Sociometric network structure and its association with methamphetamine use norms among homeless youth

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Abstract

Homeless youths' social networks are consistently linked with their substance use. Social networks influence behavior through several mechanisms, especially social norms. This study used sociometric analyses to understand whether social norms of drug use behaviors are clustered in network structures and whether these perceived norms (descriptive and injunctive) influence youths' drug use behaviors. An event-based approach was used to delineate boundaries of the two sociometric networks of homeless youth, one in Los Angeles, CA ($n = 160$) and the other in Santa Monica, CA ($n = 130$). Network characteristics included centrality (i.e., popularity) and cohesiveness (location in dense subnetworks). The primary outcome was recent methamphetamine use. Results revealed that both descriptive and injunctive norms influenced methamphetamine use. Network cohesion was found to be associated with perception of both descriptive and injunctive norms in both networks, however in opposite directions. Network interventions therefore might be effective if designed to capitalize on social influence that naturally occurs in cohesive parts of networks.

Keywords

Social networks; Perceived norms; Methamphetamine use; Homeless youth

1. Introduction

1.1. Methamphetamine use among homeless youth

Research has suggested that as many as 1.6 million youth are homeless or run away from home at some point each year (Ringwalt et al., 1998; Toro et al., 2011). Many youth report using alcohol and other drugs both before and after becoming homeless (Whitbeck, 2009). Although alcohol, cigarettes, and marijuana have been the most frequently used substances on the street, the use of hard drugs, such as methamphetamine (meth), is steadily increasing (Wenzel et al., 2010). In particular, meth use is 3–4 times higher among homeless youth compared to their housed counterparts (Greene et al., 1997), with an alarmingly high

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percentage (50%–70%) of homeless youth indicating prior meth use (Marshall et al., 2011; Nyamathi et al., 2012). Notably, meth use has been widely linked to a greater likelihood of HIV transmission, particularly through meth's associations with high-risk sexual behaviors, such as unprotected sex, sex with an injection drug user, sex with an HIV-positive partner, and sex work (Clements et al., 1997; Huba et al., 2000; Kipke et al., 1997; Martinez et al., 1998; Whitbeck et al., 2001).

1.2. A social network approach to understanding meth use behaviors

The social networks of homeless youth are key to understanding their drug use behaviors. A social network is a set of people or groups of people with some pattern of connections or interactions between them (Wasserman and Faust, 1994). A given network can be analyzed based on its structure and function (Latkin et al., 2003). The structural aspects of social networks measure characteristics of social networks, such as size of network, centralization vs. isolation, and density (Valente et al., 2004). Functional characteristics, on the other hand, refer to the roles that network members play. Furthermore, norms fulfill a very important function in social networks by acting as a source of social influence and regulation (Horne, 2001). Norms are perceived rules or properties of a group that outline specific beliefs regarding what behaviors are considered acceptable or common within that group (Kincaid, 2004). Although researchers have studied the associations among social network structural characteristics and engagement in risk behaviors, few empirical research efforts have attempted to understand how social networks influence health behaviors through their impact on social norms.

More importantly, although several theories suggest that targeting perceived social norms within key network structures may offer a powerful means of behavioral change (Fisher and Fisher, 1992; Latkin et al., 2003), intervention efforts have been impeded due to a lack of understanding of how norms cluster in specific risk-taking social network structures (Latkin et al., 2010). Understanding the structural network mechanisms that influence perception of norms would elucidate important information regarding how network interventions should be tailored and, more importantly, guide the selection of peer change agents in these networks (Barrington et al., 2009; Schneider et al., 2015).

This study therefore sought to expand on extant research regarding homeless youth and substance use by exploring how social network norms regarding meth use are clustered in specific sociometric networks. Furthermore, the current study aimed to determine whether homeless youths' meth use is influenced by their perceived social norms of meth use among their peers (i.e., how common and acceptable meth use is among their peers). Drug use-prevention interventions have tended to have limited impact on drug risk behaviors, in part, because social and contextual influences are often minimally addressed. These investigations can therefore identify opportunities for improvements to substance use prevention and intervention efforts with homeless youth.

1.3. Social network structural characteristics and drug-use behaviors

Structural network theory is primarily concerned with characterizing network structures (e.g. small worldness) and node positions (e.g. core/periphery) and associating it with a multitude

of outcomes (Borgatti & Halgin, 2011). Network analyses can be conducted in two ways: egocentric (the direct ties of an index person with all network members) and sociometric (the complete set of relations among people in a population, including both direct and indirect ties; Neaigus, 1998). One of the significant and unique aspects of sociometric network analyses is its ability to characterize people in terms of their position in the larger network (Valente et al., 2004). The prominence of a network member's position in their network is measured by the member's centrality (Scott, 2012). Actors at the center of a network have more linkages within that network and consequently are more active, in comparison to peripheral actors.

Both techniques have been used to understand drug use among both housed and homeless youth. However, to the best of our knowledge, there has been only one sociometric study so far that assessed how structural network characteristics (such as network position and cohesion) are associated with drug-use behaviors (Authors, blinded for review). This particular study found that network cohesion was associated with heroin use behaviors among this population. Sociometric analysis with homeless youth has been conceptualized as a way of measuring homeless youths' emersion into street culture (Whitbeck et al., 2009) and sociometric data helps us assess precisely how a youth is positioned vis-à-vis others in a network of other homeless youth. Placement in these social positions reflects varying levels of interaction with their street-peers (Ennett and Bauman, 1993). Therefore, one can hypothesize that youth who are in the core or center of their street networks might adhere more closely to the norms of their street-peer group and engage in greater substance use. Conversely, youth who are in the periphery might instead have access to diverse opportunities for obtaining information, ideas, and resources from many different sources and be less constrained by the influence of their street-peers (Ennett and Bauman, 1993).

1.4. Social network norm perceptions and engagement in risk behaviors

The structural network perspective emphasizes the constraining influence of structural network characteristics on behavior. However, it fails to account for normative forces that facilitate adaptation to these shared social environments (Lakon, 2004). Norms influence behavior through modeling (Bandura, 1977), comparison of attitudes behaviors with one's referent groups (Marsden and Friedkin, 1994), and through social feedback (Fisher and Misovich, 1990). Social norms are defined as beliefs regarding what behaviors are considered acceptable or common in a group (Kincaid, 2004). Perceived norms have been generally categorized as descriptive or injunctive. Descriptive norms indicate the perceived prevalence of a behavior in a group, whereas injunctive norms refer to perceived approval or disapproval of a behavior (Davey-Rothwell and Latkin, 2007). Empirical examination of these two constructs has also revealed that their significance in determining a behavior varies based on the context and specific behavior (Reno et al., 1993). For example, studies have found that injunctive norms are more significant in determining consistent condom use (van Empelen et al., 2001), whereas descriptive norms were more salient in understanding intention to consume alcohol (Reno et al., 1993). Condom use is private behavior that usually occurs between two people, whereas alcohol is often consumed in social settings. Therefore, it is possible that descriptive norms are more salient in influencing more social and visible behaviors because of the desire to conform. On the other hand, for private

behaviors like condom use, people might be influenced by how others might perceive that behavior (whether they would encourage or object to it).

There have been few investigations regarding social norms among homeless youth. One exception is a study conducted by Ennett et al. (1999), which focused on perceptions of network members' approval or disapproval regarding engagement in illicit drug use behaviors among homeless youth. Ennett et al. (1999) found that only a small proportion of the network (15%) perceived peers as approving of drug use; however, those who perceived this approval were significantly more likely to exhibit risky drug use behaviors. Tyler (2013) also studied social norms among homeless youth, but limited their focus to sexual risk behaviors. In their qualitative examination, they found that of 19 participants interviewed, only three youths reported that their social networks endorsed safe sex practices; these three youths were more likely to use condoms consistently (Tyler, 2013). Taken together, these two studies signify the potential influence of norms on homeless youths' risk behaviors.

