The peer context of adolescent substance use: findings from social network analysis. *J. Res. Adolesc.* 2006; 16:159–186.
- Halkitis PN, Moeller RW, Siconolfi DE, Storholm ED, Solomon TM, Bub KL. Measurement model exploring a syndemic in emerging adult gay and bisexual men. *AIDS Behav.* 2013; 17:662–673. [PubMed: 22843250]
- Harrison PA, Fulkerson JA, Park E. The relative importance of social versus commercial sources in youth access to tobacco, alcohol, and other drugs. *Prev. Med.* 2000; 31:39–48. [PubMed: 10896842]
- Kuhns L, Birkett M, Muth SQ, Latkin C, Ortis-Estes I, Garofalo R, Mustanski B. Modifying and adapting participant-aided sociograms for a study of social, sexual and substance-using networks among young men who have sex with men. *Connections.* 2015; 35
- Latkin CA, Kuramoto SJ, Davey-Rothwell MA, Tobin KE. Social norms, social networks, and HIV risk behavior among injection drug users. *AIDS Behav.* 2010; 14:1159–1168. [PubMed: 19466537]
- Marsden PV. Network Data and Measurement. *Annu. Rev. Sociol.* 1990; 16:435–463.
- Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, Bukstein OG, Morse JQ. Sexual orientation and adolescent substance use: A meta-analysis and methodological review. *Addiction.* 2008; 103:546–556. [PubMed: 18339100]
- Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance use in lesbian, gay and bisexual youth and heterosexual youth. *Addiction.* 2009; 104:974–981. [PubMed: 19344440]
- McCabe SE, Boyd CJ. Sources of prescription drugs for illicit use. *Addict. Behav.* 2005; 30:1342–1350. [PubMed: 16022931]
- McFadden RB, Bouris AM, Voisin DR, Glick NR, Schneider JA. Dynamic social support networks of younger black men who have sex with men with new HIV infection. *Aids Care.* 2014; 26:1275–1282. [PubMed: 24766079]
- Mustanski B, Birkett M, Kuhns LM, Latkin CA, Muth SQ. the role of geographic and network factors in racial disparities in hiv among young men who have sex with men: an egocentric network study. *AIDS Behav.* 2015; 19:1037–1047. [PubMed: 25430501]
- Newcomb ME. Moderating effect of age on the association between alcohol use and sexual risk in MSM: evidence for elevated risk among younger MSM. *AIDS Behav.* 2013; 17:1746–1754. [PubMed: 23553348]
- Newcomb ME, Birkett M, Corliss HL, Mustanski B. Sexual orientation, gender, and racial differences in illicit drug use in a sample of US high school students. *Am. J. Public Health.* 2014; 104:304–310. [PubMed: 24328653]
- Newcomb ME, Heinz AJ, Mustanski B. Examining risk and protective factors for alcohol use in lesbian, gay, and bisexual, and transgender youth: a longitudinal multilevel analysis. *J. Stud Alcohol Drugs.* 2012; 73:783–793. [PubMed: 22846242]
- Schensul JJ, Burkholder GJ. Vulnerability, social networks, sites, and selling as predictors of drug use among urban African American and Puerto Rican emerging adults. *J. Drug Issues.* 2005; 35:379–407.
- Thiede H, Valleroy LA, MacKellar DA, Celentano DD, Ford WL, Hagan H, Koblin BA, LaLota M, McFarland W, Shehan DA, Torian LV. Regional patterns and correlates of substance use among young men who have sex with men in 7 US urban areas. *Am. J. Public Health.* 2003; 93:1915–1921. [PubMed: 14600066]

- Tobin KE, Davey-Rothwell M, Latkin CA. Social-level correlates of shooting gallery attendance: a focus on networks and norms. *AIDS Behav.* 2010; 14:1142–1148. [PubMed: 20099016]
- Traube DE, Holloway IW, Schrager SM, Kipke MD. Utilizing social action theory as a framework to determine correlates of illicit drug use among young men who have sex with men. *Psychol. Addict. Behav.* 2012; 26:78–88. [PubMed: 21644802]
- Traube DE, Schrager SM, Holloway IW, Weiss G, Kipke MD. Environmental risk, social cognition, and drug use among young men who have sex with men: longitudinal effects of minority status on health processes and outcomes. *Drug Alcohol Depend.* 2013; 127:1–7. [PubMed: 22749680]
- Tucker JS, Hu JH, Golinelli D, Kennedy DP, Green HD, Wenzel SL. Social network and individual correlates of sexual risk behavior among homeless young men who have sex with men. *J. Adolesc. Health.* 2012; 51:386–392. [PubMed: 22999840]
- Unger JB, Chen XG. The role of social networks and media receptivity in predicting age of smoking initiation: a proportional hazards model of risk and protective factors. *Addict. Behav.* 1999; 24:371–381. [PubMed: 10400276]
- Valente TW. Network interventions. *Science.* 2012; 337:49–53. [PubMed: 22767921]
- Valente TW, Gallaher P, Mouttapa M. Using social networks to understand and prevent substance use: a transdisciplinary perspective. *Subst. Use Misuse.* 2004; 39:1685–1712.
- Wagenaar AC, Toomey TL, Murray DM, Short BJ, Wolfson M, Jones-Webb R. Sources of alcohol for underage drinkers. *J. Stud. Alcohol.* 1996; 57:325–333. [PubMed: 8709591]