1.5. Social network characteristics and norms

For a rule to be a norm, network members must accept and endorse it. Social norms are, for that reason, inherently linked to an individual's social networks because they usually materialize out of interactions with others and how deviations are sanctioned by network members (Cialdini and Trost, 1998). Although there is a growing literature examining network features of norms among vulnerable populations other than homeless youth (Davey-Rothwell and Latkin, 2007; Latkin et al., 2003, 2010), very few studies have examined associations between social network structural characteristics (such as network position and cohesiveness) and normative perceptions of risk behaviors, such as substance use. To our knowledge, no study has explored the intersection of social network structure and substance use norms in the homeless youth population.

1.6. Network structure and norms: egocentric versus sociometric approaches

As previously mentioned, social networks can be measured at both the egocentric as well as sociometric levels. Norm emergence is considered an element of the egocentric approach, in which norms are internalized as a process of imitation or observational modeling (Horne, 2001), and a sociometric process in which people in similar structural positions endorse similar norms (Burt, 1987). Studies have usually focused on the egocentric network attributes of norms, such as how size of networks (i.e., direct ties to an individual) and density of ties (i.e., interconnectedness of network members in an individual's network) influence HIV-related norms (Barrington et al., 2009; Davey-Rothwell and Latkin, 2007; Latkin et al., 2010). For instance, Barrington et al. (2009) found that density of ties (reflecting cohesion in the network) rather than network size was more significantly associated with reduced perceptions of condom use norms among female sex workers in the Dominican Republic. Latkin et al. (2010) reported similar findings in their study of condom use norms among injection drug users in Baltimore. Both studies concluded that density (or cohesion) in networks might be reflective of the closed nature of the group, thereby promoting a culture of silence (Latkin et al., 2010) and slowing down the adoption of new behavior (Barrington et al., 2009); this might explain perceptions of more risky norms in these populations.

Although these findings offered important insight into how network structures affect norms in specific networks, there are still areas that remain understudied. First, the aforementioned studies reported on egocentric social network data, which provide limited information about network structures. Egocentric network structural measures such as network size and density are not the most reliable ways to assess network characteristics because they only capture the network as described by the focal person, or ego, thereby potentially permitting bias (Ueno, 2005). Moreover, egocentric network measures are also limited because they are not able to account for the social influence that occurs beyond dyadic social interactions; they typically focus on direct ties, whereas people have both direct and indirect ties to one another. One of the distinctive aspects of sociometric network analysis is its ability to characterize how people are positioned in larger networks as a function of their direct and indirect relationships (Valente et al., 2004).

Network position is typically used to delineate an individual's social status in the network. Recent studies have suggested that youth are more likely to be influenced by the norms of their popular peers (who have high social status) than youth who are not as popular (Teunissen et al., 2012). In particular, network structure can be used to identify potential routes for norm diffusion and locate targets for prevention with the ultimate goal of modifying behavior. For example, in the context of both HIV and substance use prevention, interventions have typically relied on the popular opinion leader model (Kelly et al., 1991), which uses influential people (or those with social status) in communities to serve as peer change agents to diffuse safer norms into high-risk groups (Schneider et al., 2015).

A recent study demonstrated the viability of using network structural metrics such as network position to locate peer leaders based on the kind of norms they endorse (Schneider et al., 2015). Findings from this study indicated that centrally located people are not optimal change agents because of their proclivity to engaging in more risk behaviors and endorsing risky norms. To understand whether individuals regarded by homeless youth as influential (or opinion leaders) are ideal targets for interventions; it is necessary to assess whether youth in these critical positions endorse risky or protective behaviors (Green et al., 2013). This is especially important because if interventions that promote behavior change are incongruent with existing norms among youth occupying these network positions and threaten their status, they might be less invested in serving as change agents (Schneider et al., 2015).

Beyond network position, norms could also be affected by other sociometric network structures such as network cohesion. Indeed, as previously mentioned, egocentric studies have found that density (or cohesion) is an important correlate of perceived network norms. Network cohesion in a sociometric network is identified by focusing on how an individual is embedded in the structure of groups in a network (Borgatti and Everett, 2000). Cohesive subgroups are therefore identified based on dense interconnections in sets of individuals (Borgatti and Everett, 2000). Unlike network positions, where youth tend to emulate the norms of the popular members in their network, cohesion influences perceived norms because of the solidarity that group members have with one another (Fujimoto and Valente, 2012). It is also likely that a cohesive group imposes greater sanctions for deviation from established norms, which dissuades people from accepting new norms. Moreover, as Latkin et al. (2010) and Barrington et al. (2009) suggested, cohesive subgroups have the same

norms being reinforced by multiple people and because they are closed off from other networks, it is likely that its members tend to adhere more strongly to these group norms.

1.7. The current study

Three primary goals guided this study. First, we wanted to understand how social norms influence meth use behaviors in this understudied population, and second, we tried to assess which sociometric network characteristics (such as network position and network cohesion) were associated with perceived network norms with regard to homeless youths' methamphetamine use. Flowing from these two aims, we also conducted additional analyses to understand whether sociometric network characteristics are associated with meth use behaviors.

Based on previous egocentric findings, we hypothesized that homeless youths' norms regarding HIV risk behaviors such as meth use would vary depending on the structural features of their network, such as network cohesiveness or social position. Given that meth is a social drug, we also expected that descriptive norms regarding meth use would be more significantly associated with meth use behaviors in this group of youth compared to injunctive norms. Finally, it is possible that substance use is associated with greater popularity and visibility and one could hypothesize that being more central within a given network could be associated with higher risk.

2. Methodology

2.1. Sampling

Using an event-based approach (EBA; Freeman and Webster, 1994), a sample of homeless youth ($N = 358$) aged 13–25 years was recruited between October 2011 and February 2012 from two drop-in centers, one in Hollywood, CA, and one in Santa Monica, CA. The EBA was used to delineate the boundary of this sociometric network of homeless youth, to exclusively include youth who were accessing services at these two drop-in centers. Social networks are not random and simple random sampling procedures are not appropriate for social network studies, given the aim of understanding how a population of individuals interconnects. Rather, the goal of these whole-network studies is to capture as much of a target population as possible. Network researchers acknowledge the social world is composed of infinite sets of relations; however, it becomes necessary to impose certain constraints on who is to be included in a sample (Wasserman and Faust, 1994) to create some notion of a boundary. Although no clear consensus exists on how to set this boundary, the EBA is especially viable for sampling traditionally unbounded populations such as homeless youth (Rice et al., 2012).

The EBA binds individuals into a social group based on a set of shared activities or events. This sampling mechanism is most relevant for homeless youth for several reasons (Rice et al., 2012). First, homeless youth are a transient population, making it unrealistic to expect them to be listed in a formal membership list (Marsden, 2005). Second, some of these youth are isolated from other homeless youth. Therefore, the relational approach (Marsden, 2005), which starts with an agency roster and expands to include other people who are nominated

by the existing sample, will exclude social isolates and other peripheral youth. The EBA approach mitigates these limitations, because participants are sampled from natural settings in which people socialize and entry and exit is common, without imposing restrictions on formal membership. In the present study, youth who attended the two drop-in centers at least once in the prior month were included in the sample. Consistent with the EBA's original criterion (Freeman and Webster, 1994), drop-in centers served as natural settings where homeless youth routinely interacted with one another. Imposing these boundaries at the drop-in centers themselves allowed for observation of the network without restricting unregulated entry and exit from the network.

2.2. Procedures and recruitment

Recruitment was conducted for 19 days at each agency, with recruiters present at the agency to approach youth for the duration of service provision hours at each site. Any client older than 13 years of age receiving services at the respective agency was eligible to participate. Each agency has one main entrance where youth sign in for services for the day, allowing recruiters to ensure that all youth were approached. Youth new to the agency first completed the agency's intake process before beginning the study to ensure they met eligibility requirements for the agency (and thus the study). A consistent set of two research staff members was responsible for all recruitment to prevent youth from completing the survey multiple times during each data collection period per site.

Signed voluntary informed consent was obtained from each youth, with the caveats that child abuse and suicidal and homicidal intentions would be reported. Informed consent was obtained from youth 18 years of age or older and informed assent was obtained from youth 13–17 years old. The institutional review board waived parental consent, because homeless youth under 18 years are unaccompanied minors who may not have a parent or adult guardian from whom to obtain consent. Interviewers received approximately 40 h of training, including lectures, role-playing, mock surveys, ethics training, and emergency procedures.

The survey consisted of two parts: (1) an audio computer-assisted self-interview and (2) a face-to-face social network interview. The questionnaire and social network interview could be completed in English or Spanish. Study participation lasted about 60–90 min total. All participants received $20 in cash or gift cards as compensation for their time. The institutional review board affiliated with the principal investigator approved survey items and procedures.

2.3. Name generator and sociometric construction

Network data were collected from the participants by a trained interviewer using a name generator. Participants provided information for up to 50 people with whom they had interacted during the previous 30 days. When youth finished nominating persons in their networks, attributes of each nominee were collected, including first name and last initial, aliases, age, gender, race and ethnicity, and whether the nominee was a client of the agency.

The participants in the study were linked using a sociomatrix. A direct tie from participant i to participant j was recorded if participant i nominated participant j in his or her personal

network. Matches were based on name, alias, ethnicity, gender, approximate age, and agency attendance. Two research assistants created the adjacency matrices. These matrices were combined and any ties that did not match were excluded. When insufficient descriptive information was available, decisions were based on a series of algorithms that included: (1) interviewer and recruiter field knowledge (through the compilation of field notes following each data collection period); (2) how well the ego knew the alter (i.e., relative, romantic partner, needle sharer, known for at least 1 year) and whether the alter was identified as a client; and (3) via a Microsoft Access database and form that formulaically paired possible matches based on names, visible tattoos, and demographic characteristics. The independent reviewers' decisions were compared for agreement. Discrepant matches were discussed as a group with the independent reviewers and a third reviewer who served as an interviewer and recruiter during the data collection and led to final match decisions. Initially, there were 389 ties with discrepancies between the two coders, although consensus could not be reached on only five ties (99.991% agreement on possible ties).

2.4. Measures

Theoretical and empirical findings informed the selection of items used to measure the constructs of interest. Most relevant to the current study, sociodemographic characteristics, such as age, site where participants received services (i.e., Hollywood vs. Santa Monica), ethnicity (White vs. non-White), gender (male vs. female), sexual orientation (heterosexual vs. lesbian, gay, questioning, or bisexual), time spent homeless, migratory status (traveler vs. not), educational status (high school graduate vs. not), time since first homeless experience, and housing situation (literal homelessness vs. stable housing), were included. Youth experiencing literal homelessness were defined as participants who responded that they were currently staying in a shelter (emergency or temporary), stranger's home, hotel, motel, street, beach, tent or campsite, abandoned building, car, or bus, compared to youth who indicated that they were in stable housing (for more than months).

2.4.1. Position in network—Two centrality measures, specifically degree centrality and eigenvector centrality, were used to delineate the position of youth in the sociometric network. Centrality measures address the question, "Who is the most important or central person in this network?"

Degree centrality refers to the number of ties a node (person) has to other nodes (Wasserman and Faust, 1994). Therefore, a person who has one connection will have a degree centrality score of 1. In the Hollywood sociometric network, degree centrality scores ranged from 1 to 13. In the Santa Monica network, degree centrality scores ranged from 1 to 9. Based on these scores, youth who had fewer than two ties (median = 2) were regarded as peripheral to the network.

Eigenvector centrality is essentially the recursive version of degree centrality. A node is central to the extent that it is connected to other nodes that are central (Wasserman and Faust, 1994). In the Hollywood network, the eigenvector scores ranged from 0.00 (which signifies no influential connections) to 0.43 (which signifies the greatest level of influential connections). The median eigenvector score (0.04) was used to dichotomize the assignment

of actors as central or peripheral to the network based on their level of influential connections. In the Santa Monica network, the eigenvector scores ranged from 0.00 to 0.39, with a median eigenvector score of 0.03. Network structural measures were dummy coded, with youth in the "core" coded as 1 and youth in the "periphery" serving as the reference group.

2.4.2. Cohesion—K-core was used to operationalize the concept of network clustering or cohesion (Seidman, 1983). K-core is a maximal subgraph in which each point is adjacent to k other points; all points in the k-core have a degree greater than or equal to k (Wasserman and Faust, 1994). For example, a network in which everybody is connected to one another is the simplest form and has a 1 core. For both the Hollywood and Santa Monica networks, k-core scores ranged from 1 to 4. Periphery membership was defined by a k-core of 1 or 2, indicating that a youth had either one tie or two ties to other network members.

2.4.3. Descriptive norms—To assess descriptive norms regarding meth-related behaviors, after youth finished nominating their network members, they were asked: "Out of the people you nominated, how many of them use meth?" This was calculated as the proportion of people who the respondent thought or perceived engaged in meth use.

2.4.4. Injunctive norms—Similarly, to assess injunctive norms regarding meth-related behaviors, after youth finished nominating their network members, they were asked: "Out of the people you nominated, how many of them will object you using meth?" This was calculated as the proportion of people who respondents thought or perceived would object to them engaging in meth use.

To include both descriptive and injunctive norms as a dependent variable in the models, we first calculated the proportion of network members who endorsed each norm. Based on the resulting distributions (which were skewed), the norms outcomes were dichotomized based on the median. The median is used to create a threshold for measures that are not uniformly distributed (Wang et al., 1996). The descriptive norm was consequently dichotomized as either no network member (coded as 0) or at least one or more network members (coded as 1) who participants believed used meth. The injunctive norm, on the other hand (objection to meth use),was dichotomized as having no, some, or few alters (coded as 0) versus all alters (coded as 1) who would object to meth use by participants. This was true for both networks of youth (i.e., Hollywood and Santa Monica). These measures of norms have been used and validated by previous studies (Barrington et al., 2009; Davey-Rothwell and Latkin, 2007; Latkin et al., 2010).

2.4.5. Sex under the influence of drugs—To understand whether meth use is associated with risky sexual behaviors linked to HIV, an item was added to the model assessing associations between network norms and engagement in meth use. This was assessed with the question, "Did you drink alcohol or use drugs before you had sex (vaginal or anal sex) the last time?" The response options were yes (1) or no (0).

2.4.6. Meth use—Recent methamphetamine use was assessed with a question from the Youth Risk Behavior Survey (Eaton et al., 2012): "During the past 30 days, how many times

have you used meth?" The response options for methamphetamine were 0 times, 1 or 2 times, 3 to 9 times, 10 to 19 times, 20 to 39 times, and 40 times or more. These responses were dichotomized to address the skewed distribution and attain enough statistical power. Based on the median, we dichotomized recent meth use as 0–9 times (coded as 0) versus 10 or more times (coded as 1).