Substance use network characteristics are used to model substance use behavior
Transitive networks are linked to higher probability and frequency of use
Network effects remain after controlling for individual and dyadic factors

Table 1

Descriptive Statistics

Variable	Mean (SD)	N (%)
Participants (n = 156)		
<i>Participant Demographics</i>		
Age (years)	20.08 (1.42)	
Race/Ethnicity		
Black		82 (52.6)
Hispanic		34 (21.8)
White		24 (15.4)
Other		16 (10.4)
Sexual Orientation		
Gay		131 (84.0)
Bisexual		19 (12.2)
Heterosexual		3 (1.9)
Queer		3 (1.9)
<i>Substance Use Network Characteristics</i>		
Degree	12.27 (8.78)	
Transitivity	3.00 (2.90)	
Alters/Dyads: Substance Use Partners (n = 1914)		
<i>Dyadic Characteristics</i>		
Relationship Strength	1.84 (0.78)	
Frequency of Communication	3.30 (1.51)	
Relationship/Role		
Serious Partner		179 (9.3)
Family		235 (12.3)
Friend		1179 (61.6)
Support		15 (0.7)
Other		307 (16.0)
Sexual Partnership		
No Sexual Partnership		1402 (73.2)
One Time Partner		170 (8.9)
Long Term Partner		342 (17.9)
Age Difference (years)	2.27 (6.10)	
<i>Alter Demographics</i>		
Race/Ethnicity		
Black		800 (41.8)
Hispanic		451 (23.6)
White		479 (25.0)
Other		184 (9.6)
Recent Substance Use Behavior		
Alcohol		1397 (73.0)

Variable	Mean (SD)	N (%)
Any drug		767 (40.1)
Marijuana		762 (39.8)
Cocaine		14 (0.7)
Opiates		17 (0.8)
Psychedelics		18 (0.9)
Ecstasy		29 (1.5)
Other		24 (1.3)

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Table 2**Model Results**

	Recent Drug Use with Alter (Excluding alcohol)		Frequency of Substance Use with Alter	
	OR (95% CI)	p-value	b (95% CI)	p-value
<i>Individual Characteristics</i>				
Age (years)	0.61 (0.45, 0.84)	0.002	−0.07 (−0.17, 0.04)	0.225
Race/Ethnicity				
Black	—	—	—	—
Hispanic	0.40 (0.12, 1.36)	0.142	−0.15 (−0.52, 0.22)	0.419
White	1.11 (0.31, 3.91)	0.873	−0.06 (−0.44, 0.31)	0.741
Other	1.94 (0.43, 8.67)	0.385	−0.03 (−0.44, 0.38)	0.890
<i>Substance Use Network Characteristics</i>				
Degree	0.98 (0.92, 1.05)	0.599	0.02 (0.00, 0.03)	0.075
Transitivity	1.21 (1.04, 1.41)	0.012	0.08 (0.03, 0.13)	0.002
<i>Dyadic Characteristics</i>				
Relationship Strength	0.85 (0.66, 1.09)	0.201	0.02 (−0.12, 0.16)	0.760
Frequency of Communication	1.69 (1.46, 1.95)	< 0.001	0.56 (0.48, 0.63)	< 0.001
Relationship/Role Serious Partner	—	—	—	—
Family	0.81 (0.41, 1.62)	0.554	−0.35 (−0.74, 0.04)	0.077
Friend	1.86 (1.06, 3.28)	0.032	0.03 (−0.24, 0.31)	0.812
Support	1.79 (0.69, 4.69)	0.234	−0.34 (−0.69, 0.01)	0.059
Other	2.71 (1.50, 4.89)	0.001	0.10 (−0.15, 0.36)	0.427
<i>Sexual Partnership</i>				
No Sexual Partnership	—	—	—	—
One Time Partner	0.99 (0.58, 1.70)	0.980	0.06 (−0.18, 0.30)	0.648
Long Term Partner	1.12 (0.67, 1.88)	0.673	−0.01 (−0.24, 0.23)	0.960
Age Difference (years)	0.93 (0.90, 0.96)	< 0.001	−0.01 (−0.03, 0.00)	0.028

Note. Intercepts not shown. All model results are for the adjusted model including all variables in the model.