2.5. Data analyses

Data analyses were conducted using SAS Version 9.2. Network visualizations were conducted in Netdraw and network structural variables were generated via UCINET. All network variables created in UCINET (Borgatti et al., 2002) were exported and merged with self-reported data in SAS. Despite the inherent violation of the assumption of independence of observations in sociometric data, such statistical analyses have become common in applied research (Scott and Carrington, 2011). The resulting network variables were treated as individual-level characteristics in subsequent regression models. Because the hypotheses concerning all the three aims constituted largely exploratory analyses, bivariate analyses were first conducted to examine unadjusted associations between study variables and outcome measures. Any variable that was significantly associated with the outcome at $p < .05$ was retained in the multivariate model. Multivariate models were then constructed based on these analyses (Hosmer and Lemeshow, 2004). In the first multivariate model, we modeled the relationship between social network norms regarding meth use (both descriptive and injunctive) and self-reported meth use behaviors. For these analyses, the sample was not stratified by location (i.e., Hollywood vs. Santa Monica); but the model controlled for site of recruitment or sociometric membership. In the subsequent multivariate model, independent variables were the sociometric network metrics (e.g., k-core, degree centrality, etc.) and dependent variables were the descriptive and injunctive norms regarding meth use. Because these analyses assessed the relationship between sociometric network structure and norms, we stratified the participants by their sociometric boundary or membership. For the third aim, we modeled the relationship between sociometric network structure and self-reported meth use.

3. Results

3.1. Sociodemographic characteristics

Data on the sociodemographic characteristics of participants are presented in Table 1. Both networks were predominantly composed of boys and young men, however, there were more girls and young women in the Hollywood sample (35.1%) compared to the Santa Monica sample (20.9%). Because there were very few transgender youth in these networks, these cases were excluded from the final multivariate models. The networks were similar with regard to sexual orientation. The Santa Monica network was predominantly White (59.9%), whereas the Hollywood network was more diverse, with African Americans comprising the largest group of youth (42.4%). Additionally, more Santa Monica youth reported being street-based (60.5%) compared to youth in Hollywood (24.5%). A large majority of youth in Santa Monica were travelers (61.4%). Youth in Santa Monica were slightly older (21.8 years) and had been homeless a little longer (2.9 years) than in Hollywood.

3.2. Perceived network norms

Perceived norms for both sociometric networks are displayed in Table 2. More Santa Monica youth thought that at least one of their peers engaged in meth use (24.5%) compared to Hollywood youth (17.5%). A slightly lower percentage of youth in Hollywood reported that all their peers would object to them engaging in meth use (56.9%) compared to youth in Santa Monica (57.3%). Because some participants were nominated by peers but did not nominate anybody themselves, the perceived network norms did not include all youth in the network (and therefore the values do not sum to 100%).

3.3. Sociometric structural characteristics

The sociometric structural properties of the two networks are also presented in Table 2. Even though different youth occupied these networks, the two networks were structurally very similar. About 60.5% youth in the Hollywood network and 54.6% of youth in the Santa Monica network had two or fewer ties in the network. However, more youth in Hollywood had more influential connections than youth in Santa Monica. About 76.3% of youth in Hollywood and 71.1% of youth in Santa Monica had k-core values of 1 or 2.

3.4. Network visualization

Netdraw 2.090 graph visualization software was used to generate network visualizations employing the spring-embedder routine. Because analyses focused on perception of norms, isolates were excluded. Isolates are people who have no other connections (or did not nominate or were not nominated by anyone in the network), and therefore data on their perceptions of what others in their network do or expect them to do were not available. In addition, there were youth who were nominated but did not nominate anybody else in the network (i.e., unreciprocated ties). Therefore, we knew how other youth who nominated them perceived their substance use behaviors, but had no data on their perceptions. However, for the sake of the visual analyses, these youth were retained in the network matrix because removing these youth would have compromised the structural integrity of the networks, thereby modifying information on important structural attributes. In the figures, they have been retained as nodes shaped as squares.

3.5. Structural characteristics of descriptive norms regarding meth use (Hollywood)

Fig. 1 represents the sociometric network of homeless youth in Hollywood (n = 160). Small numbers of ties aggregated into larger network structures of homeless youth. Visual inspection of this network reveals a large interconnected core, some small components, and few triads and pairs of youth who are connected to one another. Triangle nodes are youth who believe that their peers engage in meth use. Visual inspection of the network reveals that youth who reported that at least one of their street peers engages in meth use are part of the large interconnected central component of the network.

3.6. Structural characteristics of injunctive norms regarding meth use (Hollywood)

Fig. 2 presents the structural characteristics of youth who believed that their peers would raise objections to them engaging in meth use. Triangle nodes are youth who believe that

their peers would object to them engaging in meth use. Unlike descriptive norms, a visual inspection of the network did not reveal any apparent structural patterns.

3.7. Structural characteristics of descriptive norms regarding meth use (Santa Monica)

Fig. 1 also presents the structural characteristics of perceptions of meth use in the Santa Monica network (n = 133). The network structure of Santa Monica looks very similar to the Hollywood network, but the pattern of network meth use is very different in these two networks. Unlike the Hollywood network, youth in the Santa Monica network who perceived that their peers used meth were more likely to be peripheral or have k-core scores of 1 or 2.

3.8. Structural characteristics of injunctive norms regarding meth use (Santa Monica)

Fig. 2 also presents the structural attributes of perceptions of peer objections to meth use in the Santa Monica network. Visual inspection of the network reveals that youth who are in the higher k-core regions (i.e., have a k-core value greater than 2) were more likely to believe that their peers would object to them engaging in meth use.

3.9. Statistical results

3.9.1. Methamphetamine use—Table 3 presents associations between perceived norms of methamphetamine use (both descriptive and injunctive) and self-reported methamphetamine use among homeless youth. Bivariate results revealed that field site ($p <$ .01), sexual orientation ($p <$ .05), race ($p <$ .05), current living situation ($p <$ .001), being a traveler ($p <$ .001), engaging in sex under the influence of drugs ($p <$ .001), and descriptive norms ($p <$ .001) and injunctive norms ($p <$ .001) regarding methamphetamine use were all significantly associated with self-reported methamphetamine use. Multivariate statistics indicated that sexual orientation, reporting engaging in sex under the influence, descriptive and injunctive norms regarding methamphetamine use remained significant. Specifically, non-heterosexual youth were 2 times more likely to report using methamphetamine compared to heterosexual youth ($p <$.05). Youth who reported engaging in sex under the influence of drugs were 1.33 times more likely to engage in methamphetamine use compared to youth who did not ($p <$.01). Youth who believed that their peers engaged in methamphetamine use were 3.5 times more likely to report engaging in methamphetamine use ($p <$.001). On the other hand, youth who believed that their peers would object to them engaging in methamphetamine use were 89% less likely to engage in methamphetamine use ($p <$.001).

In the multivariate model, sexual orientation, engaging in sex under the influence of drugs, and both kinds of perceived norms (descriptive and injunctive) remained significantly associated with self-reported methamphetamine use. Specifically, nonheterosexual youth were 2 times more likely to engage in methamphetamine use relative to heterosexual youth ($p <$ .05). Youth who reported engaging in sex under the influence of drugs were 2.5 times more likely to report methamphetamine use ($p <$ .01). Both perceived norms retained their significance in the multivariate model after controlling for other demographic behaviors, demonstrating the significance of social influences on substance use behaviors. Youth who believed that their alters engaged in methamphetamine use were 2.5 times more likely to

engage in methamphetamine use ($p < .01$). Youth who believed that a greater proportion of people in their networks would object to them engaging in methamphetamine use were 81% less likely to engage in methamphetamine use ($p < .001$).

3.9.2. Descriptive norms regarding meth use (Hollywood)—Table 4 presents bivariate and multivariate statistics assessing associations between sociometric characteristics and perceived descriptive norms of meth use in the Hollywood network. Bivariate statistics revealed that sexual orientation ($p < .01$), current living situation ($p < .05$), traveler status ($p < .05$), k-core value ($p < .001$), and degree centrality ($p < .05$) were significantly associated with perceived norms regarding meth use in the network. In the multivariate model, sexual orientation and k-core status remained significant. Specifically, nonheterosexual youth were 3.6 times more likely to think that their alters used meth ($p < .05$). Youth who were in more cohesive networks (as defined by their k-core status) were 4.5 times more likely to report that their alters used meth compared to youth who were in less dense sub networks ($p < .05$).

3.9.3. Injunctive norms regarding meth use (Hollywood)—Table 5 provides bivariate and multivariate variables associated with injunctive norms (objection to meth use). Only gender was associated with perceptions of objection to meth use. As bivariate analyses yielded only one significant association, subsequent multivariate analysis for this aim was not conducted.

3.9.4. Descriptive norms regarding meth use (Santa Monica)—Table 6 presents bivariate and multivariate statistics assessing associations between sociometric characteristics and perceived descriptive norms of meth use in the Santa Monica network. As bivariate analyses yielded only one significant association, subsequent multivariate analysis for this aim was not conducted.

3.9.5. Injunctive norms regarding meth use (Santa Monica)—Table 7 provides bivariate and multivariate statistics of factors associated with injunctive norms (objection to meth use). At the bivariate level, sociometric position as defined by k-core status ($p < .05$), and degree centrality ($p < .05$) were significantly associated with perceptions of objection to meth use. In the multivariate model, only k-core status remained significant. Youth who were in more cohesive networks in the Santa Monica network were 10.72 times more likely to believe that their alters would object to them engaging in meth use ($p < .01$).

3.9.6. Sociometric network characteristics and meth use (Hollywood and Santa Monica)—Table 8 presents bivariate statistics of sociometric properties associated with methamphetamine use in both Hollywood and Santa Monica networks. In both networks, neither sociometric position (as defined by K-core status) nor degree or Eigenvector centrality showed statistically significant associations with methamphetamine use. Therefore, no subsequent multivariate models were conducted.

4. Discussion

The results from this study confirm previous research (Barrington et al., 2009; Latkin et al., 2010) about the significance of social norms in understanding behaviors among various populations. Findings provide evidence that both descriptive and injunctive norms play an important role in understanding methamphetamine among homeless youth. Furthermore, injunctive norms remained significantly associated with methamphetamine even after controlling for descriptive norms. Although this does not confirm our hypothesis that descriptive norms would be more significantly associated with a social behavior like meth use, it is consistent with other research, which has found that descriptive and injunctive norms have independent effects across a wide range of behaviors, including drug use (McMillan and Conner, 2003), safe sex (White et al., 1994), physical exercise (Rhodes and Courneya, 2003), and aggressive behavior (Norman et al., 2005).

Our data suggest that there is little encouragement of and substantial objection to methamphetamine use. Specifically, in both networks more than half of youth indicated that they had a greater proportion of people in their networks that would object to their engagement in methamphetamine use. This parallels past research, which has reported very similar findings (Flom et al., 2001). Flom et al. (2001) found in their study of low-income minority non-homeless youth that 98% of youth indicated that none of their peers would encourage them to engage in injection drug use, and almost all (97%) of their peers would object to them engaging in injection drug use. Given that this is a population of youth, among whom drug use is much higher than similarly aged housed youth, the lack of encouragement of drug use is somewhat surprising as well as encouraging.

However, these findings also need to be interpreted with caution. Absence of encouragement does not always imply the lack of influence. One needs to note here that an important distinction must be made between peer pressure and peer influence (McIntosh et al., 2003). Apart from direct coercion, peers also influence individuals' behaviors in other ways (McIntosh et al., 2003). For example, a study of 235 teenagers aged 11 through 19 found that direct pressure from peers to use drugs was rare (Hart and Hunt, 1997). Instead, the selection of like-minded friends and the process of socialization by which individuals internalize the group's attitudes and values were more significant in understanding the mechanisms through which peer mechanisms influenced drug use (McIntosh et al., 2003). This reinforces the need to study both descriptive and injunctive norms.

It is also important to note the discrepancy found between reports of descriptive versus injunctive norms. For example, in the Santa Monica network, almost 76% of youth reported that they had no meth using alters, yet only 57% of youth said they had alters who objected to meth use. The discrepant findings could be a function of how the questions were asked as well as how intimate these network relationships were. For example, the way "perception of whether or not youth's network members engaged in meth-use" was assessed with "how many members of your street social network that you just nominated do you think engage in meth-use?" This is a more factual question where participants respond with either a "yes or no" based on their knowledge of their network members' behaviors. On the other hand, the way youth's "perception of whether or not their network members would object to their

meth-use" was assessed with the question "how many members of your street social network that you just nominated do you think would object to you engaging in meth-use?" This is a more value-laden question and would depend on the nature of the relationship with the network member. While a youth might have nominated a peer as a person in their social network, the youth might not be able o make a precise determination whether these same peers care enough to object to them engaging in a risk behavior. Therefore, although they reported that most of their network members do not engage in meth-use, this might not translate into how they perceive these peers would react to their substance use.

Findings also provided preliminary evidence that meth use norms are associated with certain structural sociometric characteristics. However, there were variations in network characteristics associated with each kind of norm (i.e., descriptive vs. injunctive) and more notably, the direction of the associations between the network characteristics and norms for each network (i.e., Santa Monica vs. Hollywood). In particular, results suggest that perceptions of methamphetamine use and objections to its use are largely shaped by the cohesiveness in sub-regions of the sociometric network (defined as k-core) rather than an individual's centrality in these networks (as defined by the individual's number of connections or influential connections). While network centrality was significant in the bivariate regressions, they failed to remain significant when cohesion was added to the multivariate model.

From a theoretical and measurement standpoint, a distinction needs to be made between network centrality and network cohesion (or k-core status) in sociometric networks. The following example illustrates the difference between centrality and cohesion. It is possible to assess a network's most central actors and discover that these individuals have no connections to one another, in essence forming an empty core (Borgatti and Everett, 2000). This happens because although each actor may have high centrality by being strongly connected to different cohesive regions of the network, they don't necessarily have any ties to one another (Borgatti and Everett, 2000). Therefore, although people who are in cohesive regions are central, not every central person needs to be in a cohesive region (Borgatti and Everett, 2000). Consequently, a highly central person might have many connections in a network but not be part of an influential group. Therefore, prominence cannot always be equated with influence (Mizruchi, 1993).

As such, it is not surprising to find that cohesion was more significant in understanding the perception of norms relative to an individual's centrality in a network. Because of the dense nature of ties, cohesion is more salient in understanding how people are socialized into a subgroup and the internalization of group norms, because of the frequency of communication and sanctions associated with nonconformity in a closely connected group (Carpentier and White, 2002; Tyler and Melander, 2012).

However, what may seem paradoxical is the finding that social network cohesion was associated with increased perceptions of substance use in one network and reduced perceptions in another. More specifically, in the Santa Monica network, being in a cohesive network was associated with increased perceptions of objections to methamphetamine use. In Hollywood, on the contrary, cohesiveness was associated with norms supportive of more

risky behaviors. This seemingly contradictory effect of network cohesion on health outcomes has also been demonstrated in other studies (Barrington, 2008). For example, among people meeting criteria for mental illness diagnoses, it has been found that being a part of a cohesive network is associated with both increased and reduced use of mental health care (Kadushin, 1966; Pescosolido et al., 1998). Similarly, among injection drug users, cohesiveness has been associated with norms supportive of both risk enforcement and risk avoidance (Barrington, 2008; Latkin et al., 2003). Therefore, it is important to note that social networks operate differently in diverse contexts.

Moreover, this prompts the larger question of why youth who are in cohesive networks in Santa Monica might take fewer risks than their Hollywood counterparts. One salient factor may be the greater number of travelers in the Santa Monica network. Almost 64% of youth in Santa Monica considered themselves travelers, compared to only 37% in Hollywood. Travelers are a migratory subgroup of homeless youth (Martino et al., 2011) who travel along common routes in the United States and are less likely than nontraveling homeless youth to stay in one geographic area for longer periods. Previous studies have also found that travelers engage in riskier drug and sexual behaviors relative to nontraveling homeless youth (Lankenau et al., 2008; Martino et al., 2011; Sanders et al., 2008).

Furthermore, because travelers do not live in one geographic area for very long, although they associate with similarly situated peers, these connections are not very stable and likely not very cohesive. Travelers are thus plausibly part of less cohesive and peripheral network spaces. Furthermore, because research has shown that travelers are more likely to engage in risky practices, this might explain why risk is distributed differently in the Santa Monica and Hollywood networks. Although not the focus of this study, future studies should explore the positioning of travelers in different networks and their risk taking behaviors to determine whether this explanation can be confirmed.

An additionally surprising finding was that none of the sociometric network characteristics were associated with self-reported meth use. This could be attributed to two primary reasons. First, this network of homeless youth represents an open system, lacking stability. Studies have consistently shown that network ties among homeless youth are often transient and short-lived in nature (Bender et al., 2007; Barczyk et al., 2014). The network here represents a snapshot of with whom youth interact at that particular time and therefore the structure itself might be fluid. However, what this also suggests is that there might be strong selection preferences around meth use, which might bring the youth together in either "core" or "peripheral" regions. A feature of social networks that could explain this is a high degree of clustering, meaning that two people who both have a link with a third are likely to also be linked to one another. Higher clustering in a network indicates high "cliqueishness," such that attitudes and norms also tend to cluster in these networks (Latané and Bourgeois, 1996). Second, these findings also provide support for the hypotheses of our study that social networks may influence engagement in risk behaviors such as meth-use through their impact on perceived norms. As such, homeless youth may develop permissive attitudes regarding drug use if they perceive that their peers have positive opinions about drug use or are drugusers themselves. These findings may also have implications regarding how drug-use

interventions might be tailored, as prevention strategies may need to consider that perceived norms within "key network structures" can be targeted for change.

In addition to network characteristics, this study also found associations between other socio-demographic and behavioral characteristics with regard to self-reported methamphetamine use and associated norms. Sexual orientation, in particular, was associated with greater methamphetamine use. Non-heterosexual youth were particularly more likely to engage in methamphetamine use compared to heterosexual youth and additionally, believe that their peers were more likely to engage in methamphetamine use. This is consistent with two previous studies that have assessed methamphetamine use among homeless youth (Das-Douglas et al., 2008; Salomonsen-Sautel et al., 2008), and perhaps further bolster the argument for more targeted intervention programs. These findings suggest that even among homeless youth who are by nature at-risk, lesbian, gay, bisexual, transgender, questioning (LGBTQ) youth bear a greater burden of negative outcomes compared to their heterosexual peers, including a greater risk for drug use. The reasons associated with such use range from coping with their sexual identity, general stigmatization, disparities in health and access to care, and the availability of drugs at "club scenes" (Cochran et al., 2002).

Youth who indicated that they lived on the streets (compared to youth who had temporary housing) were more likely to believe that their peers and other network contacts practiced risky behaviors. This finding might be reflective of the inherently perilous nature of street life. Homeless youths' experiences are entrenched within the complexity of the challenges that they face in their day-to-day lives (Karabanow and Naylor, 2007). Street youth have fewer resources and less stable social networks (Davey-Rothwell and Latkin, 2007), often have no ties to conventional support systems (i.e. to non-street peers), and feel highly alienated and marginalized (Rice et al., 2005). In addition, street youth often use drugs as a conduit to numbing the pain of and enduring the extremities and stressors of street life (MacNeil and Pauly, 2011). Therefore, drug use among street youth might be more of a structural dysfunction than a personal pathology (Karabanow and Clement, 2004).

Another noteworthy, yet expected finding that emerged out of this study is the association between engaging in sex under the influence and self-reporting as methamphetamine users. Methamphetamine use has been in previous studies implicated with HIV transmission because of its association with high-risk sexual behaviors (Clements et al., 1997; Huba et al., 2001; Kipke et al., 1997; Martinez et al., 1998; Whitbeck et al., 2001). Methamphetamine is known to increase sexual arousal, while reducing inhibitions. The findings of this study provide further evidence that methamphetamine use is not just a substance use issue, but also a broader public health problem, because of the implications it has for HIV and other STD transmission.

4.1. Limitations

Limitations of this analysis include only sampling from drop-in centers, thus constraining generalizability of findings to service-seeking homeless youth. As such, we could not address the experiences of all homeless youth in the current study. Notably, however, this sample of youth included youth in emergency shelters, independent living programs, and

those sleeping on the streets, and as such is generalizable to a broad spectrum of homeless youth and their respective experiences. Additionally, with self-reported data there is the possibility of social desirability bias because participants may not accurately report substance use behaviors or feel comfortable sharing certain information with interviewers. Because of the nature of the convenience sampling approach used, we also could not infer causality with regard to the impact of network structure on substance use. Moreover, the norms variables were based on the perceptions of participants, which might not be accurate. However, research has suggested that perceptions of peer substance use play a more significant role in an individual's substance-using behavior relative to actual peer substance use (Perkins et al., 1999).

Additionally, regression analyses are generally used after a series of assumptions are met, such as linearity and normality of the error distribution. These assumptions often cannot be met with network data given the nonlinear relationship between variables. Although regression models are generally robust, they may not adequately capture the relationships between network characteristics and outcome variables. Furthermore, data used in this analysis did not allow for examination of additional injunctive norms. Future studies should examine the encouragement of meth use in addition to objections to meth use. This would better enable a determination of how both the encouragement of and objection to meth use are affected by network cohesion. Moreover, because of the small sample size, this study focused on a limited number of network variables, specifically network position and cohesion. As such, it is possible that other network characteristics are also associated with the perception of norms.

4.2. Implications

Findings of this and previous studies (Rice and Rhoades, 2013; Schneider et al., 2015; Valente, 2012) suggest that leaders in a community might not necessarily be the best change agents. First, just because an individual is central to a network does not mean that he or she has significant influence in the community. For example, it has been suggested that the most central individuals are sometimes linked to the same people, and therefore might not be the best people to disseminate information (Valente, 2012). Second, leaders in a network might be vested in the status quo because it helps them preserve their status in the network, and therefore might be resistant to change (Rice and Rhoades, 2013).

Furthermore, this study also found that network cohesion was more significantly associated with substance use norms relative to centrality. The significance of network cohesion in sociometric network implies the presence of close and dense ties among members of a subnetwork within a larger bounded network (Seidman, 1983). The presence of these tightly knit subgroups suggests that instead of using a leader-centric technique, network interventions should be designed to capitalize on the naturally occurring reciprocity and social influence in these subnetworks (Neaigus, 1998). Valente (2012) suggested that segmentation might be the most effective approach in such a situation. Segmentation involves identifying groups of people that can be persuaded to change at the same time. When there is significant interdependence among individuals, they may only consider

changing when the whole group changes. Therefore, group-level network interventions might work best for these individuals.

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Fig. 1.
Perception of meth use in networks. Left: Hollywood, $n = 160$, ties = 290. Right: Santa Monica, $n = 130$, ties = 242. Triangles are youth who believe that their peers use methamphetamine.
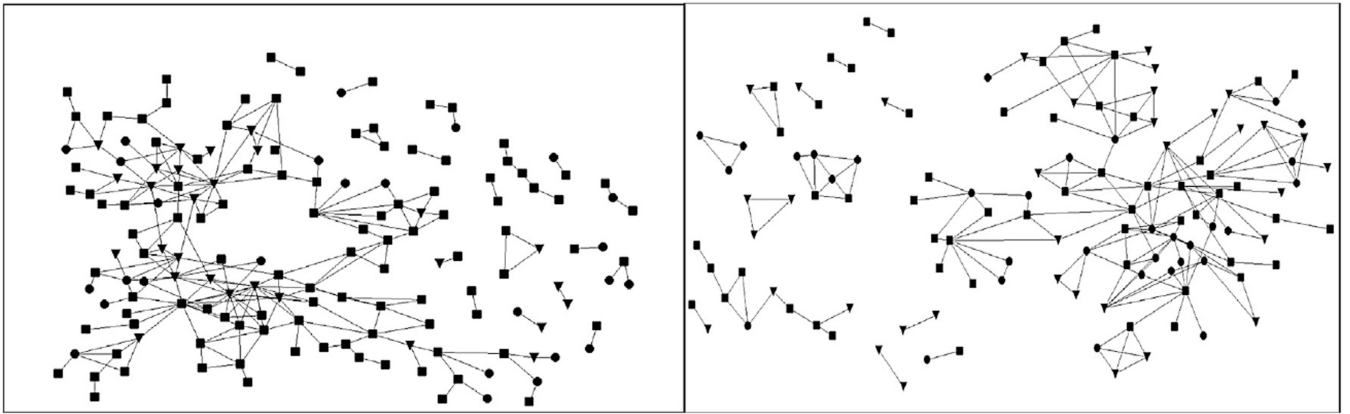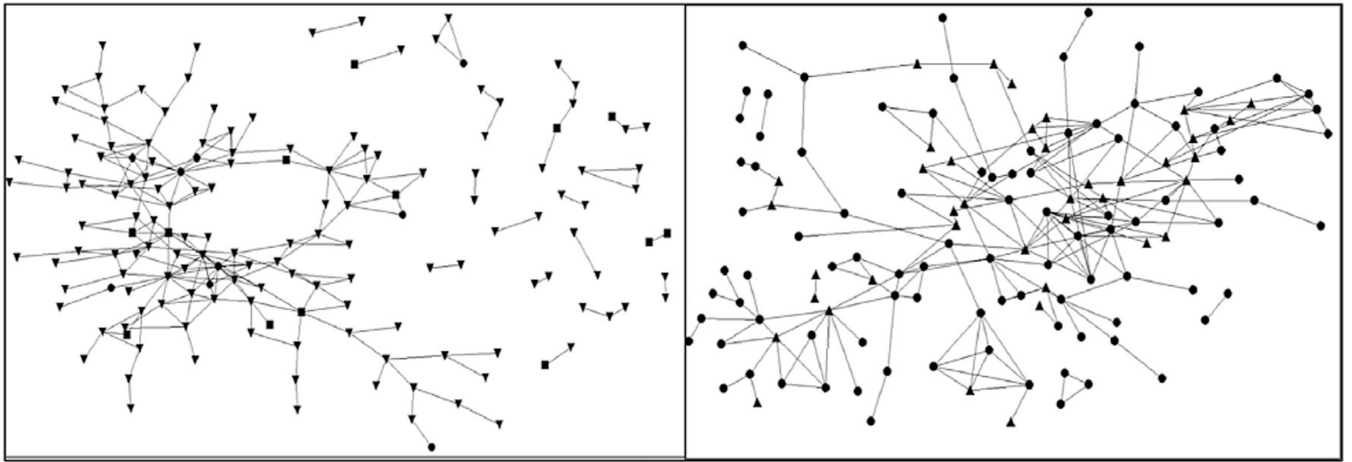
Fig. 2.
Perception of objection to meth use in networks. Left: Hollywood, $n = 160$, ties = 290.
Right: Santa Monica, $n = 130$, ties = 242. Triangles are youth who believe that their peers
would object if they used methamphetamine.

Table 1

Sample characteristics of homeless youth in Los Angeles, CA.

	Full sample (N = 358) n (%)	Hollywood (n = 205) n (%)	Santa Monica (n = 153) n (%)	(df) χ^2
Gender[a]				(2) 8.90**
Male	250 (69.8)	130 (63.4)	120 (78.4)	
Female	104 (29.1)	72 (35.1)	32 (20.9)	
Transgender	*4 (1.1)*	*3 (1.5)*	*1 (0.7)*	
Sexual orientation *(n = 353)*				(2) 2.60
Heterosexual	266 (75.4)	145 (72.1)	121 (79.6)	
Nonheterosexual	87 (24.7)	56 (27.9)	31 (20.4)	
Race and ethnicity (n = 357)				(7) 82.00***
Native American	10 (2.8)	6 (2.9)	4 (2.6)	
Asian	1 (0.3)	1 (0.5)	0 (0.0)	
Black/African American	107 (30.0)	87 (42.4)	20 (13.2)	
Native Hawaiian or Pacific Islander	2 (0.6)	1 (0.5)	1 (0.7)	
White	126 (35.3)	35 (17.1)	91 (59.9)	
Latino/a	54 (15.1)	43 (21.0)	11 (7.2)	
Biracial or multiracial	57 (16.0)	32 (15.6)	25 (16.5)	
Current living situation (n = 356)				(4) 55.61***
Couch surfing	122 (34.3)	80 (39.2)	42 (27.6)	
Stable situation	43 (12.1)	30 (14.7)	13 (8.6)	
Streets	142 (40.0)	50 (24.5)	92 (60.5)	
Emergency shelter	49 (13.8)	44 (21.6)	5 (3.3)	
High school graduate	148 (41.3)	89 (43.4)	59 (38.6)	(2) 1.00
Traveler	169 (47.2)	75 (36.6)	94 (61.4)	(2) 21.23***
Time spent homeless[b]	2.8 (2.8)	2.7 (2.6)	2.9 (3.0)	(2) 1.33
Age[b]	21.5 (2.1)	21.2 (2.0)	21.8 (2.2)	(2) 2.55*

Note. Some categories may not sum to 100% due to rounding error or measurement method.

***
$p < .001$.

**
$p < .01$.

*
$p < .05$.

[a]Transgender individuals were excluded from *subsequent multivariate* analyses.

[b]Figures represent M (SD) in first three columns and (df) F in fourth column.

Table 2

Characteristics of networks.

	Hollywood *n* (%)	Santa Monica *n* (%)
Network structure		
Degree centrality		
1 or 2	92 (60.5)	70 (54.6)
3–14	60 (39.5)	58 (45.3)
Eigenvector centrality[a]		
< 0.04 or < 0.03	121 (79.6)	87 (68.0)
> 0.04 or > 0.03	31 (20.4)	41 (32.0)
K-core		
1 or 2	116 (76.3)	91 (71.1)
3 or 4	36 (23.7)	37 (28.9)
Perceived network norms		
Meth-using alters		
None	105 (65.6)	83 (75.5)
Any	28 (17.5)	27 (24.5)
Alters who encourage meth use		
None	121 (75.0)	100 (90.9)
Any	12 (7.5)	10 (9.1)
Alters who object to meth use		
None	91 (56.9)	63 (57.3)
Any	42 (31.6)	47 (42.7)

Note. Figures dichotomized based on median score. Some categories may not sum to 100% due to rounding error or measurement method.

[a]Eigenvector median was 0.04 for Hollywood and 0.03 for Santa Monica.

Table 3

Odds ratio for associations between perceived norms and methamphetamine use (logistic regression).

	Meth use		Meth use	
	(Bivariate)		(Multivariate)	
	Unadj. OR	95% CI	Adj. OR	95% CI
Demographic characteristics				
Field site (Santa Monica)	2.32[**]	(1.46–3.71)	0.54	(0.28–1.06)
Age	1.06	(0.95–1.18)	–	–
Time spent homeless	1.06	(0.98–1.16)	–	–
Gender (male)	1.63	(0.95–2.81)	–	–
Sexual orientation (nonheterosexual)	1.72[*]	(1.02–2.92)	2.02[*]	(1.04–3.90)
Race (White)	1.61[*]	(1.01–2.58)	0.65	(0.33–1.28)
Current living situation (streets)	2.83[***]	(1.75–4.56)	1.05	(0.72–2.75)
High school graduate (yes)	0.71	(0.44–1.15)	–	–
Traveler (yes)	2.81[***]	(1.74–4.54)	1.50	(0.79–2.84)
Sex under influence of drugs (yes)	3.78[***]	(2.34–6.09)	1.33[**]	(1.12–1.58)
Perceived norms				
Descriptive	6.42[***]	(3.87–10.65)	3.55[***]	(1.93–6.52)
Injunctive	0.13[***]	(0.08–0.22)	0.11[***]	(0.05–0.23)
Pseudo R^2			0.29	
2 log likelihood			269.99	

Note. Only variables significant in bivariate analyses at $p < .05$ were included in the final adjusted analyses. Unadj. = unadjusted; Adj. = adjusted.

[***] $p < .001$.

[**] $p < .01$.

[*] $p < .05$.

Table 4

Odds ratios of associations between sociometric properties and perceived descriptive norms and methamphetamine use in Hollywood, CA (logistic regression).

| | Alters use meth | | Alters use meth | |
| | (Bivariate) | | (Multivariate) | |
	Unadj. *OR*	*95% CI*	Adj. *OR*	*95% CI*
Demographic characteristics				
Age	0.98	*(0.77–1.23)*	–	-
Time spent homeless	0.17	*(0.98–1.39)*	–	-
Gender (male)	0.44	*(0.18–1.13)*	–	-
Sexual orientation (nonheterosexual)	4.41 **	*(1.66–11.69)*	3.67 *	*(1.22–11.11)*
Race (White)	2.78	*(0.88–7.73)*	–	-
Current living situation (streets)	2.67 *	*(1.00–7.14)*	2.13	*(0.68–6.65)*
Traveler (yes)	2.74 *	*(1.04–7.18)*	1.91	*(0.62–5.96)*
Sociometric structural properties				
K-core (3 or 4)	5.95 ***	*(2.25–15.70)*	4.59 *	*(1.08–19.59)*
Degree centrality (3–21)	2.90 *	*(1.12–7.51)*	1.03	*(0.81–1.30)*
Eigenvector centrality (>0.03)	2.23	*(0.81–6.12)*	–	–
Pseudo R^2			0.12	
2 log likelihood			89.27	

Note. Only variables significant in bivariate analyses at *p* < .10 were included in the final adjusted analyses. Unadj. = unadjusted; Adj. = adjusted.

***
p < .001.

**
p < .01.

*
p < .05.

Table 5

Odds ratios of associations between sociometric properties and perceived injunctive norms and methamphetamine use in Hollywood, CA (logistic regression).

	Alters object to meth	
	(Bivariate)	
	Unadj. *OR*	**95% CI**
Demographic characteristics		
Age	1.02	*(0.85–1.23)*
Time spent homeless	0.97	*(0.83–1.13)*
Gender (male)	0.38[*]	*(0.16–0.89)*
Sexual orientation (nonheterosexual)	0.73	*(0.31–1.68)*
Race (White)	0.65	*(0.26–1.60)*
Current living situation (streets)	0.27	*(0.12–0.62)*
Traveler (yes)	0.69	*(0.32–1.48)*
Sociometric structural properties		
K-core (3 or 4)	0.52	*(0.23–1.16)*
Degree centrality (3–21)	0.67	*(0.32–1.42)*
Eigenvector centrality (>0.03)	0.45	*(0.19–1.06)*
Pseudo R^2		
2 log likelihood		

Note: Unadj. = unadjusted.

[***]
$p < .001$.

[**]
$p < .01$.

[*]
$p < .05$.

Table 6

Odds ratios of associations between sociometric properties and perceived descriptive norms and methamphetamine use in Santa Monica, CA (logistic regression).

	Alters use meth	
	(Bivariate)	
	Unadj. _OR_	**_95% CI_**
Demographic characteristics		
Age	0.88	_(0.71–1.09)_
Time spent homeless	1.14	_(0.99–1.32)_
Gender (male)	0.79	_(0.29–2.17)_
Sexual orientation (nonheterosexual)	1.47	_(0.53–4.06)_
Race (White)	0.75	_(0.31–1.84)_
Current living situation (streets)	2.13	_(0.77–5.85)_
Traveler (yes)	1.12	_(0.46–2.75)_
Sociometric structural properties		
K-core (3 or 4)	0.38	_(0.13–1.11)_
Degree centrality (3–21)	0.64	_(0.27–1.54)_
Eigenvector centrality (>0.03)	0.74	_(0.29–1.90)_
Pseudo R^2		
2 log likelihood		

Note. Unadj. = unadjusted.

**
_p_ < .01.

*
_p_ < .05.

Table 7

Odds ratios of associations between sociometric properties and perceived injunctive norms and methamphetamine use in Santa Monica, CA (logistic regression).

	Alters object to meth		Alters object to meth	
	(Bivariate)		(Multivariate)	
	Unadj. *OR*	*95% CI*	Adj. *OR*	*95% CI*
Demographic characteristics				
Age	1.05	*(0.88–1.27)*	–	–
Time spent homeless	0.96	*(0.84–1.10)*	–	–
Gender (male)	0.87	*(0.35–2.14)*	–	–
Sexual orientation (nonheterosexual)	0.62	*(0.25–1.55)*	–	–
Race (White)	1.09	*(0.50–2.41)*	–	–
Current living situation (streets)	0.61	*(0.27–1.37)*	–	–
Traveler (yes)	0.81	*(0.37–1.76)*	–	–
Sociometric structural properties				
K-core (3 or 4)	3.17[*]	*(1.31–7.65)*	10.72[**]	*(4.70–24.45)*
Degree centrality (3–21)	2.51[*]	*(1.15–5.47)*	0.92	*(0.38–2.12)*
Eigenvector centrality (>0.03)	1.72	*(0.76–3.89)*	–	-
Pseudo R^2			0.14	
2 log likelihood			118.31	

Note. Only variables significant in bivariate analyses at *p* < .05 were included in the final adjusted analyses. Unadj. = unadjusted; Adj. = adjusted.

[**]
p < .01.

[*]
p < .05.

Table 8

Odds ratios of association between sociometric properties and methamphetamine use (bivariate logistic regression).

	Meth use		Meth use	
	Hollywood (*n* = 133)		**Santa Monica (*n* = 109)**	
	(Bivariate)		**(Bivariate)**	
	Unadj. OR	*95% CI*	**Unadj. OR**	*95% CI*
Sociometric structural properties				
K-core (Kcore 3–4 = 1)	1.53	*(0.68–3.47)*	0.63	*(0.27–1.50)*
Degree centrality (Deg 3–21 = 1)	1.44	*(0.73–2.84)*	0.78	*(0.34–1.78)*
Eigenvector centrality (>0.03 = 1)	1.03	*(0.39–2.70)*	1.04	(0.41–2.61)

Note. Unadj. = unadjusted.

***
$p < .001$.

**
$p < .01$.

*
$p < .05$.